

# IMPLEMENTATION OF EFFECTIVE WASTEWATER CHARGES BY MUNICIPALITIES IN SOUTH AFRICA: AN INVESTIGATION INTO THE BARRIERS AND ENABLERS

Nuveshen Naidoo, Darian Pearce, Wean Visser, Jackie Crafford, Dineo Maila & Kyle Harris



**WATER  
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Report to the  
**WATER RESEARCH COMMISSION**

by

**Nuveshen Naidoo, Darian Pearce, Wean Visser, Jackie Crafford, Dineo Maila & Kyle Harris**

Prime Africa Consultants



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The publication of this report emanates from the Water Research Commission project K5/2210//3, entitled 'An investigation into the barriers to implementation of effective wastewater charges by municipalities in South Africa'.

This report forms part of a series of two reports. The other report is *Setting effective wastewater charges: a Guide for Municipalities* (WRC Report No. TT 674/16).

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## FOREWORD

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Wastewater treatment services is one of the core business responsibilities of a municipality. Legislation in South Africa ensures the access to water services, affordably and effectively, to all consumers in an economic and sustainable manner. The approach for setting an effective wastewater treatment tariff is often challenging because it requires coordination of activities across multiple municipal departments and setting effective tariffs requires a genuine long term perspective. Fundamentally, a municipality needs to issue a tariff that covers all wastewater treatment costs and recover all these costs from the clients that it serves.

The aims of this study were:

1. To assess the barriers slowing the development and implementation of suitable wastewater treatment charge structures at the municipal level.
2. To recommend corrective actions to remove these barriers
3. To develop training guidelines that will facilitate the development of human capacity to cope with the barriers identified.

Barriers were identified through a comparative risk assessment methodology using an extensive information collection exercise that included a literature review, municipal revenue and expenditure, municipal statistics, Green Drop Data, expert interviews, selected case studies and workshops. Barriers included lack of: cost accounting, ring-fencing, asset management, human resources and knowledge of the client base, with political will viewed as a necessary prerequisite.

Based on the barriers identified, a national workshop was hosted that brought together key stakeholders from national and local government, academia and the private sector. During the workshop, some barriers identified through literature, interviews were validated, and recommendations on corrective actions to address these barriers were identified.

In response to these sectoral challenges a strategy was developed in the form of a training guideline that is primarily based on due diligence, cross departmental coordination and long term planning. The interventions developed to address these barriers have been grouped into strategic thrusts with intermediate objectives that are grouped according to a specific time horizon for implementation. This section is presented in separate publication entitled, 'Setting effective wastewater charges: a Guide for Municipalities' (WRC Report No. TT 674/16).

## EXECUTIVE SUMMARY

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### Background

Government introduced the Green Drop certification programme, a suasion-type incentive programme for WSAs, to encourage and monitor effectiveness of wastewater treatment in WSAs. In 2010, the Department of Water and Sanitation (DWS) published the first national Green Drop Report, based on assessments done in 2009. Only 7.4% of the assessed plants achieved Green Drop certification. A subsequent Green Drop assessment was done in 2011 and only about 10% of WSAs assessed achieved a Green Drop score exceeding 80%. Effective wastewater management is a requirement to safeguard South Africa's water resources and their associated economic, social and environmental benefits. The Green Drop assessments demonstrate that most wastewater treatment systems fail to effectively treat wastewater and therefore serve as a significant source of pollution. There are numerous reasons for this, one of which may be partly due to ineffective wastewater charges. In the context of this study, the term 'wastewater charges' refers to the charges set for recovering the costs associated with the provision of waterborne sanitation, including effluent reticulation, pumping and treatment. Dry sanitation costs and charges were not considered as part of the scope of this study.

### Aims

Accordingly, the aims of the project were:

1. To assess the barriers slowing the development and implementation of suitable wastewater treatment charge structures at the municipal level.
2. To recommend corrective actions to deal with these barriers.
3. To develop training guidelines that will facilitate the development of human capacity to cope with the barriers identified.

### Study approach

The broad methodological approach to identifying and assessing the barriers to effective wastewater charges included a comparative risk assessment to identify preliminary constraints, combined with expert analysis and analysis of empirical data. The comparative risk assessment was followed by an economic investigation, which included data collection and economic modelling. The data was analysed and subsequently used in wastewater charge models to determine wastewater reticulation and treatment revenue and expenditure. The combined findings of the research were used to develop training guidelines that facilitate the development of human capacity to cope with the barriers identified.

### Findings

The findings of this study indicate that there are significant barriers to the implementation effective wastewater charges, most notably a lack of sufficient organizational capacity and resources. Through the analysis of different municipalities, marginal cost curves for wastewater services were developed to provide a guideline charge. The analysis showed that effective charges would generate R13.68 billion in total per annum, compared to the current income of R9.54 billion reported in the Financial Census of Municipalities (2013/14). This provides strong empirical evidence that the current wastewater charge structure is inadequate and under-recovers on likely actual costs. Using the findings from the study, a strategy was developed. In the strategy a set of strategic actions that focus on rebasing organizational priorities, to redirect scarce resources toward essential functions are recommended. The guidelines developed allow for a gradual improvement in the level of service over short, medium and long terms; allowing a municipality with very little formalisation of wastewater charges to begin from using a rapid wastewater charge based on empirical evidence, to an effective and comprehensive wastewater charge.

### **Conclusion and recommendations**

An important part of the work involved the development of wastewater charge cost and revenue models. The setting of an appropriate WWTW charge has been demonstrated to be a complex task requiring consideration of operations costs (referred to here as Opex), infrastructure maintenance (which we will refer to as Capex) as well as economic regulation policy imperatives. In the case of economic regulation policy imperatives, it is understandable that there may be a range of financial, economic, socio-economic and political-economy policy imperatives that relate to the demand side of the wastewater charges. For instance, subsidies to indigent households may be a sanitation service policy imperative, and this subsidy may be designed within a setting of full cost-recovery, meaning that non-indigent households would pay larger charges to cover the subsidy cost. In another case, a WSA may decide to provide a wastewater subsidy to attract investment to a particular development node.

On the other hand, wastewater charges may be designed to contain penalty measures for cases where pollution concentrations exceed allowable standards. This would be akin to a form of waste discharge charge system which attempts to use charge structures not only as a cost-recovery mechanism, but also as an economic policy instrument. Thus, many demand-side policy considerations and variables may exist. It is both the prerogative and the mandate of the WSA to consider how these factors would transform into effective subsidies for wastewater charges. Economic regulation imperatives however fall outside the scope of this study, the present study focuses on operations costs and infrastructure maintenance costs.

The operations costs relate to the annual operations of WWTWs and pump stations. This includes a large number of fixed and variable costs including salaries, electricity, chemical costs, general repairs and maintenance and other costs. The setting of operations charges therefore requires an in-depth understanding of the actual costs required to consistently treat wastewater to required effluent standards. The infrastructure maintenance relates to the proactive maintenance and repair of immovable assets comprising WWTWs, reticulation systems, pump stations and associated infrastructure. The concepts of infrastructure maintenance and depreciation are closely related. In an ideal world, where all immovable assets are registered and correctly valued based on replacement value and depreciated over the appropriate period, an infrastructure maintenance charge may be accurately estimated, and levied on users. Such an infrastructure maintenance charge would reflect the annual depreciation of the immovable assets. The setting of infrastructure maintenance charges therefore requires that a functional Immovable Asset Management (IAM) system is in place.

In a context where only about 10% of WSA have more than 80% Green Drop compliance (2011), it is very likely that both operation charges and infrastructure maintenance charges are currently underestimating the real cost of wastewater reticulation and treatment.

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## ACRONYMS & ABBREVIATIONS

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CMA	Catchment Management Agency
CoGTA	Department of Cooperative Governance and Traditional Affairs
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
GD	Green Drop
GDCP	Green Drop Certification Programme
LM	Local Municipality
MFMA	Municipal Finance Management Act
MM	Metropolitan Municipality
NWA	National Water Act of 1998
NWRS	National Water Resources Strategy
RQO	Resource Quality Objectives
WDCS	Waste Discharge Charge System
WMA	Water Management Area
WRC	Water Research Commission
WRCS	Water Resource Classification System
WSA	Water Service Authority
WSP	Water Service Provider
WWTW	Wastewater Treatment Works

## GLOSSARY

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**Free Basic Services** – Free basic service is defined as the minimum amount of basic levels of services, provided on a day to day basis, sufficient to cover or cater for the basic needs of the poor households.

**Resource Quality Objective** – Clear goals relating to the quality of the relevant water resources

**Ring-fencing** – Ring-fencing occurs when the assets and income from wastewater treatment works are separated from the municipality's total assets and income, without being a separate entity.

**Sanitation charge** – This is an administered tariff charged for sanitation services. The term is a catch-all for both wastewater charges and sanitation services provision. Please also see wastewater charge below.

**Sewerage** – A system of sewers; the removal of waste materials by means of a sewer system.

**Wastewater** – Wastewater is "used" water, the water leftover after its use in numerous applications such as industrial, agricultural, municipal and domestic.

**Wastewater charge** – This is an administered tariff charged for wastewater services. Wastewater includes services sewage conveyance, treatment and discharge. Dry sanitation is excluded. The wastewater charge incorporates operating costs (Opex) as well as infrastructure maintenance costs (Capex).

**Wastewater Effluent** – Wastewater (treated or untreated) that flows out of a treatment plant.

**Wastewater Influent** – The untreated wastewater or raw sewage coming into a wastewater treatment plant.

**Wastewater treatment works** – Is an industrial structure designed to remove biological or chemical waste products from water, thereby permitting the treated water to be used for other purposes.

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## CHAPTER 1: BACKGROUND

### 1.1 INTRODUCTION

The South African wastewater services provisioning and management is a diverse industry, with effective wastewater management a requirement for safeguarding South Africa's water resources and their associated economic, social and environmental benefits. Wastewater treatment services are one of the core business responsibilities of a municipality who have the responsibility to ensure access to water services, affordably and effectively, to all consumers in an economic and sustainable manner. In order to encourage improvements in the provision of wastewater services, the Department of Water and Sanitation (DWS) introduced the Green Drop certification programme, which is awarded to effluent treatment plants that adhere to certain minimum operating standards (Figure 1.1). These standards include the extent to which water quality is monitored, the extent to which operations and maintenance are done effectively, and the ultimate quality of the plant effluent. Table 1.1 shows key performance areas for the Green Drop Certification Programme, (DWS, 2011).

MODERATED COLOUR CODING TO ASSIST WSI WITH CONFIRMATION SESSION PREPARATIONS JAN – MARCH 2013		
Colour codes		Status description
A+	95-100%	Excellent situation – WSI scored very well, no / limited gap identified
A-	91-94%	
B+	85-90%	Good status, WSI require minor evidence to move score into blue category
B-	80-84%	
C+	70-79%	Average performance, additional evidence needed to improve on this criteria
C-	50-69%	
D+	40-49%	Poor performance, substantial evidence still required to improve this score
D-	31-39%	
E+	15-30%	Critical state, substantial evidence needed to improve on this score. This score is likely to result in significant reduction of the WSI's Green Drop score.
E-	0-14%	
	<i>Comment box</i>	Full or partial bonus awarded; No penalty awarded
	<i>Comment box</i>	Full or partial penalty awarded; No bonus awarded

Figure 1.1 Green Drop Certification score codes (Green Drop Score Card 2012/2013)

In 2010, the Department of Water and Sanitation published the first national Green Drop Report, based on assessments done in 2009. This report aimed to assess the quality of wastewater effluent in South Africa from all 852 wastewater plants operated by municipalities (Figure 1.2 and Figure 1.3) however only 53% of all plants were assessed (i.e. 449 plants). This was due to the low number of authorities that responded to the call to be assessed. Only 7.4% of the assessed plants achieved Green Drop certification, while a further 37% scored between 50-89% (i.e. within acceptable standards). However, 55% or 247 plants scored below 50% which is an unacceptable rating.

**Table 1.1: Key performance areas for the Green Drop Certification Programme, (DWS, 2011)**

Focus	Key Performance Area (as defined by DWA)	Purpose of KPA is to ensure
Wastewater Quality	Wastewater Quality Monitoring programme	<ul style="list-style-type: none"> <li>• Adequate monitoring is taking place towards effective wastewater management</li> <li>• Management and planning is based on measurement/monitoring</li> </ul>
	Wastewater sample analysis (credible)	<ul style="list-style-type: none"> <li>• The Credible of analysis is enhanced</li> <li>• A renewed focus on credible laboratory</li> <li>• Improved Integrity of results</li> <li>• A basis for is provided for procurement of credible laboratory services</li> </ul>
	Submission of Wastewater Quality Results	<ul style="list-style-type: none"> <li>• The necessary information/data is submitted to the DWA to conduct regulatory performance monitoring</li> <li>• Adherence to Section 62 of the water Service Act</li> </ul>
Process Control	Process Control: maintenance and management skills	<ul style="list-style-type: none"> <li>• Compliance with Regulation 2834</li> <li>• A renewed focus on O&amp;M skills requirements</li> <li>• Adequately skilled staff employment</li> </ul>
Immovable Asset Management	WWTW Capacity	<ul style="list-style-type: none"> <li>• That emphasis is place on the need to ensure that treatment and collection capacity risks have been mitigated</li> </ul>
	Publication of WWTW Management Performance	<ul style="list-style-type: none"> <li>• That emphasis is places on the need to enhance Accountability through transparency</li> </ul>
	Wastewater Asset Management	<ul style="list-style-type: none"> <li>• That the critical importance of effectively Asset Management is re-enforced</li> </ul>
Facilitated Operations Support	Wastewater Quality Failure response Management	<ul style="list-style-type: none"> <li>• That emphasis is placed on the need to have protocols in place for incident management</li> </ul>
	Storm Water and water Demand Management	<ul style="list-style-type: none"> <li>• That artificial load of WWTW are minimised</li> <li>• The influence of faecal contamination in storm and run-off is minimised</li> </ul>
	Local Regulations	<ul style="list-style-type: none"> <li>• That emphasis is place on the need to promote local regulation to prevent industrial, commercial and domestic practices having a detrimental impact on the WWTW</li> </ul>
	Wastewater Quality Compliance	<ul style="list-style-type: none"> <li>• WWTW comply with limits sets in the License/Authorisation</li> <li>• That effective Risk Abatement planning is being put in place</li> </ul>

A subsequent Green Drop assessment was done in 2011. Although the coverage of plants assessed was much improved, still only about 15% of WSAs achieved a Green Drop score exceeding 80% (Figure 1.2 and 1.3). There are many reasons for municipalities failing to achieve effective wastewater treatment (not achieving Green Drop Certificates), these include, but are not limited to, insufficient financial resources, human capacity, competence and financial control. The lack of financial resources may be one of the greater concerns, especially in smaller municipalities, and is in part due to under recovery of costs. Although many factors contribute to poor financial management in municipalities, including an absence of ring-fencing of income from wastewater rates, the most basic point of departure for a sustainable wastewater treatment

Barriers to the Implementation of Effective Wastewater Charges

sector is the wastewater charge. In this study, an understanding of the barriers to the implementation of effective wastewater charges is attempted through a combined expert-based and empirical investigation.

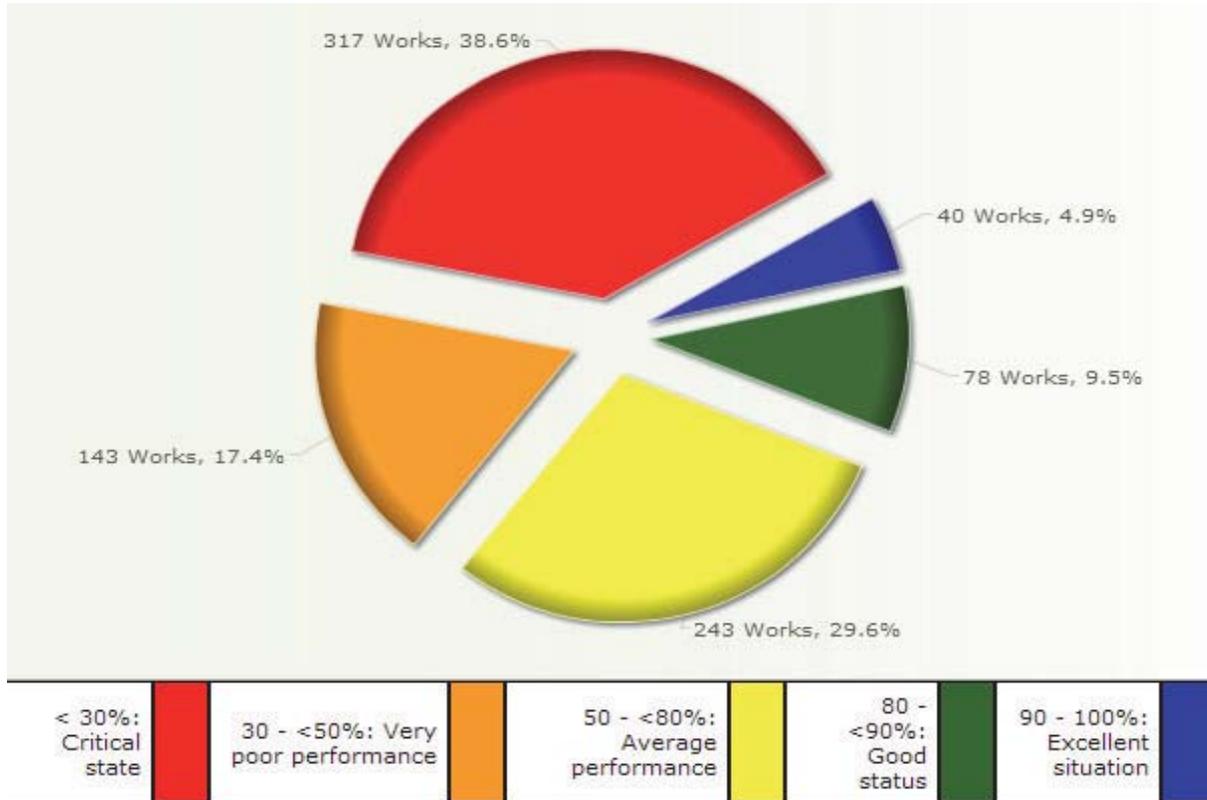


Figure 1.2 Green Drop Performance of all wastewater treatment works evaluated (DWS, 2011)

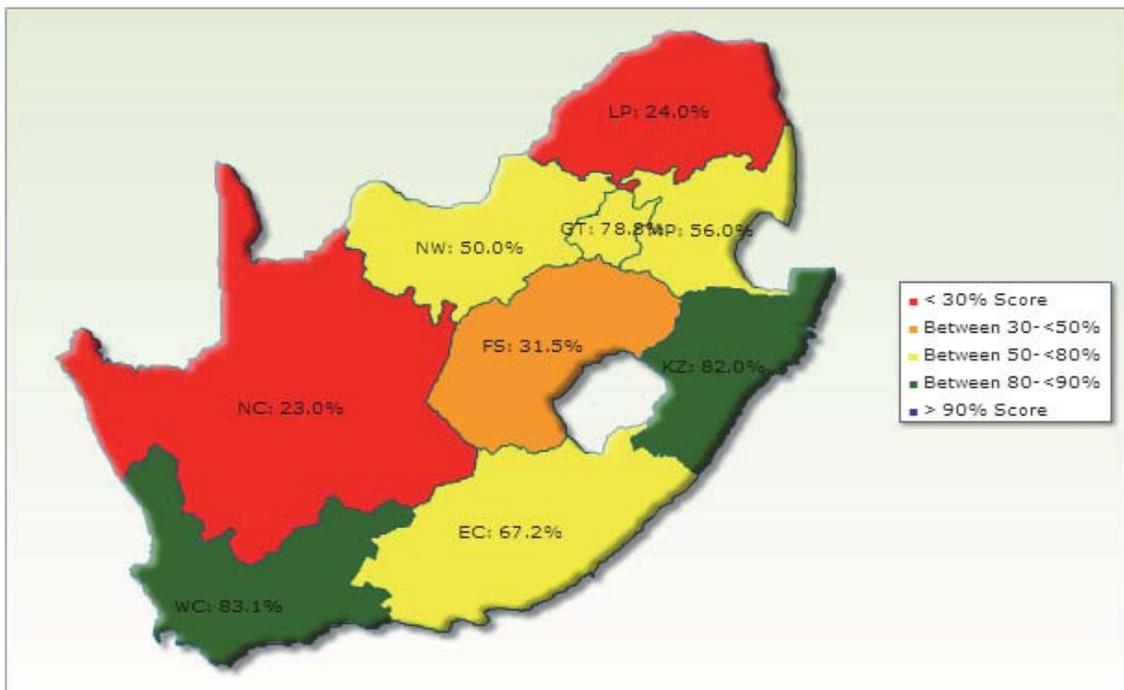


Figure 1.3 Green drop performance of provinces (DWS, 2011)

## **1.2 PROJECT AIMS**

The following are the aims of the project:

1. To assess the barriers slowing the development and implementation of suitable wastewater treatment charge structures at the municipal level.
2. To recommend corrective actions to deal with these barriers.
3. To develop training guidelines that will facilitate the development of human capacity to cope with the barriers identified.

## **1.3 SCOPE AND LIMITATIONS**

This scope of this study was limited to wastewater services (water-borne sanitation) provided by municipalities that are water service authorities.

## **1.4 GENERAL APPROACH**

Firstly, a literature review on the subject was conducted. The literature review section of this report provides a general understanding of wastewater charges implemented by municipalities in South Africa. It provides an overview of wastewater services provision and management in South Africa, with consideration of the legal framework guiding wastewater services provision and management; the roles and responsibilities of different entities in relation to wastewater in South Africa; the water and sanitation value chain; economic aspects of wastewater management, including local and international practices in wastewater charge setting, as well as costs of wastewater management.

In order to achieve Aim 1, “To assess the barriers slowing the development and implementation of suitable wastewater treatment charge structures at the municipal level”, and Aim 2, “To recommend corrective actions to deal with these barriers”, a comparative risk assessment approach was followed. The purpose of this methodology was to identify and prioritise the full set of barriers to implementing effective wastewater charges. The comparative risk assessment was informed by literature review, expert interviews and a national workshop held in February 2015 in Pretoria. During the workshop, inputs from stakeholders were used to identify and contextualise further barriers experienced by municipalities. The workshop also resulted in recommendations that informed the development of an outline to a strategy to assist municipalities with setting effective wastewater charges.

The comparative risk assessment was followed by an economic investigation, which included data collection and economic modelling. Expert and empirical data was collected from a variety of sources. This included a municipal questionnaire, analysis of municipal bylaws, the Green Drop certification programme database, the Department of Water and Sanitation, National Treasury, Statistics South Africa’s Financial Census of Municipalities (FCM), and expert interviews. The data collected was collated in a context specific manner to inform the findings and analyses. The data was analysed and subsequently used in wastewater charge models to determine wastewater reticulation and treatment revenue and expenditure.

The combined findings of the research and workshop outputs were used to derive a summary of conclusions and recommendations, as well as to develop a strategy and training guidelines that can be used to facilitate the development of human capacity to cope with the barriers identified (Aim 3).

## CHAPTER 2: LEGISLATIVE AND POLICY FRAMEWORK FOR WASTEWATER MANAGEMENT IN SOUTH AFRICA

### 2.1 INTRODUCTION

The South African wastewater services provisioning and management is a diverse industry, with effective wastewater management a requirement for safeguarding South Africa's water resources and their associated economic, social and environmental benefits. The wastewater sector in South Africa is part of South Africa's water sector, which due to the scarcity of the resource, is a very prominent sector. As such, there is numerous legislation and policy governing the approach to meeting the targets of this sector. An overview of the legislative and policy framework governing wastewater services provision is provided. Specifically, the constitution, relevant acts, frameworks and regulations are discussed in the context of wastewater services provisioning.

In general, policies establish the vision, overall goals and approach, legislation creates the enabling environment and strategies set out the detail of how the policies will be implemented in order to achieve the vision and goals. Some specific documents within the water services sector are highlighted in the Strategic Framework for Water Services (Figure 2.1), and show levels at which they operate. The roles of different and responsibilities of the different levels of government including national, provincial and local government are also described in this chapter.

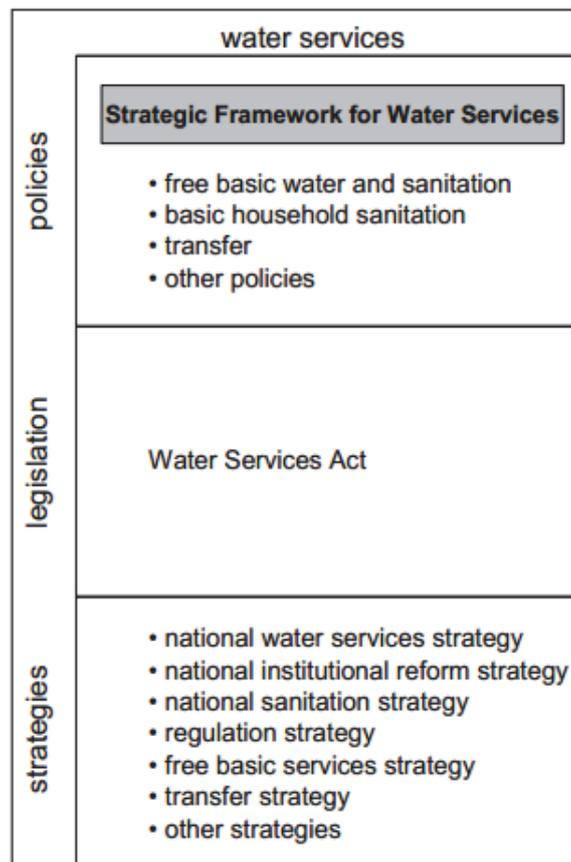


Figure 2.1: Policies, legislation and strategies in the water services sector (DWA, 2003)

## **2.2 LEGISLATIONS AND POLICIES FOR WASTEWATER MANAGEMENT**

### **2.2.1 Constitution of South Africa (Act 108 of 1996)**

Section 27 of the Constitution provides, amongst other rights, that everyone has the right to have access to sufficient food and water and that the state must take reasonable legislative and other measures within its available resources, to achieve the progressive realisation of each of these rights. Section 24 of the Bill of Rights in the Constitution states that everyone has the right to an environment that is not harmful to their health or wellbeing; and to have the environment protected for the benefit of present and future generations through reasonable legislative and other measures that: prevent pollution and ecological degradation; promote conservation; and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development. The Constitution vests the executive authority for water services in local government. One of the objectives of local government is to ensure the provision of services to communities in a sustainable manner.

### **2.2.2 Water Services Act (36 of 1998)**

The Water Services Act stipulates the role of municipalities (local government) in the provision of water supply and sanitation services. Although local government may contract an outside body or a local structure to do the actual work of providing water and sanitation services, it remains responsible to end-users for the service. The overall objective of the Water Services Act is to assist municipalities to undertake their role as WSAs, and to look after the interests of consumers. It is also to clarify the role of other water services institutions, especially water services providers and water boards (DWA, 2005). The Water Services Act provides, amongst others, for the setting of national standards and norms and standards for tariffs. The norms and standards specifically allow for the differentiation of tariffs on an equitable basis by differentiating between users, types of water services and considering socio-economic and physical attributes of geographic areas. The Act states that limitations can be placed on profits and the income generated from the recovery of charges. The Act also makes provision for tariffs to promote water conservation. The Norms and Standards for Water Service Tariffs are discussed further in Section 3.4.1.

### **2.2.3 National Water Act (108 of 1997)**

The National Water Act legislates the way that the water resource (surface and ground water) is protected, used, developed, conserved, managed and controlled. It is in terms of this Act that a municipality obtains use of the water that it requires for distribution to its consumers. This Act also governs how a municipality may return effluent and other wastewater back to the water resource (DWA, 2005). The purpose of the National Water Act is to ensure that the nation's water resources are protected, used, developed, conserved, managed and controlled in an optimal manner. This requires consideration of factors such as meeting basic human rights, equity, efficiency, sustainability, conservation and equality.

### **2.2.4 Municipal Structures Act (117 of 1998)**

The Municipal Structures Act of 1998 sets up the basis for the establishment of municipalities in three different categories: (A) Metropolitan Municipalities, (B) Local Municipalities and (C) District Municipalities. The Structures Act takes into account need to provide municipal services in an equitable and sustainable manner. The Act gives district municipalities the powers and functions necessary to perform the WSA function as contained in the Water Services Act. The Minister of Provincial and Local Government may however authorise a local municipality, after consultation, to be a water service authority (WSA).

### **2.2.5 Municipal Systems Act (32 of 2000)**

The Municipal Systems Act complements the Structures Act by regulating key municipal organisational, planning, participatory and service delivery systems. The Act allows a municipal council to finance the affairs of the municipality by charging fees for services, imposing surcharges on fees or property rates, and (when allowed by national legislation) imposing surcharges on other taxes, levies and duties.

A municipality under the Act has duties, amongst others, to ensure that municipal services are provided to the local community in an equitable, and financially and environmentally sustainable manner; as well as to promote a safe and healthy environment in the municipality.

The Municipal Systems Act obliges municipal councils to consult the local community about municipal services. Communities should have a say in the way in which services are delivered (for example, by the municipal administration or through a service agreement); the level of services (for example, VIP latrines or waterborne sanitation); the quality of services (for example, how quickly the municipality processes planning applications); and the range of services which are provided (for example, whether the municipal council should provide recycling facilities) (PMG, 2013).

### **2.2.6 Strategic Framework for Water Services**

The Strategic Framework sets out a comprehensive approach with respect to the provision of water services in South Africa ranging from small community water supply and sanitation schemes in remote rural areas to large regional schemes supplying water and sanitation to people and industry in the largest urban areas.

The policy makes reference to a 'water ladder' with the emphasis is on the progressive improvement of levels of service over time (steps) that involves the provision of at least a basic water supply and sanitation service to all people living in South Africa with poor households receiving this basic service free of charge and an intermediate level of service such as a tap in the yard with water service authorities expected to assist communities in achieving an intermediate and higher level of service where feasible.

The policy outlines the institutional framework for water provision in the country and provides that DWA will no longer operate services but rather regulate and support water services institutions in their role of providing water services to the people. WSAs are given the responsibility of ensuring delivery of water services (DWA, 2003).

### **2.2.7 National Water Services Regulation Strategy**

The National Water Services Regulation Strategy allows the Department of Water and Sanitation to fulfil its requirements under the Water Services Act to serve as the national regulator of the water services sector. The role of DWS as a regulator is to ensure that consumer and public interest is ensured through compliance with national norms and standards, good performance and efficient use of resources, and good contracting practices. The sector decided to take a developmental approach to regulation, with the first leg including effluent quality as one of the three priority programmes.

The second leg focusses on the performance of the water sector, including data collection, communication and accountability of water service institutions. The third leg is the implementation of all regulatory tasks in the water sector.

### 2.2.8 National Water Policy Review

The Department of Water and Sanitation has recently (30 August 2013) released a government gazette on updated policy positions for public comment. The purpose of this policy review is to determine any unintended oversight and gaps in the current water policies in order to pave the way for the Department to amend legislation.

The policy review will seek to update the positions and amend legislation where gaps or unintended interpretations are found in the following documents:

- White Paper on Water Supply and Sanitation (1994)
- White Paper on a National Water Policy for South Africa (1997)
- White Paper on Basic Household Sanitation (2001)
- Strategic Framework for Water Services (2003)

## 2.3 ROLES AND RESPONSIBILITIES IN WASTEWATER MANAGEMENT

The key role-players responsible for the management of South Africa's water resources and the supply of water and sanitation are referred to as water sector institutions (Figure 2.2).

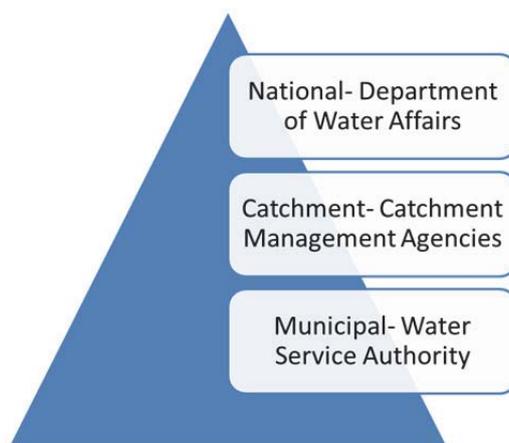


Figure 2.2: Water Sector Institution hierarchy in South Africa

### 2.3.1 Department of Water and Sanitation (DWS)

The Minister of Water and Sanitation sets the national objectives for protecting the resource in the national water resource strategy. Section 155(7) of the Constitution, as well as section 62(1) of the Water Services Act, mandates DWS to monitor the performance of the water sector. The department is the custodian of the Nation's water resources and is also the custodian of the National Water Act and the Water Services Act. In accordance with a Cabinet decision, the Department of Water Affairs and Forestry (now DWS) is responsible for co-ordinating the involvement of national government in the sanitation sector.

According to the White Paper on Basic Household Sanitation (2001), the Department will also, together with the other national level role players, be responsible for developing norms and standards for the provision of sanitation, co-ordinating the development by the municipalities of their Water Services Development Plans, and providing support to the provinces and municipalities in the planning and implementation of sanitation improvement programmes. Furthermore the Department is responsible for monitoring the outcome of such

programmes and maintaining a data base of sanitation requirements and interventions, providing capacity building support to provinces and municipalities in matters relating to sanitation, providing financial support to sanitation programmes until such time as these are consolidated into a single Department of Provincial and Local Government programme; and undertaking pilot projects in programmes of low cost sanitation.

Furthermore, the Department is responsible for the establishment of catchment management agencies (CMAs). CMAs are statutory bodies established by a notice in the government gazette, with jurisdiction in a defined water management area (WMA) (Figure 2.3). A CMA therefore manages water resources and coordinates functions of other institutions involved in water related matters within WMAs. A CMA begins to be functional once a governing board has been appointed, and is then responsible for specified initial functions, as well as any other functions delegated or assigned to it (DWA, 2012a).

### **2.3.2 Provincial Government**

Many municipalities will need assistance and guidance to develop the capacity required to prioritise, plan and implement programmes under this policy. The provinces will be key agents in supporting the municipalities in achieving their objectives and ensuring that local municipalities perform effectively. The province can provide support to municipalities in a number of areas, including financial, human resource and technical. According to the Strategic Framework document on water services – which states the responsibility of provincial government, together with national government to support and strengthen the capacity of local government in the fulfilment of its functions, and to regulate local government to ensure effective performance of its duties. The White Paper on Basic Household Sanitation (2001) lists the primary responsibilities of provincial government as the monitoring of legislation through the National Council of Provinces, ensuring compliance with national policy and norms and standards, and developing enabling provincial legislation and norms and standards. Furthermore, it states that, certain provincial departments, such as the provincial departments of the environment, local government, education, health and housing are the implementation arm of their national counterparts.

### **2.3.3 Local Government**

According to Part B of Schedule 4 of the Constitution, the primary responsibility for providing water and sanitation services in South Africa lies with WSAs, which the Water Services Act defines as the municipalities or local government. The Water Services Act of 1997 and the Municipal Systems Act also clearly outline this obligation, while the Municipal Structures Act and the institutional arrangements for water and sanitation provision at the local government level are outlined in the Strategic Framework for Water Services. Usually municipalities provide water and sanitation services directly through a municipal unit or department. However, they can delegate this responsibility to a water services provider for a defined period. The WSA is responsible for ensuring that infrastructure is developed, operated and maintained. It may perform the functions of a water services provider itself (i.e. it may develop, operate and maintain the infrastructure, manage revenue collection and customer relations, and promote health and hygiene awareness itself), or it may contract another water services provider to carry out this function on its behalf.

Under the Water Services Act, Water services providers are responsible for delivering water and sanitation services, acting on behalf of the WSA whose responsibility it is to ensure that consumers have access to these services (DWAF, 2005). Typical responsibilities of water services providers include the promotion and facilitation of the construction of at least basic sanitation facilities, health and hygiene promotion, ensuring that on-site latrines are desludged as necessary, management of sewer systems, safe treatment and disposal of waste and the monitoring and evaluation of service provision. Some of these functions can be sub-contracted to other agencies with the approval of the WSA (DWAF, 2005).

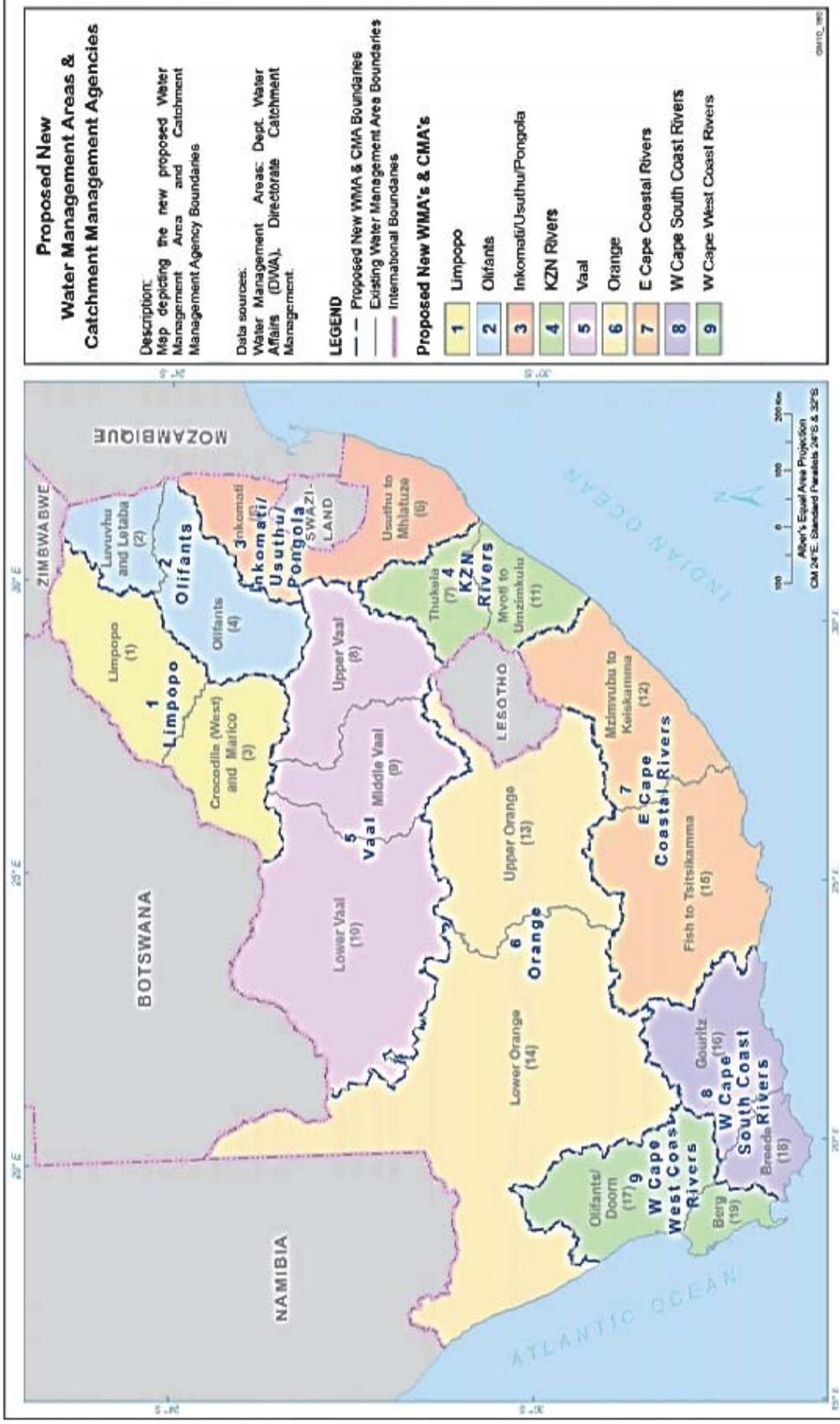


Figure 2.3: The boundaries of CMAs and corresponding WMAs (DWA, 2012a)

### **2.3.4 Department of Cooperative Governance and Traditional Affairs (CoGTA)**

The Department of Cooperative Governance and Traditional Affairs (formerly the Department of Provincial and Local Government) is responsible for the relationship between the national government and the provincial governments and municipalities, and for overseeing the traditional leadership of South Africa's indigenous communities. The department's responsibilities in terms of municipal infrastructure include the coordination and facilitation of municipal infrastructure policy development through intergovernmental forums at a national level; establishing municipal infrastructure delivery systems to monitor performance on delivery mandates and identify support requirements; as well administering and monitoring the transfer of Municipal Infrastructure Grant (MIG) funds to municipalities, and reporting to relevant authorities.

### **2.3.5 National Treasury**

The National Treasury is responsible for managing South Africa's national government finances. Efficient and sustainable public financial management is fundamental to the promotion of economic development, good governance, social progress and a rising standard of living for all South Africans. The Constitution mandates the National Treasury to ensure transparency, accountability and sound financial controls in the management of public finances. According to the White Paper on Basic Household Sanitation (2001), Treasury will take primary responsibility for funding arrangements such as the allocation of the equitable share and the various grants to provinces and municipalities; monitoring of the financial policies and performance of national departments, provinces and municipalities; and development of financial policies, norms and standards and guidelines. The National Treasury administers legislation that has implications for municipal service delivery, notably the Municipal Finance Management Act (MFMA), which highlights the provision of support to municipalities in terms of all financial matters relating to municipal infrastructure. National Treasury provides funds for infrastructure and operations/maintenance through the Municipal Infrastructure Grant and Equitable Share, respectively.

#### *2.3.5.1 Equitable share*

All municipalities receive a constitutionally mandated share of national tax revenues as an unconditional recurrent grant. One of its objectives is to offset the cost of free basic services. The formula provides higher grants to those municipalities that have a high number of poor among those that receive water services. Equitable Share also incentivises municipalities to increase access to services. In the 2012/13 budget the total equitable share (for all services) was R37.8 billion.

#### *2.3.5.2 Municipal Infrastructure Grant (MIG)*

The MIG programme is aimed at providing all South Africans with at least a basic level of service through the provision of grant finance to cover the capital cost of basic infrastructure for the poor. In the 2012/13 budget the allocation for MIGs was R13.8 billion.

## **2.4 SUMMARY**

This section provided a summary of wastewater management in South Africa. The legislative and policy framework governing wastewater management is described and found that although it is prescriptive, the ultimate responsibility falls to the municipality. The roles and responsibilities similarly place charge structure setting at the municipal level.

## **CHAPTER 3: PRICING AND ECONOMIC REGULATION IN THE WATER SECTOR**

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### **3.1 INTRODUCTION**

Wastewater treatment services are one of the core business responsibilities of a municipality who have the responsibility to ensure access to water services, affordably and effectively, to all consumers in an economic and sustainable manner. The different legislation and strategies that guide pricing and economic regulation in the water sector are discussed in the context of wastewater management by municipalities. Examples of wastewater charge structures by municipalities are provided, and inform the analyses conducted in proceeding chapters. Different cost components to the provisioning of wastewater services are also discussed to highlight the complexity of cost accounting municipalities' face, as well as give insight into how diverse municipality costs can be. This chapter serves to introduce many concepts that affect the wastewater charge setting process in municipalities, and provide an outline on the different ways municipalities can be assessed for the identification of barriers that they face in proceeding chapters.

### **3.2 THE WATER AND SANITATION VALUE CHAIN**

The water and sanitation business cycle varies drastically between municipalities based on scale, resources and requirements. They can all be simplified the following principle components presented in Figure 3.1. An overview of the water and sanitation value chain is discussed to provide insight into the how the wastewater sector fits into the value chain.

#### **3.2.1 Water Sourcing**

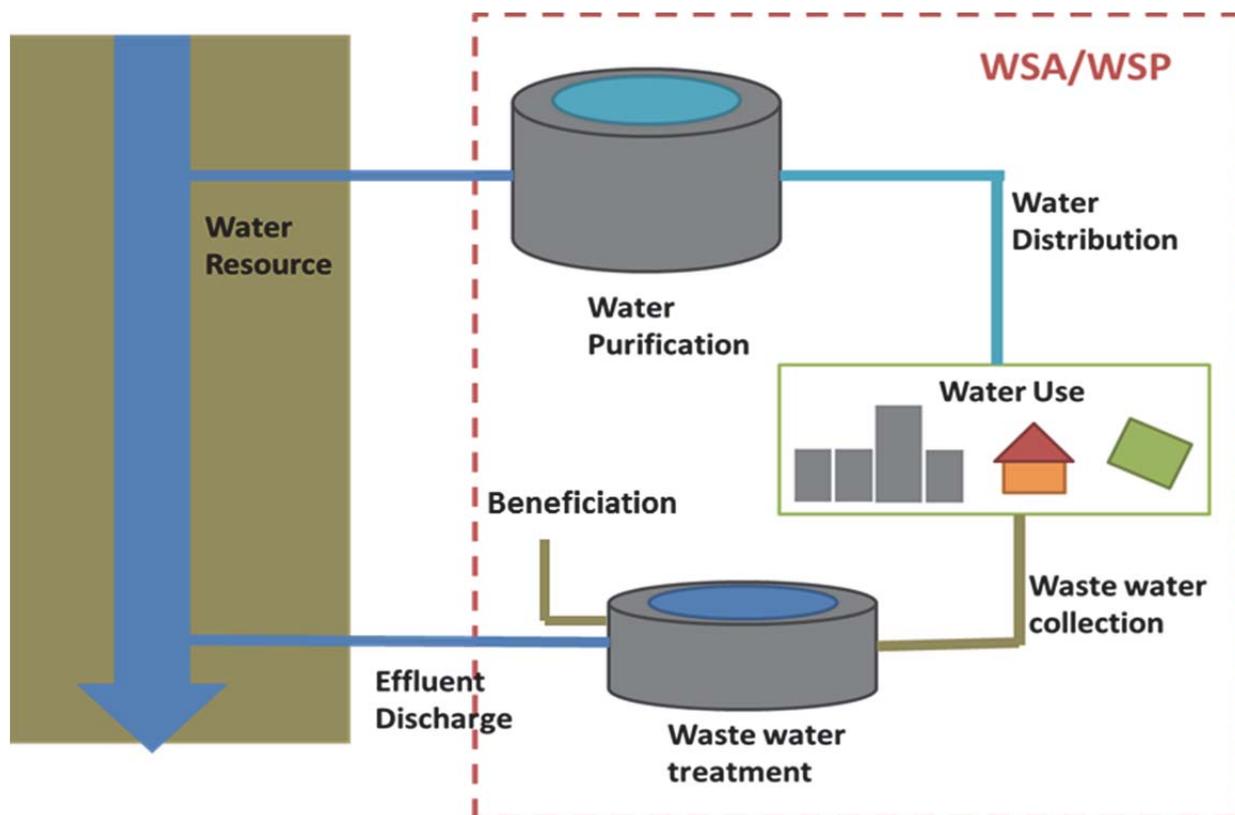
The Catchment Management Agencies will be responsible for the protection, development, management and control of use of raw water (surface and ground water). In many cases the national Department of Water and Sanitation has taken the initiative to develop, operate and maintain the inter-basin transfer schemes and the storage dams used to store the raw water (DWAf, 2005).

#### **3.2.2 Water Purification**

Bulk water services providers are responsible for developing, operating and maintaining abstraction works and bulk potable infrastructure, such as bulk water treatment plants and pump stations, and reservoirs and pipelines for distributing bulk potable water to the municipal reservoirs. In terms of bulk potable water, the municipality can either fulfil this function itself, or it can contract a bulk water services provider.

#### **3.2.3 Water Distribution**

The WSA or its designated Water Service Provider is responsible for ensuring that infrastructure for water reticulation to consumers is developed, operated and maintained. Municipal infrastructure comprises the municipal reservoirs, pump stations and pipelines used to reticulate the water to the consumer.



**Figure 3.1: Schematic diagram of the water and water-borne sanitation business cycle. The responsibility of the Water Service Authority (WSA) or Water Service Provider (WSP) is outlined**

### 3.2.4 Water Use

Water serves for domestic, commercial, industrial and agricultural sectors. Water user associations are cooperative associations of individual water users who wish to undertake water-related activities for their mutual benefit, typically agricultural. Dependent on the type of water use, wastewater of varying qualities is produced.

### 3.2.5 Wastewater Collection

The WSA is responsible for the collection (water-borne) and treatment of sewage, wastewater and effluent. The White Paper on Basic Household Sanitation (2001) states that the minimum acceptable basic level of sanitation is a system for disposing of human excreta, household wastewater and refuse, which is acceptable and affordable to the users, safe, hygienic and easily accessible and which does not have an unacceptable impact on the environment, and a toilet facility for each household. However, there are many different types of sanitation systems in South Africa, with the most basic acceptable form as identified by the National Sanitation Policy being the Ventilated Improved Pit toilet (onsite). In this study, only water-borne sewage is considered.

### 3.2.6 Wastewater Treatment

Wastewater treatment aims at removing conventional, non-conventional and emerging constituents from wastewater. This is achieved by arranging conventional and non-conventional (advanced) unit operations and processes in a logical sequence of treatment levels. Wastewater treatment is the process of removing contaminants from wastewater from domestic and industrial sources. It includes physical, chemical, and biological processes to remove physical, chemical and biological contaminants. Its objective is to produce an environmentally safe fluid waste stream and a solid waste suitable for disposal or reuse. The levels of treatment are preliminary, primary, secondary and tertiary, and are classified according to the constituent removed and the treatment technology used to achieve constituent removal (Figure 3.2).

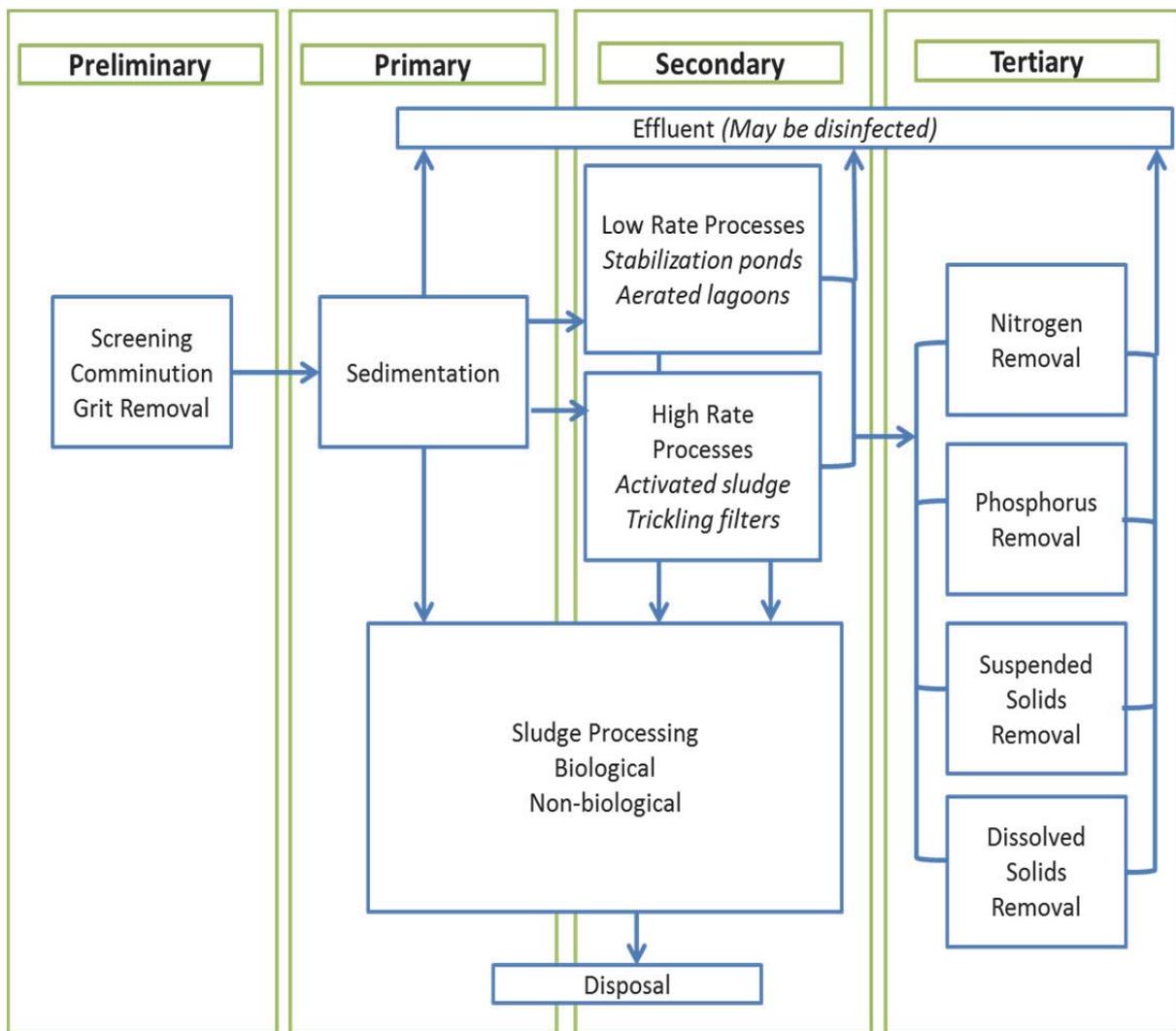


Figure 3.2: Levels of treatment and unit operations and processes (adapted from Asano *et al.*, 1985)

Table 3.1 summarises treatment processes in terms of constituents removed and Table 3.2 provides an overview of the technologies applied in South Africa. Examples of effluent standards are presented in Table 3.3.

**Table 3.1: Major biological treatment processes, uses and metabolic function (Burger and Pearce, 2012)**

<b>Metabolic function</b>	<b>Biological treatment process</b>	<b>Uses</b>
<p><b>Aerobic</b> Biological treatment processes occurring in the presence of oxygen</p>	<p><b>Suspended growth</b> Biological treatment process in which micro-organisms responsible for treatment are kept in suspension within the liquid</p>	<p><b>Carbonaceous BOD removal</b> Biological conversion of organic material to cell tissue and gasses with the assumption that all organic nitrogen compounds be converted to ammonia</p>
<p><b>Anoxic</b> The biological conversion of nitrate to nitrogen gas i.e. denitrification, in the absence of oxygen</p>	<p><b>Attached growth</b> Biological treatment process in which micro-organisms responsible for treatment are attached to an inert material</p>	<p><b>Nitrification</b> Two-step biological process by which ammonia is first converted to nitrite and then nitrate</p>
<p><b>Anaerobic</b> Biological treatment processes occurring in the absence of oxygen</p>		<p><b>Denitrification</b> Biological reduction of nitrate to nitrogen containing gasses</p>
<p><b>Combined</b> Various combinations of aerobic, anoxic and anaerobic processes grouped together to achieve a specific treatment objective</p>		<p><b>Biological phosphorous removal</b> The biological removal of phosphorous by accumulation in biomass and the subsequent removal of the solids</p>
<p><b>Lagoon</b> Generic term for treatment processes taking place in ponds or lagoons</p>		

**Table 3.2 Summary of the various wastewater treatment technology types in South Africa by province. (Scheepers and vd Merwe-Botha, 2013)**

PROVINCE	Techn ology # per provin ce	Wastewater Treatment Technology Types															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Limpopo	75	13	3	0	0	0	0	0	44	0	0	14	0	0	1	0	0
Mpumalanga	94	39	4	0	0	0	0	0	24	0	1	22	0	2	0	0	2
Gauteng	69	24	19	0	1	0	1	0	2	0	0	19	0	0	0	3	0
North West	42	19	4	0	2	0	0	0	12	0	0	5	0	0	0	0	0
Free State	134	36	3	0	0	0	0	1	49	0	14	27	1	0	0	0	3
Northern Cape	75	11	1	0	1	0	1	0	52	0	2	6	0	0	0	1	0
KwaZulu Natal	158	58	2	17	5	1	1	4	38	0	7	21	0	1	2	1	0
Eastern Cape	146	45	4	0	0	0	1	0	61	0	2	19	2	2	6	2	2
Western Cape	182	65	1	4	0	0	2	2	57	0	3	12	3	3	3	1	26
<b>Totals</b>	<b>975</b>	<b>310</b>	<b>41</b>	<b>21</b>	<b>9</b>	<b>1</b>	<b>6</b>	<b>7</b>	<b>339</b>	<b>0</b>	<b>29</b>	<b>145</b>	<b>6</b>	<b>8</b>	<b>12</b>	<b>8</b>	<b>33</b>
	975	1- 7: Activated sludge and variations							8 & 10 Ponds and lagoons			11: Biof ilter	9 & 12-16: Other				
	975	395							368			145	100				

**Table 3.3 Concentration limits of water quality indicators (Burger and Pearce, 2012)**

STANDARDS	WATER QUALITY INDICATORS					
	NO <sub>3</sub> <sup>-</sup>	TIN	PO <sub>4</sub> <sup>3-</sup> /SRP	SO <sub>4</sub> <sup>2-</sup>	TDS	EC
WQG Domestic Use – Formal	6			200	450	
WQG Domestic Use – Informal	10			400	1000	
WQG Industrial Use	6		0,02	200	500	
WQG Agricultural Use		0,5			450	
WQG Aquaculture			0,077			
WQG Livestock Watering	100			1000	1000	
EU Drinking Water Use	< 50			250		
Canadian Drinking Water	45			500 <sup>a</sup>		
Australian Drinking Water	50			500		
Australia Recreational	10			400		
Category A		0,25	0,005	130		
Category B		0,75	0,02	200		
Category C		2	0,058	350		
Category D		4	0,125	530		
Recommended/Ideal	6		0,005		200	31
Acceptable	10		0,015		350	54
Not Recommended/ Tolerable	20		0,025		800	123

### **3.2.7 Water Reuse and Beneficiation**

There is the potential for treated water to be reused, dependent on the final quality. Subject to meeting relevant standards, final wastewater effluent may be used for industrial or irrigation purposes. If the final wastewater effluent is of high quality, it may be beneficiated further to be combined with raw water and treated to potable standards. Similarly, there is the potential for wastewater sludge to be processed into useful byproducts. Sludge may be utilized for its thermal or chemical properties. Internationally the perspective has shifted towards sludge being a valuable resource. If the same could be achieved locally, it could potentially alter the decision making process with regards to the installation of wastewater treatment facilities.

### **3.2.8 Wastewater Treated Effluent Discharge**

Treated effluent is discharged into water resources, and is required to meet effluent standards. The National Water Act (NWA) aims to ensure the sustainable use of water resources for the benefit of all users. One of the measures for achieving this is the so-called Resource Quality Objectives (RQOs). The RQOs would affect wastewater treatment works (WWTW) through the water quality conditions associated with effluent emanating from the WWTW. Where river classes are higher and RQOs are more stringent, stricter water use licence conditions will be associated with the effluent standards will be stricter. It is to be expected that the WDCS effects will also be larger. Although no RQOs have yet been gazetted for South Africa, preliminary RQOs do exist, and these will be considered in this study.

## **3.3 COST RECOVERY FOR WASTEWATER SERVICES**

### **3.3.1 Introduction**

Wastewater treatment services are one of the core business responsibilities of a municipality. Legislation in South Africa ensures the access to water services, affordably and effectively, to all consumers in an economic and sustainable manner. For this reason, Water Service Authorities (WSAs) are equipped with bylaws and reasonable charges in order to assist and guide them for cost recovery and revenue collection as to provide water services.

The provision of wastewater treatment, due to national and international economic and policy changes, is likely to become increasingly costly. Drivers of increasing costs include:

- Rising electricity costs: Increasing electricity costs which make up a considerable proportion of treatment costs will raise the total costs of wastewater management, particularly for more technologically advanced WWTWs.
- Discharge charges: The implementation of the waste discharge charge will increase costs of wastewater management, particularly for WWTWs that have poor effluent quality.
- Depreciation: If infrastructure depreciation is included, wastewater service costs will increase notably.
- Increased utilisation: The National Water Policy Review recommends increased access to water services i.e. more than the basic standpipe. More individuals having access to running water will mean that more households will likely install flush toilets, increasing the treatment volumes for rural wastewater services in particular.
- Increased chemical costs: Increasing fuel and commodity prices internationally will likely put upward pressure on the price of chemicals used in WWTWs.

Municipal sewage and wastewater treatment infrastructure comprises the sewerage pipes and sewerage treatment plants used to collect sewage, wastewater and other effluent and to treat it before returning the treated water back into the water resource. Wastewater management in South Africa has many costs related to the collection treatment and discharge of effluent, and an understanding of these costs is crucial to setting wastewater charges. The total cost of wastewater management includes many components that need to be recovered by wastewater charges (Figure 3.3). The contribution of different components to the total costs of wastewater management vary considerably depending on the different technologies implemented (Table 3.4). However, technology type is not the only factor that affects the cost breakdown.

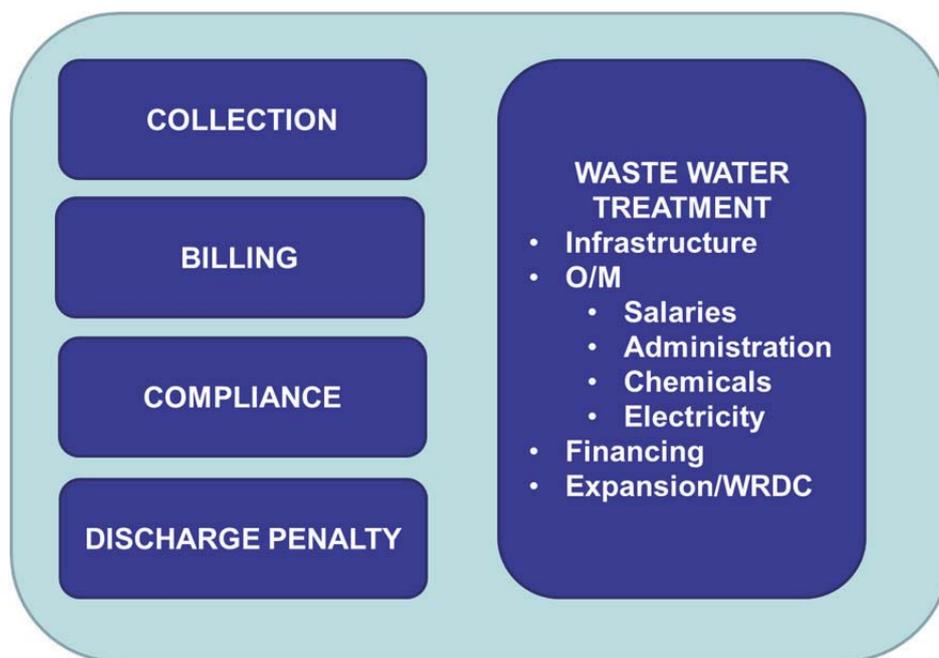


Figure 3.3: Components of wastewater costs to municipalities.

Table 3.4: Breakdown of cost elements of two technology scenario WWTWs (Scheepers and vd Merwe-Botha, 2013)

	Description	Low end technology plants		High end technology plants	
		%	Cost (R/kl)	%	Cost (R/kl)
2011	Maintenance	28	0.200	35	0.639
	Staffing	52	0.366	31	0.559
	Electricity	11	0.076	20	0.364
	Chemicals	9	0.067	13	0.240
	Full O&M	100	0.708	100	1.801
	Annual municipal budget per cost centre		258,429.976		657,485.884

### 3.3.2 Collection/conveyance of Wastewater

The collection costs of wastewater (from water-borne systems) include all costs incurred in the conveyance of wastewater from the water user (domestic or industrial) to the wastewater treatment plants. These costs include infrastructure costs and operation and maintenance costs.

### 3.3.3 Wastewater Treatment

Wastewater treatment pricing is required to recover costs of wastewater treatment, as well as consider several other factors. Wastewater treatment costs form bulk of the entire wastewater management costs. They include:

**Infrastructure costs:** with wastewater treatment systems chosen considering the volumes and types of effluents the plant needs to process. Apart from the establishment costs of WWTW, infrastructure costs also include financing costs and costs associated with the development of new infrastructure.

**Operations and Maintenance costs:** include salaries for staff, administration costs, chemicals (consumables) used in the treatment of wastewater and electricity costs. Increasing electricity costs are a putting severe strain on WWTW budgets.

### 3.3.4 Financing and Expansion

New builds and expansions require financing. Sanitation investments can be financed through inter-governmental grants, borrowing and internal cash generation. The larger municipalities rely more on loans and on internal cash generation, while the smaller ones depend more on grants and other sources of funding, such as the Municipal Infrastructure Grant (MIG). Wealthier municipalities partially finance free basic water through cross-subsidies from non-residential users and local tax revenue. On a national scale, large gaps in investment need to be addressed (Figure 3.4).



Figure 3.4: Overall annual and per capita investment requirements and contribution from different sources (AMCOW, 2011)

### 3.3.5 Wastewater Treated Effluent Discharge

The release of effluent from WWTW into the environment carries additional costs to comply with regulation. These costs can include further treatment to meet effluent standards, charges for disposal of effluent or potential fines for non-compliance.

#### 3.3.5.1 *Water-use license*

WWTW discharging above 2 million litres per day are required to apply for a water-use license. Costs associated with obtaining a license include application costs and studies to assess the ecosystems.

#### 3.3.5.2 *Waste discharge charge system*

The WDCS is a charge associated with the discharge of effluent into water resources.

The Waste Discharge Charge System (WDCS) was developed by the Department of Water Affairs and Forestry (DWAF), now the Department of Water and Sanitation (DWS), to promote waste reduction and water conservation. This WDCS, based on the polluter pays principle, was developed within the Pricing Strategy of the National Water Act (Act 36 of 1998).

The broad aims of the WDCS are the:

- Promotion of sustainable development and efficient use of water resources.
- Promotion of the internalisation of environmental costs by impactors.
- The creation of financial incentives for dischargers to reduce waste and use water resources in a more optimal way.
- Recover the costs of mitigating the impacts of waste discharge on water quality.

An important part of the WDCS are the catchment specific Resource Quality Objectives (RQOs) which are the acceptable levels of impact on the water resource. They are defined in the National Water Act as “clear goals relating to the quality of the relevant water resources.” The RQOs are numerical and narrative descriptors of quality, quantity, habitat and biotic conditions that need to be met in order to achieve the required management scenario. The NWA provides for the determination of preliminary RQOs of the water resources before the formal water resource classification system is established. Once RQOs have been gazetted, or preliminary RQOs have been determined, they must be given effect to (DWAF, 2007).

Resource Water Quality Objectives (RWQOs) are the water quality components of the Resource Quality Objectives (RQOs). They are defined as numeric or descriptive in-stream (or in-aquifer) water quality objectives typically set at a finer resolution (spatial or temporal) than RQOs to provide greater detail upon which to base the management of water quality of the resource. RWQOs outline water user compliance requirements with respect to water quality, as well as their needs with respect to the disposal of water containing waste to the resource and the aquatic ecosystem requirements (DWAF, 2007).

The principles of the WDCS listed in the strategy are (DWAF, 2007):

1. Resource quality objectives are the basis for the WDCS
2. The WDCS applies to surface and groundwater resources
3. Catchment scale
4. Downstream/upstream catchments
5. Charge based on load
6. Constant charge rate
7. Subtraction of intake
8. Minimum load thresholds

## Barriers to the Implementation of Effective Wastewater Charges

Managed by Catchment Management Agencies (CMAs), registered water uses will be subjected to the WDCS, which include point sources and non-point sources in terms of Section 21 of the National Water Act (Grosskopf *et al.*, 2003). The WDCS considers the effect of water uses on water quality variables such as salinity, nutrients, pH, heavy metals and organic material. The WDCS will address its aims through two distinct charges. The Incentive Charge seeks to provide an incentive to reduce waste load at source with a discharge charge which makes it an environmental tax. The Mitigation Charge seeks to cover the costs of mitigating the effects of the load on the water resource and falls into four categories: load removal from the resource, dilution of the load, downstream treatment and treatment at the source (Figure 3.5).

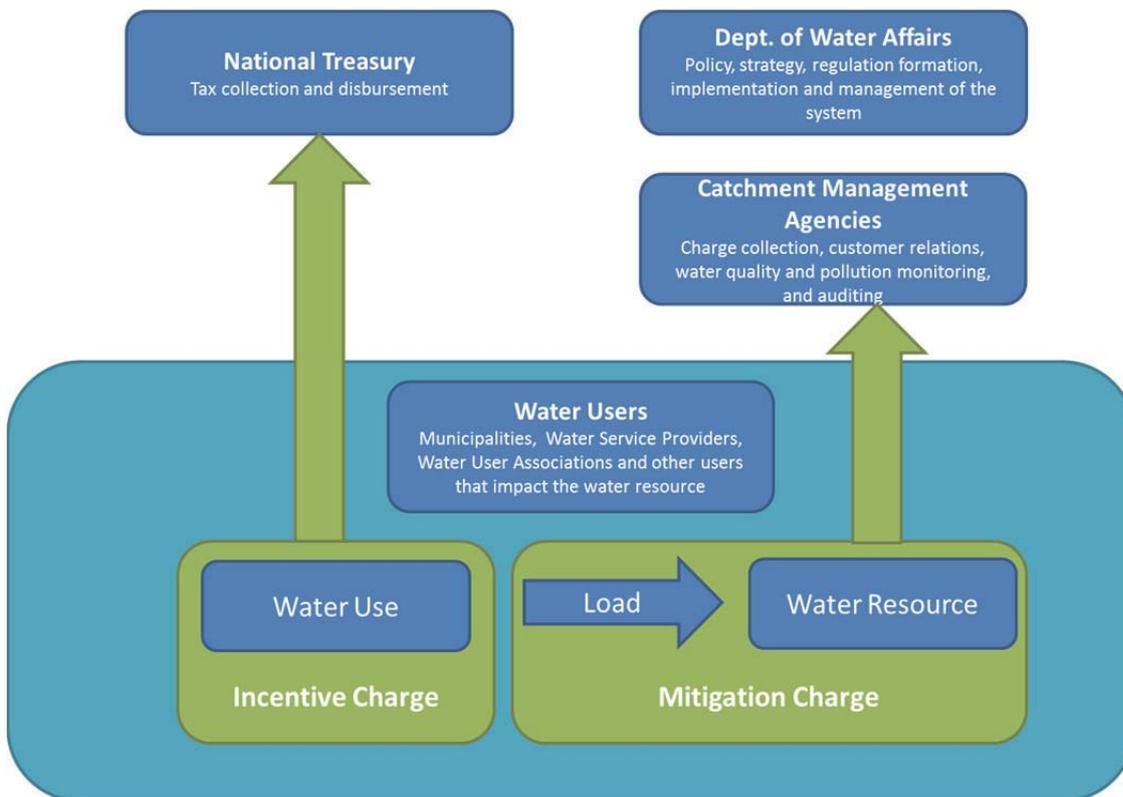


Figure 3.5: Overview of the components of the Waste Discharge Charge System

### 3.3.6 Billing

Billing water users is essential to recovering costs of wastewater treatment, and has several costs associated with it.

#### *Metering*

Industrial and domestic water users can be billed using separate charge structures that typically include a fixed and variable component. The calculation of influent from domestic users is often calculated as a proportion of water used. Industrial users are usually charged according to the quantity of effluent produced as well as certain indicators of water quality.

### *Equity*

Many consumers are unable or unwilling to pay for access, such that the costs may have to be passed on to the paying consumers or recovered through subsidies.

**Equitable Share** is the unconditional allocation of revenue to the national, provincial and local spheres of government as stipulated by Section 214 of the South African Constitution providing for:

- The equitable division of revenue nationally among the national, provincial and local spheres of government;
- The determination of each province's equitable share of the provincial share of that revenue; and
- Any other allocations to provinces, local government or municipalities from the national government's share of that revenue, and any conditions on which those allocations may be made.

The equitable share has been designed to ensure that municipalities have the resources to render basic services to low income or poor households and to enable them to build an administrative infrastructure. It is intended to provide municipalities with sufficient funds for the operational costs of providing free basic services to their poor households. However, municipalities with a low revenue base rely on the Equitable Share as their primary revenue source to finance the operations of the municipality as a whole thus the share actually going to poor households is reduced (DWA, 2012b).

**Charge structures:** There are three main types of charge structures (Boland and Whittington, 2000; Hajispyrou *et al.*, 2002):

- **Average Cost Pricing:** Are flat tariffs where the costs are divided equally based on consumption. Consumers are charged a single volumetric rate (Olmstead *et al.*, 2003)
- **Increasing Block Pricing:** Price per unit increases with consumption. Can serve as a cross subsidy and/or incentivise conservation. In South Africa, increasing block tariffs are prescribed by regulations under the Water Services Act to address problems of unequal income distribution and provide fair access to water (Bailey and Buckley, 2005).
- **Declining Block Pricing:** Price per unit decreases with consumption. Can serve to capture fixed costs associated with the service.

## 3.4 REGULATION OF WASTEWATER CHARGES IN SOUTH AFRICA

### 3.4.1 Norms and Standards for Water Services Tariffs

The Water Services Act allows the Minister to prescribe compulsory national standards relating to tariffs for water services. The Act tasks the Minister to, when setting norms and standards, consider social equity, financial sustainability, cost recovery, the return on capital investments and the need for reserve capacity. As such the Department of Water and Sanitation sets norms and standards for the pricing of water services, but local government is free to determine its own price levels within this guiding framework (Table 3.5). The Act prohibits water service institutions from using a tariff substantially different from the prescribed norms and standards.

**Table 3.5: Institutional responsibility for tariff setting and regulation (Muller, 2007)**

Tariff/Charge	Responsibility for setting tariff and source of authority	Responsibility for regulating the tariff (and comments)
<p>Water resource management charge (Recovers the costs of water resources management)</p> <p>Raw water tariff (water resource development charge). (Recovers the infrastructure and operating cost of schemes)</p> <p>Bulk water and wastewater tariffs (Recovers the cost of conveying and treating bulk water and wastewater.)</p> <p>Retail water tariff and sanitation charges. (Includes the bulk water and wastewater tariff and recovers the retail costs.)</p> <p>Waste discharge charge (proposed). (A water resource charge based on the polluter pays principle)</p>	<p>Catchment Management Agency in terms of National Water Act</p> <p>DWAF in terms of the national raw water pricing strategy and in consultation with water users including local government</p> <p>Negotiations between Water Board and Water Services Authority (or its appointed provider) in the case of a Water Board.</p> <p>Water Services Authority where bulk function undertaken itself or by an entity owned by the Water Services Authority.</p> <p>Consultation between Water Services Authority and external provider of services (for example, another municipality).</p> <p>Water Services Authority in terms of the Water Services Act and Municipal System Act</p> <p>Catchment Management Agency in terms of National Water Act, in consultation with water users, including local government. DWAF where there is no CMA</p>	<p>DWAF. Where there is no catchment management agency, DWAF also sets the tariff (self-regulation). DWAF (subject to National Treasury oversight). (Note: raw water tariffs are also implicitly set by Water Services Authorities and Water Boards where these organisations manage raw systems.)</p> <p>DWAF (direct regulation of Water Boards.)</p> <p>Water Services Authority</p> <p>DWAF (these are subject to National Treasury oversight)</p> <p>Water Services Authority (Subject to DWAF oversight). DWAF sets national norms and standards for the setting of retail tariffs.</p> <p>DWAF (subject to National Treasury oversight).</p>

The Norms and Standards for Water Service Tariffs thus serve to regulate the process of the setting of tariffs while providing water service institutions flexibility in its application. A key regulation in the norms and standards pertaining to wastewater tariffs are that water service institutions ensure cost recovery, which requires them to determine their full revenue requirements of ensuring that all households have at least the basic levels of service. Apart from prescribing the costs that need to be considered when determining the revenue required it also encourages the use of subsidies. It also recommends that wastewater charges be determined from water use, rather than direct metering.

Some limitations of the current norms and standards are that they do not provide for ringfencing of WSPs, do not adequately address sanitation services and do not provide for tariff determination or disclosure. These limitations will be addressed in the revision of norms and standards (Figure 3.6) (DWS, 2013). The Department is also currently developing a Water Services Financial Model based on a budget process described by National Treasury that will be aligned to and support the norms and standards (DWS, 2013).

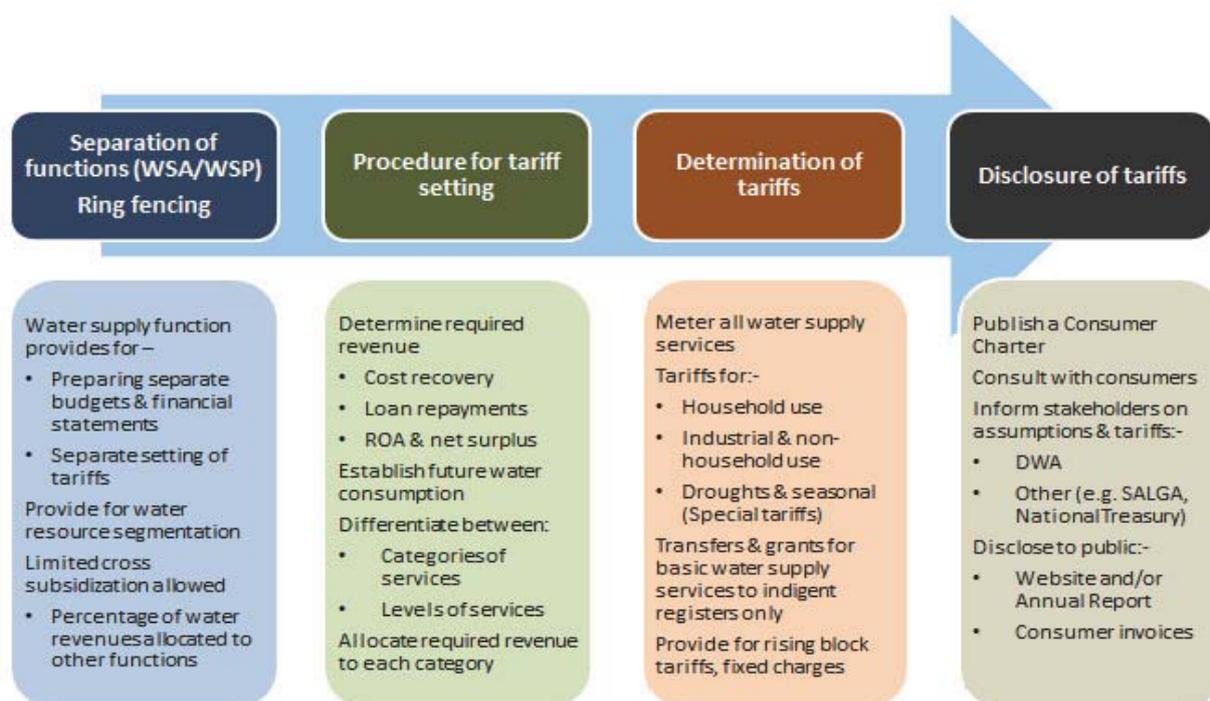


Figure 3.6: New Norms and Standards for WSAs and WSPs (DWS, 2013)

### 3.4.2 Water Pricing Strategy Document

DWS's Water Pricing Strategy document is based on the principles (Eberhard, 2005; DWA 2007) of social equity, ecological sustainability, financial sustainability and economic efficiency.

The social equity component focuses redressing the imbalances of the past with respect to inequitable access to basic water services at affordable tariffs within municipal areas, by facilitating a conditional subsidy on raw water cost where stepped tariffs are introduced; and inequitable access to water for productive use purposes by subsidising tariffs for emerging farmers for a limited time period.

Ecological sustainability requires the safeguarding of the ecological reserve through ecological management at the catchment level, focussing on water quality protection and water conservation through demand management. Financial Sustainability is aimed at generating adequate revenue for funding the costs related to the management of water resources; and the operation, maintenance and refurbishment of existing schemes. Economic efficiency aims to promote the efficient allocation and beneficial use of water, by requiring water to be priced at its opportunity cost; and allows for administrative as well as market-related measures to achieve this goal.

### 3.4.3 Municipal Waterborne<sup>1</sup> Sanitation Charges and Tariffs

Water services institutions must comply with the requirements for municipal tariff setting as set out in the Municipal Systems Act (SALGA, 2011). The setting of wastewater charges requires a municipality to determine the full costs of providing the service on a sustainable basis, determine the amount of subsidy

<sup>1</sup> The focus of this report is limited to waterborne sanitation.

## Barriers to the Implementation of Effective Wastewater Charges

available to assist in the provision of the service and to determine the revenue required to meet the shortfall between the costs of providing the service and the subsidy available to the service.

Specifically, the Act states with regards to tariff policy that:

(1) A municipal council must adopt and implement a tariff policy on the levying of fees for municipal services provided by the municipality itself or by way of service delivery agreements, and which complies with the provisions of this Act and with any other applicable legislation.

(2) A tariff policy must reflect at least the following principles, namely that—

- (a) users of municipal services should be treated equitably in the 'application of' tariffs;
- (b) the amount individual users pay for services should generally be in proportion to their use of that service;
- (c) poor households must have access to at least basic services through-
  - (i) tariffs that cover only operating and maintenance costs;
  - (ii) special tariffs or life line tariffs for low levels of use or consumption of services or for basic levels of service; or
  - (iii) any other direct or indirect method of subsidisation of tariffs for poor households;
- (d) tariffs must reflect the costs reasonably associated with rendering the service, including capital, operating, maintenance, administration and replacement costs, and interest charges;
- (e) tariffs must be set at levels that facilitate the financial sustainability of the service, taking into account subsidisation from sources other than the service concerned;
- (f) provision may be made in appropriate circumstances for a surcharge on the tariff for a service;
- (g) provision may be made for the promotion of local economic development through special tariffs for categories of commercial and industrial users;
- (h) the economical, efficient and effective use of resources, the recycling of waste, and other appropriate environmental objectives must be encouraged;
- (i) the extent of subsidisation of tariffs for poor households and other categories of users should be fully disclosed.

(3) A tariff policy may differentiate between different categories of users, debtors, service providers, services, service standards, geographical areas and other matters as long as the differentiation does not amount to unfair discrimination.

And that with regards to by-laws to give effect to policy that a municipal council must adopt by-laws to give effect to the implementation and enforcement of its tariff policy. By-laws may differentiate between different categories of users, debtors, service providers, services, service standards and geographical areas as long as such differentiation does not amount to unfair discrimination.

### 3.4.4 National Water Services Regulation Strategy

The National Water Services Regulation Strategy states that “the financial ring-fencing of water services provision is a prerequisite for financial transparency. Ring-fencing of wastewater functions in a municipality is essential in the management of costs and the effectiveness of charge setting. Typically, municipal financial accounts do not show water services accounts in terms of a ring-fenced set of financial accounts. As such, it is not possible to determine with any confidence or accuracy the true costs associated with delivering water services on a sustainable basis, and hence the revenue requirements and sustainability of services.” The National Regulation Strategy sets out a strategy for getting water services provision to be financially ring-fenced. This strategy includes the development of clearer legislation and regulations on ring-fencing and

notes the need for “a consistent and appropriate accounting framework for water services which recognises the capital intensity of water services and places significant emphasis on adequate provisions for maintenance, rehabilitation and asset renewal” (SALGA, 2011). The strategy includes many Key Performance Indicators to measure performance of WSAs (Figure 3.7)

2. ACCESS TO A BASIC SANITATION SERVICE		
2.1	Indicator	Percentage access to a basic sanitation service
	Definition	The proportion of households with access to at least basic level of sanitation service
2.2	Indicator	Absolute backlog (sanitation)
	Definition	Number of households without access to at least a basic sanitation services (as per the definition in the Strategic Framework), this includes both those served but to below basic level, those with a bucket disposal service and those with no service
2.3	Indicator	Rate of reduction in backlog (sanitation)
	Definition	The percentage reduction in the number of households without access to at least a sanitation service (as per the definition in the Strategic Framework)
2.4	Indicator	Households with access to a free basic sanitation service
	Definition	The number of households with access to a free basic sanitation service as defined in the Strategic Framework
7. BASIC SANITATION PROVISION		
7.1	Indicator	Monitoring the impacts of on-site sanitation systems
	Definition	The WSA has a programme in place to monitor and assess the environmental conditions and impacts of on-site dry sanitation and non reticulated systems.

**Figure 3.7: Key performance areas specific to sanitation in the National Water Services Regulation Strategy (DWA, 2004)**

### 3.4.5 National Treasury Guidelines

National Treasury provides guidelines to municipalities on setting water charges (National Treasury 2011). This document recognises that South Africa faces challenges with regard to water supply as due to demand growth often exceeding supply.

#### 3.4.5.1 Tariff Level and Structure

The document encourages municipalities to review the level and structure of their tariffs to ensure that tariff structures are cost reflective by 2014.

#### 3.4.5.2 Calculation of sanitation annual tariff increases

The document provides an example of calculating sanitation annual tariff increases (Table 3.6). It does however not provide guidelines for calculating the actual tariff as it assumes that this tariff is already in place and accurate. The determination of tariff increases is based on inflationary adjustment of input costs. For example, if electricity cost contributes approximately 20 per cent of wastewater treatment input costs, a higher than CPI should be implemented for sanitation tariffs. Other factors that also contribute to the proposed tariff increases are mentioned:

- Wastewater charges are to be calculated according to the percentage water discharged;
- Free sanitation (98% of 6 kl water) are be applicable to registered indigents; and
- The total revenue expected to be generated from rendering this service o needs to be considered.

**Table 3.6: Comparison between current sanitation charges and increases**

CATEGORY	CURRENT TARIFF 2010/11		PROPOSED TARIFF 2011/12	
	per cent DISCHARGED	TARIFF PER kl	per cent DISCHARGED	TARIFF PER kl
		R		R
0 -6 kl per 30-day period	98	3,10	98	3,44
7-12 kl per 30-day period	90	4,20	90	4,66
13-18 kl per 30-day period	75	5,42	75	6,02
19-24 kl per 30-day period	60	5,42	60	6,02
25-30 kl per 30-day period	52	5,42	52	6,02
31-42 kl per 30-day period	10	5,42	10	6,02
More than 42 kl per 30-day period	2	5,42	2	6,02

#### 3.4.5.3 Analysis of impact of proposed sanitation increases

The document also gives examples of tables comparing the current and proposed tariffs, as well as an analysis of the impact of the proposed increases in sanitation tariffs on the sanitation bill for a single dwelling-house (Table 3.7).

**Table 3.7: Comparison between current sanitation charges and increases, single dwelling- houses**

Monthly sanitation consumption kl	Current amount payable R	Proposed amount payable R	Difference (11% increase) R
5	15,19	16,86	1,67
10	33,35	37,02	3,67
20	71,80	79,79	7,90
30	101,72	112,91	11,19
40	107,14	118,93	11,79
50	108,66	120,61	11,95
80	110,28	122,42	12,14
100	111,37	123,62	12,25

### 3.5 REVIEW OF WASTEWATER CHARGE SETTING PRACTICES

#### 3.5.1 Overview

The provision of wastewater treatment, due to national and international economic and policy changes, is likely to become increasingly costly. Drivers of increasing costs include:

- Rising electricity costs: Increasing electricity costs which make up a considerable proportion of treatment costs will raise the total costs of wastewater management, particularly for more technologically advanced WWTWs.
- Discharge charges: The implementation of the waste discharge charge will increase costs of wastewater management, particularly for WWTWs that have poor effluent quality.
- Depreciation: If infrastructure depreciation is included, wastewater service costs will increase notably.
- Increased utilisation: The National Water Policy Review recommends increased access to water services i.e. more than the basic standpipe. More individuals having access to running water will mean that more households will likely install flush toilets, increasing the treatment volumes for rural wastewater services in particular.
- Increased chemical costs: Increasing fuel and commodity prices internationally will likely put upward pressure on the price of chemicals used in WWTWs.

#### 3.5.2 Wastewater setting practices in South Africa

##### 3.5.2.1 Types of Wastewater Charges

The structuring of wastewater charges is a fairly complex process, dependent on several contextual considerations including (DWAF, 2007), the type of water uses occurring within a given municipality (and the resulting pollutants that enter the system), the classification status of the water resources intended to absorb any untreated effluent and their associated ability to absorb it, also seasonal variation thereof, and the overarching objective of protecting water resources necessitates charge considerations that promote the prevention of water resource degradation rather than remediation of polluted/damaged water resources. Municipalities generally require two types of wastewater charges:

- a. Flat-rate charges – The flat rate charges are charged to domestic and commercial users, whose wastewater is of a generic quality, and which is linked to their average water use.
- b. Variable rate charges. The variable charges are charged to industrial users whose wastewater quality may contain extremes of COD, nutrients and other pollutants.

The development of an effective wastewater treatment charge is thus dependent on an intimate understanding of the various factors that determine how it should be structured. A lack of understanding in any of the underlying contextual considerations, be it monitoring, resource quality, resource quality objectives or a clear delineation of which pollutants accrue to which sectors/industries/businesses, the end result will be a sub optimal wastewater treatment charge. A significant amount of work has been done to delineate the complexities of setting wastewater treatment charges, most notably and most recently by Hosking *et al.* (2011). However, despite the availability of such resources recent investigations as part of the DWS Olifants Water Resource Classification System (DWA, 2012) have revealed that these proposed charge structures are not being applied at the municipal level, especially in municipalities that struggle to achieve Green Drop certification. This suggests that the reasons for the lack of implementation of new and relevant charge structures within municipalities is most probably due to a lack of understanding in one or more of the contextual considerations listed earlier that are required to set the charge.

3.5.2.2 Examples of wastewater charge setting pstructures

A preliminary study on the setting of wastewater charges in municipalities was conducted on four different municipalities (Examples 1-4) that performed well in the Green Drop Certification Programme in order to understand how municipalities calculated charges (Burger, 2012). The calculation of charges for industrial effluent available in their published bylaws was evaluated. A bylaw is a law passed by the council of a municipality to regulate the affairs and the services it provides within its area of jurisdiction. Different municipalities have different methods of calculating wastewater charges. In interviews with the municipalities, Burger (2012) found that the formulas were based on historic engineering studies. Burger (2012) also found that the larger metros appear to have well-formulated structures, for both industrial effluent tariffs and the domestic sewerage tariffs, but it is not clear whether the same is true for smaller municipalities. The potential for some formulae to be outdated was also a concern.

**Example 1 – eThekweni Municipality**

Item No.	Description	Present tariff excl. VAT	Proposed tariff excl. VAT
2	Disposal of Trade Effluent		
a)	Disposal of Trade Effluent to the sewage disposal system excluding direct discharge to a sea outfall-per kilolitre of trade effluent discharges	4.98	5.32
	Additional of charges for high strength sewage determined in Accordance with the formula: $y(\frac{C}{R}-1) + Z(\frac{B}{S}-1)$		
	i) Treatment cost "V" All areas excluding the erstwhile local authority area of Hammarsdale	0.53	0.57
	ii) Treatment cost "Z" All areas excluding the erstwhile local authority area of Hammarsdale	0.49	0.52
	iii) Chemical oxygen Demand Value "K"	Factor 360	Factor 360
	iv) Settleable solids value "S"	Factor 9	Factor 9

**Example 2 – Mbombela Municipality**

$$T_i = C \times (Q_i/Q_t) \times [0.3 + 0.35 K_c + 0.25 K_n + 0.1 K_p]$$

Where:

$T_i$  = Charges due by an individual contributor, R

$C$  = Total cost of sewerage management for both treatment and conveyance and must include fixed, semi fixed and variable charges as set by Sembcorp Silulumanzi (R/month)

$Q_i$  = Sewage flow from an individual from an individual contributor, m3 per month (rolling average)

$Q_t$  = Total sewage flow to the Works, m3 per month (rolling average)

$K_c$  =  $COD_i/COD_t$

$K_n$  =  $TKN_i/TKN_t$

**Example 3 – Tshwane Municipality**

$$T_c = Q_c t \left( 0.6 \frac{(COD_c - COD_d)}{COD_d} + 0.25 \frac{(P_c - P_d)}{P_d} + 0.15 \frac{(N_c - N_d)}{N_d} \right)$$

Where:

$T_c$  = Extraordinary treatment cost to consumer

$Q_c$  = Wastewater volume discharged by consumer in KI

$T$  = Unit treatment cost of wastewater in R/KI

$COD_c$  = Total COD of wastewater discharged by consumer in milligrams/litre and is inclusive of both the biodegradable and non-biodegradable portions of the COD

$COD_d$  = Total COD of domestic wastewater in milligram/litre

$P_c$  = Ortho-phosphate concentration of wastewater discharged by the consumer in milligrams of phosphorus/litre

$P_d$  = Ortho-phosphate concentration of domestic wastewater in milligram of phosphorus/litre

$N_c$  = Ammonia concentration of wastewater discharged by consumer in milligrams of nitrogen/litre

$N_d$  = Ammonia concentration of domestic wastewater in milligrams of nitrogen /litre

**Example 4 – City of Cape Town**

$$T_c = X + Y (COD_c / COD_w) + Z + \text{Penalty}$$

Where:

$T_c$  = Extraordinary treatment cost to consumer per KI

$X$  = Conveyance cost per KI

$$= C C / V A$$

Conveyance = The transports of effluent or any liquid waste in the bulk or external lower network from the point of discharge to the inlet of the treatment works

$C C$  = The operation and maintenance expenditure towards the conveyance of the wastewater in KI per annum

$V A$  = Adjusted volume (adjusted volume means total volume corrected for infiltration) in KI per annum

$V$  = Variable treatment cost per KI

$$= C T / V A$$

Variable treatment cost = These cost are defined as expenditure that does vary significantly with volume and COD leading

$CT$  = the operation and maintenance expenditure

### 3.5.3 International best practices on wastewater charge setting

There are numerous international best practice studies on the setting of water and wastewater tariffs. Tariff best practices are not independent of other aspects of regional or local water system management (Cadmus Group *et al.*, 2002). Realization of the benefits of best practices in tariff selection depends on supporting practices in administration, financing, regulation, and technology (Morris and Kis, 2004).

A report by the UNDP/GEF (2006) suggested that tariffs should:

1. Be simple and easy for customers to understand;
2. Produce a revenue stream sufficient to covers the cost of providing service;
3. Provide a steady revenue stream that can be relied upon to pay long term debts and obligations;
4. Discourage inefficient use of resources, including water resources;
5. Support investments and operations that provide high quality service to its customers,
6. Support investments and operations that protect the environment,
7. Provide “affordable” service to customers, and
8. Reflect the different costs of providing service to different customers.

Furthermore, best practices on achieving on achieving these goals in transition economies should develop and maintain accurate and extensive accounts and records, meter and measure water and wastewater flows and quality, establish cost-based tariffs, set tariffs with both variable and fixed charge components, limit the tariff burden on customers, provide incentives for good management, and include public information programs.

## 3.6 SUMMARY

The water and sanitation value chain was compartmentalised to provide an understanding of the different cost components that municipalities face, and demonstrated the complexity involved in accurate cost accounting. The regulations governing the setting of wastewater charges also is primarily focused at the municipal level, and as such this section also included examples of how municipalities implement them, with much diversity in the implementation of wastewater charges being found, and much digression from best practice.

This chapter served as an introduction to factors that affect the wastewater charge setting process in municipalities, and provides an outline on the different ways municipalities can be assessed for the identification of barriers that they face in proceeding chapters.

## **CHAPTER 4: BARRIERS FOR WASTEWATER CHARGE SETTING IN SOUTH AFRICA**

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### **4.1 INTRODUCTION**

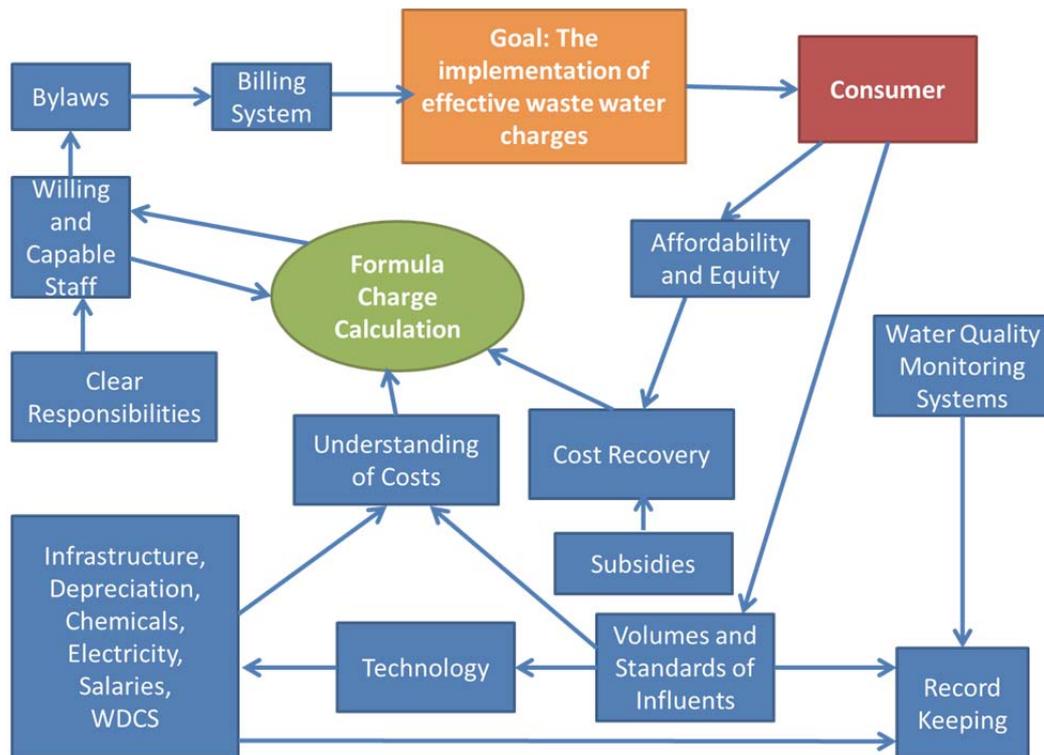
There are many different regulations on wastewater charges in South Africa, but they are synergistic, and in line with international best practice. However, the implementation of wastewater charges which occurs at the municipal level varies drastically between municipalities. In assessing the barriers to setting effective charges, consideration has to be given to different aspects that affect the costs of wastewater collection and treatment. This could include location (i.e. whether it is a Metropolitan Municipality (MM) or a not (Non-metro)), treatment capacity, technology type, state of infrastructure, human capital, developmental goals, financial resources, existing infrastructure and water uses.

### **4.2 STUDY APPROACH**

The broad methodological approach to identifying and assessing the barriers to effective wastewater charges included a comparative risk assessment to identify preliminary constraints, combined with expert analysis and analysis of empirical data. The comparative risk assessment was informed by literature review, expert interviews and a national workshop held in February 2015 in Pretoria. This assessment enabled the achievement of Aim 1: which was “to assess the barriers slowing the development and implementation of suitable wastewater treatment charge structures at the municipal level” and of Aim 2: “to recommend corrective actions to deal with these barriers.”

The analysis used the Theory of Constraints methodology (Dettmer, 1997), with it, potential barriers were identified in a preliminary assessment of constraints of intermediate objectives in a goal-orientated system (Figure 4.1). With a goal being “The implementation of effective wastewater charges”, a theoretical framework of the relationships and interactions between different aspects of the process was developed.

The intermediate objectives identified in the comparative risk assessment were used to develop a framework for the collection of data from primary and secondary sources, described in the next section.



**Figure 4.1: Intermediate objectives, of a goal orientated system, to achieve the implementation of effective wastewater charges by a municipality**

### 4.3 DATA COLLECTION

Using the goal orientated system approach, produced during the comparative risk assessment; the data required for the analysis was identified. The analysis would require both primary and secondary data, to provide evidence for specific barriers to the implementation of effective wastewater charges.

#### 4.3.1 Primary data

##### 4.3.1.1 Municipal questionnaire

A comprehensive questionnaire for municipalities from which constraints could be identified was developed (Appendix A). All WSAs were contacted via telephone and/or email and requested to participate by completing the questionnaire. Poor participation in this exercise necessitated the collection of this information through other sources.

##### 4.3.1.2 Municipal bylaws

Municipal wastewater charges were collected from online sources such as municipal websites, bylaws, and tariff notices. When the information was not available online, municipalities were contacted via telephone or email to obtain wastewater charges. Municipalities were grouped according to the manner in which the charges were structured. Furthermore, the charges were collated in a database to be used in a modelling exercise.

## Barriers to the Implementation of Effective Wastewater Charges

### 4.3.1.3 *Expert interviews*

Information on specific topics to address gaps in existing data sources were obtained from expert interviews. Information of human capacity, municipal preparedness for the WDCS and the handling of depreciation were obtained as per the suggestions of the reference group. The project team interviewed a variety of stakeholders in the water sector including national government, local government and the private sector.

### 4.3.1.4 *National workshop*

A national workshop was hosted in February 2015, in which representatives of all WSAs as well as key stakeholders were invited.

### 4.3.1.5 *Case studies*

Case studies on specific municipalities with unique circumstances or approaches to setting wastewater charges were conducted to address the issues/gaps identified in the national workshop. Two case studies were conducted on the Sekhukhune and Joe Gqabi municipalities, addressing issues on long-term planning and rural effects on wastewater service costs, respectively.

## 4.3.2 **Secondary data**

Numerous sources of secondary data were used to address gaps in the primary information collected. Advantages of the use of secondary sources were that they were often official, objective and collected through mandates.

### 4.3.2.1 *Green Drop Certification Programme*

The Green Drop Certification Programme to encourage improvements in wastewater management by awarding certificates to effluent treatment plants that adhere to certain minimum operating standards. Plant and municipal specific data were obtained from the online Green Drop System. On a municipal level, green drop scores were obtained from the 2011 Green Drop Report. The Department of Water and Sanitation supplied preliminary data from the 2013 round on plant operational capacities, average flows, budget and expenditure figures, and the status of asset registers. In most cases, plant specific data was scaled to a municipal level using weighted average figures based on plant design capacities. The location of WWTWs owned by municipalities was also captured.

### 4.3.2.2 *Municipal statistics*

General statistics on municipalities were obtained from Statistics SA's 2011 Census (StatsSA, 2011). Information included municipal populations, household counts and income level. Also used in the study was information on household access to basic services such as piped water and flush-toilets. Municipal revenue and expenditure figures were obtained from the Financial Census of Municipalities (StatsSA, 2014).

### 4.3.2.3 *Municipal budgets*

Municipal budgets were obtained courtesy of National Treasury. The budgets included information on access to basic services, expenditure and revenue, and populations served.

4.3.2.4 Other data sources

The total volume of potable water supplied and the billed consumption volumes for municipalities were obtained from the Non-Revenue Water Assessment (Mckenzie *et al.*, 2012). Information on the influent treated at municipalities was provided by the Department of Water and Sanitation.

4.4 DATA ANALYSIS

Municipality data was collated from numerous sources to complete a template from which municipalities could be assessed, and from which capabilities, costs and functions could be modelled (Appendix B). WWTWs owned by municipalities were also described spatially in Figure 4.2:. A summary of the costs of wastewater services based on reporting in the Financial Census of Municipalities (FCM) reports (StatsSA, 2014) was performed and showed that 30.20% of expenditure is paid to salaries and wages in the 2013/14 financial year. The next largest total cost item is provision for Depreciation and amortisation (20.56%). Other major cost items include Repairs and Maintenance (7.90%), Contracted services (6.29%), and Bad debts (6.09%). These figures are presented per municipality in Appendix C. Preliminary barriers identified were presented, and expanded on during the workshop, with specific barriers being captured, and recommendations on the study methodology being updated. National workshop proceeding are covered in Appendix D.

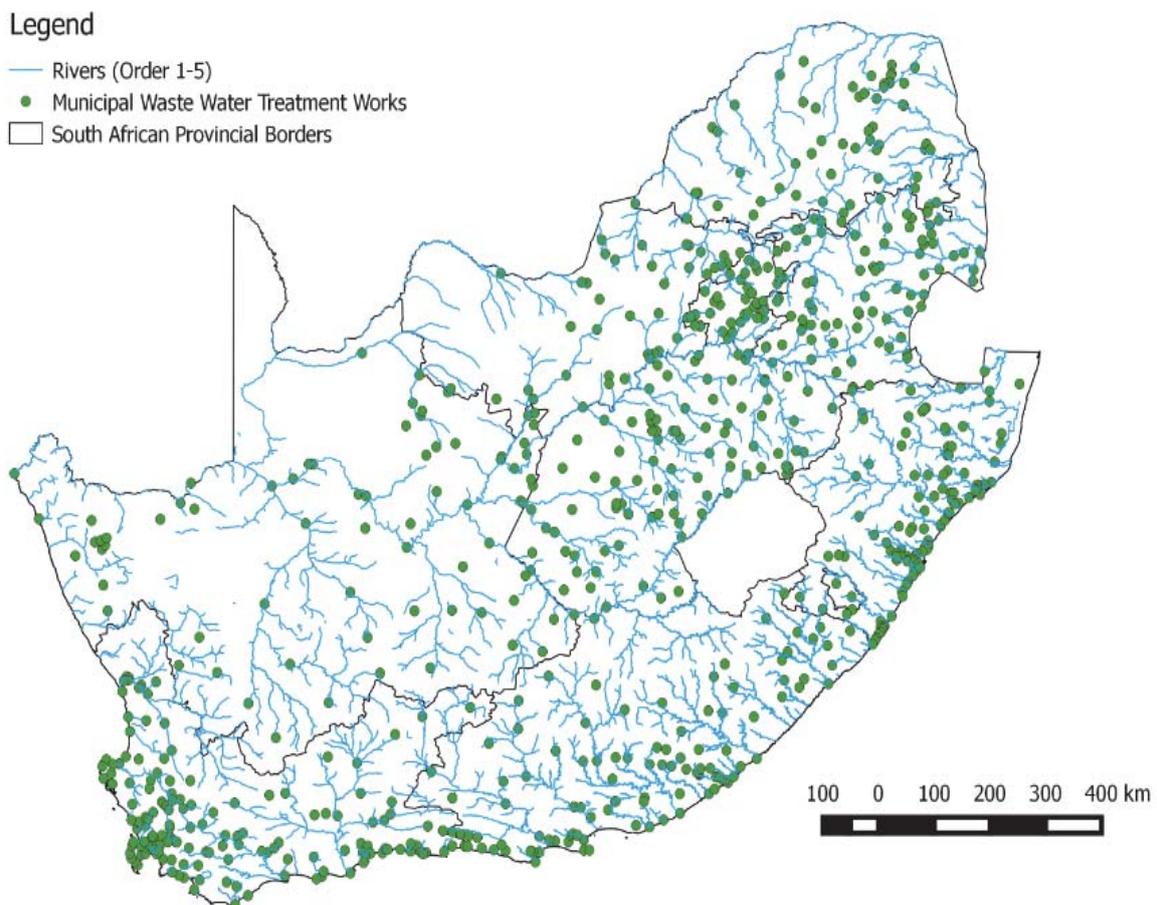


Figure 4.2: Wastewater treatment works owned by municipalities of South Africa

#### 4.5 WASTEWATER SETTING PRACTICES IN SOUTH AFRICA

An analysis of bylaws was used to determine the types of tariff structures employed by WSAs in South Africa. A bylaw is a law passed by the council of a municipality to regulate the affairs and the services it provides within its area of jurisdiction. A challenge to the desktop analysis of bylaws is that the bylaws for many municipalities were difficult to obtain (Figure 4.3).

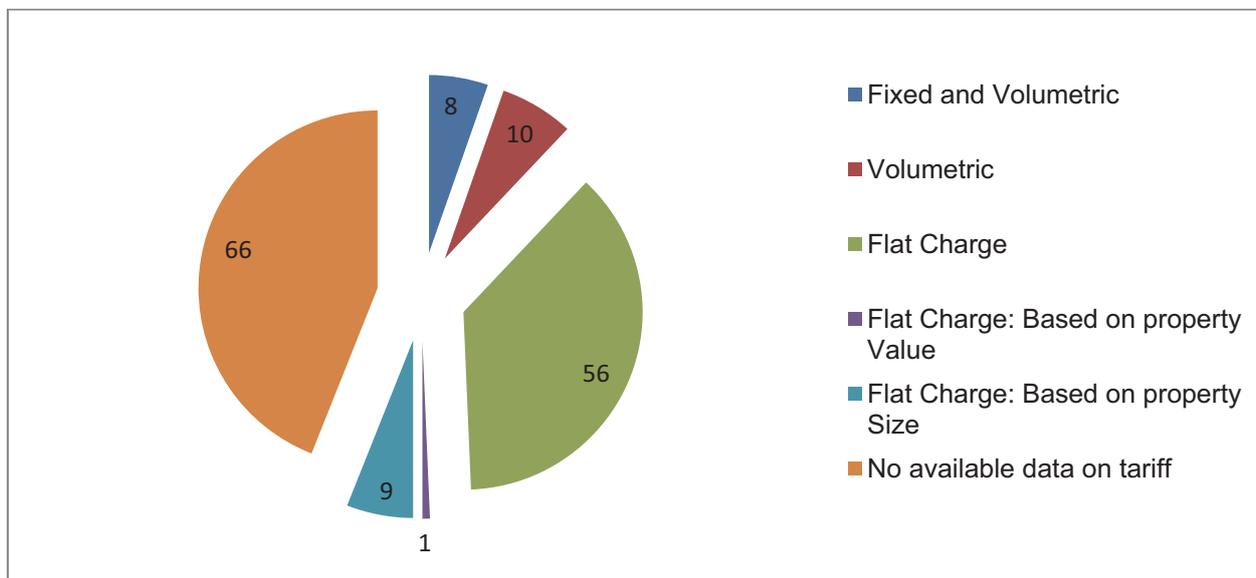


Figure 4.3: Summary of tariff structures employed by WSAs.

WSAs utilize one of several approaches towards stipulating wastewater treatment charges for households, including:

##### 4.5.1 Volumetric charge

In this approach the wastewater charge is dependent on water consumption. This method is often considered best practice, as it follows the ‘user pay principle’ and allows for progressive tariffs to be implemented. This approach however can fail to properly distribute the fixed costs associated with the service, but often time a fixed and volumetric charge is used to account for it.

##### 4.5.2 Flat fee across all households.

This approach is most common in relatively small communities where households are relatively homogeneous. Limited provision is made for indigent household and for household that exceed a certain size or level of potable water consumption. A number of municipalities charge a fixed annual rate to fund water treatment. Whilst these mechanisms are not particularly effective at differentiating between classes of services users, the approach is necessary in certain area due to the relatively large seasonal fluctuation of the population (i.e. holiday destinations). In such a context there is a risk attached to the utilization of volume based charged structures as they might generate insufficient revenue.

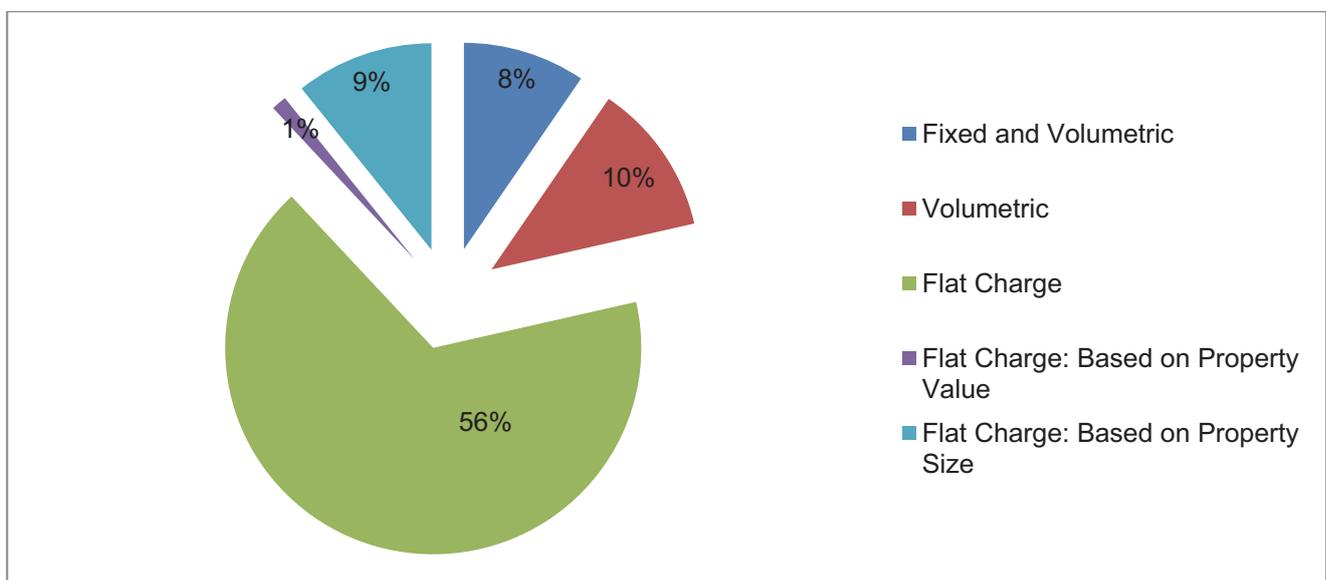
#### 4.5.3 Fee related to the size of the erf (m<sup>2</sup>)

Such a method generally assigns a fee relative to the size of the property, with consideration being made for indigent households. An advantage of this method is that it is relatively easy to implement. This method has a benefit over the flat charge method, as it allows some differentiation based on socio-economics of users.

#### 4.5.4 Fee related to the rateable value of the property

Similar in its approach to the previous type, with a fee being assigned to a property relative to its rateable value, again with consideration being made for indigent households. The advantage of this method over the previous type, is that it allows for further differentiation of charges based on consumers' ability to pay.

Figure 4.4 provides a breakdown of the various approaches, and their corresponding use among the WSAs.



**Figure 4.4: Summary of tariff structures employed by WSAs.**

Table 4.1 shows the different charge structures in different WSAs that were investigated in this study. The development of an effective wastewater treatment charge is dependent on an intimate understanding of the various factors that determine how it should be structured. A lack of understanding in any of the underlying contextual considerations, be it monitoring, resource quality, resource quality objectives or a clear delineation of which pollutants accrue to which sectors/industries/businesses, the end result will be a sub optimal wastewater treatment charge. A significant amount of work has been done to delineate the complexities of setting wastewater treatment charges, most notably and most recently by Hosking *et al.* (2011).

However, despite the availability of such resources recent investigations as part of the DWS Olifants Water Resource Classification System (DWA, 2012) have revealed that these proposed charge structures are not being applied at the municipal level, especially in municipalities that struggle to achieve Green Drop certification. This suggests that the reasons for the lack of implementation of new and relevant charge structures within municipalities is most probably due to a lack of understanding in one or more of the contextual considerations listed earlier that are required to set the charge.

**Table 4.1: Tariff structures at different municipalities**

<b>Fixed and Volumetric</b>	<b>Flat Charge (cont...)</b>	<b>Flat Charge (Cont...)</b>
Ugu District municipality Ilembe District municipality Kouga Merafong City Dipaleseng Govan Mbeki Nkomazi Bushbuckridge	Setsoto Dihlabeng Maluti a Phofung Emakhazeni Dr JS Moroka Thaba Chweu Richtersveld Nama Khoi Kamiesberg Ubuntu	Mossel Bay Oudtshoorn Bitou Knysna Laigsburg Ngwathe Metsimaholo Mafube Emfu Midvaal
<b>Volumetric</b> Chris Hani District municipality Umzinyathi District municipality Capricorn District municipality Sisonke District municipality eThekweni municipality metropolitan uMhlathuze Mbombela Nelson Mandela Bay Metropolitan City of Tshwane Metropolitan	Umsobomvu Emthanjeni Kareeberg Sol Plaatjie Phokwane Ga-Segonyana Ventersdorp Tlokwe City Council City of Matlosana Maquassi Hills Matzikama	Lesedi Mogale City The Msunduzi Lephalale Bela-Bela Msukaligwa Pixley ka seme Lekwa
<b>Flat Charge</b> Amatole District municipality Uthukela District municipality Makana Ndlambe Baviaans Letsemeng Kopanong Mohokane Tswelopele	Cederberg Bergrivier Saldanha Bay Swartland Drakenstein Stellenbosch Breede Valley Cape Agulhas	<b>Flat Charge: Based on Property Size</b> Buffalo City Metropolitan City of Johannesburg Metropolitan Polokwane Thabazimbi Mookgopong Modimolle Mogalakwena Victor Khanye Steve Tshwete
		<b>Flat charge based on Property Value</b> Mangaung metropolitan

#### 4.6 BARRIERS AND ENABLERS FOR SETTING EFFECTIVE WASTEWATER CHARGES IN SOUTH AFRICA

In assessing the barriers to setting effective charges, consideration has to be given to different aspects that affect the costs of wastewater collection and treatment. Data on municipalities was collated from numerous sources to complete a template from which municipalities could be assessed, and from which capabilities, costs and functions could be modelled. Two case studies described other factors affecting the charge setting processes at municipalities. An analysis on the charge structures reported in bylaws was conducted to evaluate the motivation behind a municipality's choice. Estimated of revenue potentials and treatment costs were modelled to determine whether municipalities are able to recover costs. These models also informed the creation of benchmark wastewater charges for municipalities.

There are many potential barriers preventing the setting of effective wastewater charges, and thus leading to ineffective wastewater treatment. A report on Status of sanitation services in South Africa (DWA, 2012b) identified challenges that included governance, institutional, social, technical, and O&M (Table 4.2:).

The main issues (barriers and enablers) identified in the municipal assessment (which included expert interviews), and the analyses are presented in Section 4.6.1-4.6.6.

**Table 4.2: Challenges to the provision of sanitation services (DWA, 2012b)**

<b>Governance</b>	The need for consolidated norms and standards.
	Need for sanitation strategies to give better guidance on implementation of higher levels of service.
<b>Institutional</b>	Inadequate technical capacity at municipal level.
	Inadequate O&M capacity at local level.
	Lack of M&E systems.
<b>Social</b>	Low affordability of households
<b>Technical</b>	Inadequate and un-coordinated M&E and regulation functions with sector departments.
	Effective service level choice and affordability is lacking.
<b>O&amp;M</b>	Inadequate maintenance of infrastructure (need of proper O&M plan).
	Small municipalities do not effectively operate and maintain their waterborne sanitation schemes.

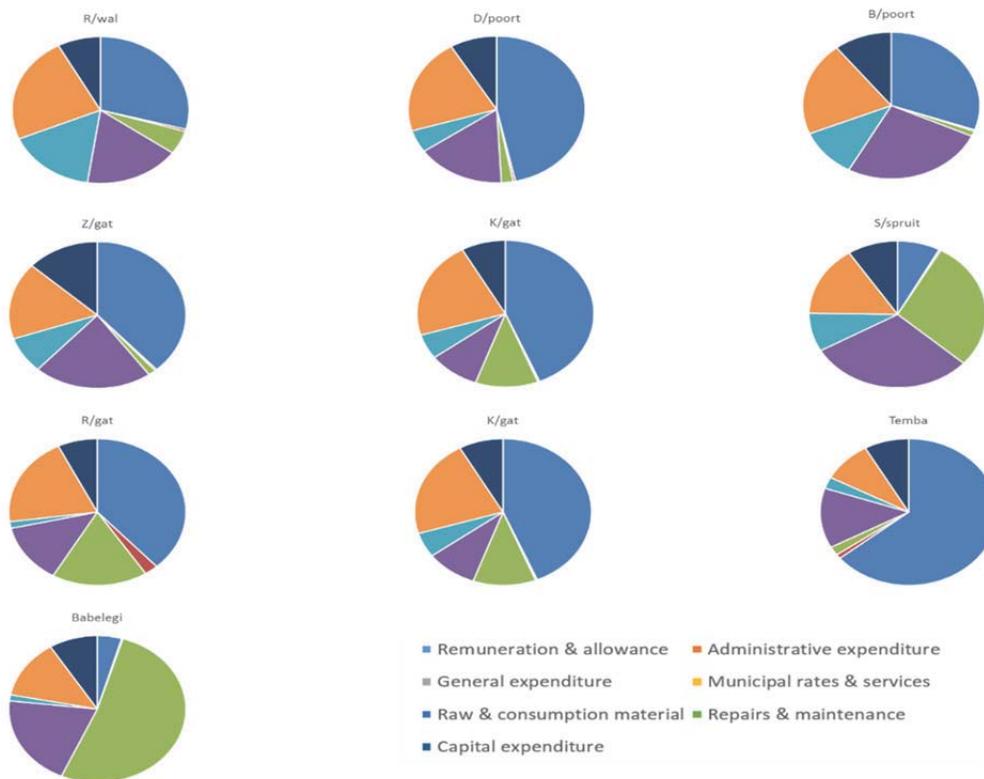
#### 4.6.1 Understanding Costs

Determining the cost of treating wastewater is the most fundamental step towards determining what a wastewater treatment charge should be. The charge structure itself is the manner in which that cost is distributed among a set of consumers. However, costing of wastewater treatment services is a highly technical process that within the often resource constrained South African context is not given adequate consideration. The lack of political will and inadequate skills are seen as the main barrier to the good understanding of costs that are a requirement for the setting of effective wastewater charges. With regards to human resources in terms of skills availability is one of the biggest constraints to the wastewater sector. Many municipalities face issues over either high vacancy rates or inadequate qualifications. The magnitude of the constraint disproportionately affects smaller municipalities with the main drivers being insufficient training due to financial constraints and low critical mass of skills, the potential for nepotism and difficulties in attracting relevant skills. Essential to setting effective wastewater charges is the requirement for municipalities to have a deep understanding of the cost components of wastewater treatment as described in Section 3.3.

Figure 4.5 shows an example of the breakdown of costs for wastewater treatment for different plants. This figure demonstrates that even within a municipality, the relative share of costs can vary dramatically. Older plants in generally incur more costs related to maintenance and repairs, smaller plants typically have higher administrative costs in relation to treatment capacity and more sophisticated technology can often result in higher energy costs. A poor understanding of these costs can result in the inadequate setting of effective

## Barriers to the Implementation of Effective Wastewater Charges

wastewater charges that fail to ensure adequate revenue generation, result in inadequate treatment and discharge or fail to plan for the future effectively. These cost components and the barriers preventing their adequate understanding are discussed in more detail below.



**Figure 4.5: Breakdown of costs at different WWTWs owned by Tshwane Municipality in the 2009/10 financial year**

### 4.6.1.1 Depreciation

Correctly accounting for depreciation is essential to plan for replacing infrastructure. This is a major constraint, primarily due to capacity at municipalities. The most basic requirement is that municipalities have asset registers, which approximately 16% lack. Asset registers require significant manpower to be maintained, Johannesburg Water as an example tracking over 3 million assets. Even if municipalities have an asset register, the valuation of assets is also very difficult. Most municipalities use historic costs rather than replacement values, due to the relative ease of use. Municipalities are able to mitigate for the lack of replacement values by grandfathering old infrastructure and sharing costs amongst all infrastructure. However, this poses a significant risk to small municipalities that may have relatively new infrastructure and only a small number of WWTWs, meaning that the replacement of infrastructure has a larger impact on the entire wastewater treatment budget.

### 4.6.1.2 Technology types, scale and age of WWTWs

The age, size and technology employed at a plant affect the unit cost of treatment. It was found that economies of scale are realised such that larger plants generally face lower unit costs. The technology

## Barriers to the Implementation of Effective Wastewater Charges

employed at a specific plant is covered by the size of the plants since in most cases different technologies are used for different plant sizes. The age of a plant was found as not being feasible to bring into the calculations of unit cost of treatment since many older plants have been upgraded over the years and the commission dates, which would've been used to incorporate the age of plant, then becomes inaccurate.

### 4.6.1.3 *Waste Discharge Charge System*

The Waste Discharge Charge System is viewed by some municipalities to be a considerable risk to finances. However, due to the emerging nature of the system, the full impacts and implications of the system on municipalities have not yet been determined. The major constraint to municipalities has to date been the uncertainty over the system's implementation and a lack of information sharing. In addition, poor political support and a lack of continuity at the Department of Water and Sanitation has meant that the process has been slow, and that municipalities may not have been adequately engaged. This has resulted in municipalities having a poor understanding of the WDCS and how consultative it is.

### 4.6.2 **Ring Fencing**

Ring fencing the context of the water services sector ring fencing refers to instances where the revenue generated from the provision of water services is separated from other revenue streams and reallocated back to water services in order to ensure ongoing service provision. Although ring-fencing of revenue generated by water services is legally required, the practice of doing so does not appear to be the norm. There are a number of obstacles to the implementation of proper ring-fencing and these include the lack of cost accounting and the highly technical nature of wastewater service provision that make intra-departmental communication difficult. Furthermore, many municipalities are forced by poor financials to cross subsidise services to manage cash flow or to fund other non-revenue services. Again, resource constraints were stated as the primary barrier to ring fencing.

### 4.6.3 **Asset Management**

The asset register is the foundation of an asset management framework that keeps asset information as well as an historical record of both financial and non-financial information over the life cycle of the asset. The asset register records this information to facilitate asset planning, meeting accounting standard and legislative compliance as well as performance monitoring and accountability. The general consensus among the workshop panellists was that asset management strategies currently in practice were insufficient, with resource constraints being stated as the primary reason for this being the case.

### 4.6.4 **Context Specific Differences**

WSAs and their associated wastewater management strategies occur across a range of socio-economic and geographical contexts. The variation between regions has meant that wastewater management strategies have been designed differently, according to the nuances of the given region. Some of the aspects related to this particular matter include; technological and asset differences, population flux, outsourcing of service provisioning, and the capacity to implement. South Africa is host to an exceedingly wide variety of geographic and socio-economic contexts, the context of a given municipality and its capacity to implement reforms and projects needs to be taken into account.

#### **4.6.5 Consumer Behaviour and Demand Elasticity**

Consumers of wastewater services are affected by many factors that influence their consumption of services as well as their ability to pay for these services. At the national workshop, particular emphasis was placed on the extent to which pricing and charge structures affect the consumption patterns of households and business, and the extent to which the consumption patterns impact on revenue generation for service provision. A key barrier to understanding this relationship between the price of services provided and the consumption of those services is the limited resources and skills shortages that many municipalities face.

#### **4.6.6 Stakeholder Consultation and Generating Consensus**

Stakeholder consultation is the process by which an organization consults with individuals or organisation that may be affected by the decision that are made or who are in a position to affect the implementation of their decision. With respect to these considerations the workshop panellists discussed political will as a key barrier that many municipalities face. There is a need to achieve “buy-in” from those in political or major decision making positions. Their consensus or agreement with a given course of action is essential to driving the agenda forward.

### **4.7 GOOD PRACTICES FOR WASTEWATER MANAGEMENT: CASE STUDIES**

As part of the study into setting effective wastewater charges, specific cases were investigated to identify best practice by municipalities and understand some contextual differences between urban and rural municipalities. Sekhukhune District Municipality case study demonstrates how strong political will to address service delivery was key in shaping the long term strategy in systematically overcoming barriers faced by the municipality. The Joe Gqabi District Municipality case study demonstrated that municipalities face diverse challenges, and that strategies to overcome context specific barriers need to consider these differences, particularly amongst rural municipalities.

#### **4.7.1 Sekhukhune Municipality: Saving for the Future**

Sekhukhune District Municipality is located in Sekhukhune, one of the 6 districts of the Limpopo Province of South Africa. It is home to slightly less than 1 million South Africans and has its seat located in Groblersdal. The Sekhukhune DM is of special interest in this study due to the financial mechanisms they have employed to ensure sustainable and affordable provision of wastewater treatment services over the long term.

The Sekhukhune DM has officially recognized that matter of provisioning water and sanitation services is the primary challenge faced by the communities that they serve. They have thus allocated a significant portion of their capital budget (57% of the currently available R1.6 billion) toward this delivery mandate. Of key interest is the fact that the Sekhukhune DM has put in place a savings plan to prepare for the future augmentation of wastewater treatment capacity.

The Sekhukhune DM utilizes a financial entity known as a Capital Reserve Fund (CRF) to accumulate the capital necessary to fund large scale infrastructure development. The CRF is type of account on a municipality's or company's balance sheet that is reserved for long-term capital investment projects or any other large and anticipated expenses that will be incurred in the future.

The questions of interest, however, is how did the Sekhukhune DM manage to implement an action that allows them to prioritize funds for saving rather than for other, seemingly more urgent, community needs? In addition to saving for the future, the Sekhukhune DM was, in the 2013/14 financial year, able to achieve their

## Barriers to the Implementation of Effective Wastewater Charges

first clean audit. How is it that the Sekhukhune DM is able to prioritize these actions when so many other LM's and DM's are struggling with exactly the same issue?

Conversations with representatives from the Sekhukhune DM, revealed some of the factors that supported the progress of the Limpopo Province DM. These issues have been detailed below:

*Sound Leadership and Political Will:* The Municipal Sector in South Africa is fraught with a myriad of workplace pressures and political intricacies. In a workspace where there are limited resources and a range of pressing needs, an effective leader must possess the ability to prioritize actions that serve the long term goals of an organization despite the urgency of the issues that occupy the present situation. Of key consideration, is the fact that the demand of the current political term, must not be allowed to shape or limit the long term considerations of the organizations.

*“Our country has produced remarkable leaders that are committed to the ideals enshrined in our Constitution and to ensuring effective service delivery for all our people – leaders that wish to serve rather than be served. These leaders have shown that adversity can be overcome and that solutions can be developed for any challenge.” – Deloitte (2012)*

*Clear Organizational Policy:* With regards to their successes in the area of asset management, the Sekhukhune DM assigns a great deal of credit to the development of a clear and comprehensive asset management policy as being foundational to the progress that they were able to achieve. The Asset Management Policy (2014) of the Sekhukhune DM captures the principles and mandated requirements derived from the organizational Integrated Development Plan (IDP) and provide an effective framework for the development and implementation of the asset management strategy and the setting of the asset management objectives.

*Long Term Planning:* Planning for the long-term health of your organization sets the agenda for success. A strategic plan acts as a road map, not only for the current year but also for three to five years into the future. Many municipalities have capital improvement plans in place for the next five to ten years, but find it challenging to tie it into their organization as a whole. This is mostly as a result of inadequate consultation of the all of the necessary stakeholders when developing the long term plan. In order for long term planning to be effective, it needs to be conducted with the support of all key stakeholders, so that the plan may be a reflection of the collective goals of the organization, and so that individuals may have ownership over the objectives that are set and over the specific actions that need to be implemented for the long term plan to be realized.

*Effective Public Consultation:* Effective public consultation is a necessary step in developing and managing the expectation of a municipal constituency. The communities served by a municipality needs to be clearly aware of the developmental objectives of their given municipality, and how those developmental objectives fit in with the capacity and available resources of the municipality.

These are the 4 key factors that the Sekhukhune DM attributes as being responsible for the efficacy of their asset management strategies and for the turnaround in the performance of the municipality as a whole.

### 4.7.2 Joe Gqabi Municipality: The Costs of Being Rural

The Joe Gqabi District Municipality is one of the district municipalities of the Eastern Cape Province of South Africa. It is home to approximately 350,000 people and has its seat located in Barkly East. The Joe Gqabi DM is of special interest to this study due to its classification as a rural municipality, and due to the fact the employees of the Joe Gqabi DM have made a case for rural wastewater treatment plants being more

## Barriers to the Implementation of Effective Wastewater Charges

expensive to run than, *ceteris paribus*, comparable plants located in metropolises. Taking this as a point of departure, the project team set out to investigate the case for increased costs in rural settings.

In the national workshop that was held on 5 February 2015 some of the rural municipality representatives were concerned that they face a higher unit cost when compared to some of the larger municipalities and especially the metropolitan municipalities. The initial cost model utilized in this study (see chapter 5.3.2) used the City of Tshwane and eThekweni as the point of departure for the model. In order to investigate the case for “higher wastewater treatment costs in rural districts” it was necessary to update the costing model to accurately reflect the costs faced by all of the municipalities. The utilized two methods to make the estimation, they are presented below.

**Method 1: Green Drop Cost Estimates:** The first approach continues to use the cost estimates as reported by each municipality for each plant in the Green Drop System and found that on average the per unit treatment cost of a metropolitan municipality’s plant is R2.46 lower than the per unit treatment cost of other, smaller municipality’s plant. This leads to an estimated treatment cost for all the plants in the country to rise from R4.1bn to R5.2bn which translates to an increase of 26.49%.

**Method 2: StatsSA Financial Census:** The second approach uses Stats SA’s financial census of municipalities to compare the total expenditure on waste, water management of the City of Tshwane and eThekweni to the expenditure of Joe Gqabi. The total expenditure is divided by the average volume of treated water for each municipality to get an average per unit cost of treatment.

By using the second approach it was found that the average per unit treatment cost of Tshwane was R2.99 lower and average per unit treatment cost of eThekweni was R3.64 lower than the per unit treatment cost of Joe Gqabi. It can be concluded that, based on the evidence available, that smaller municipalities face higher per unit treatment costs than metropolitan municipalities. In summation then the treatment cost of plant depends on its size as well as whether or not it is located in a metropolitan municipality. These figures were used to improve the model to include the higher costs associated with rural treatment.

## 4.8 SUMMARY

The implementation of wastewater charges which occurs at the municipal level varies drastically between municipalities. Findings obtained in this study have demonstrated examples of how municipalities implement them with much diversity in the implementation of wastewater charges being found, and much digression from best practice. In assessing the barriers to setting effective charges, consideration has to be given to different aspects that affect the costs of wastewater collection and treatment. This could include location (i.e. whether it is a Metropolitan Municipality (MM) or a not (Non-metro)), treatment capacity, technology type, state of infrastructure, human capital, developmental goals, financial resources, existing infrastructure and water uses. This section served as an introduction to factors that affect the wastewater charge setting process in municipalities. The studies conducted so far, indicate that the development of an effective wastewater treatment charge is dependent on a number of factors. In addition, a number of studies have revealed that cost reflective charge structures are not being applied at the municipal level, especially in municipalities that struggle to achieve Green Drop certification.

## **CHAPTER 5: ASSESSMENT OF WASTEWATER REVENUE AND EXPENDITURE**

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### **5.1 INTRODUCTION**

All data collected in from municipal bylaws, questionnaires and alternative sources were captured electronically and stored in a Microsoft Excel based database. Data was classified and collated to a municipal scale. The database used municipality codes as the unique identifier. Analyses were then conducted on this standardised format.

### **5.2 ASSESSMENT OF WASTEWATER TREATMENT REVENUE POTENTIAL**

#### **5.2.1 Wastewater Revenue Model**

This section assesses the revenue potential of wastewater treatment, for the domestic segment of South Africa's WSAs, specifically, the revenue estimates for household that have access to piped sewerage. The assessment was conducted using the most up to date charge regimens (financial year 2013/14) to generate the estimates. Through communication with the various WSAs the study team were able to obtain the charge structures for 84 WSAs. The estimates of access to piped sewerage were obtained directly from StatsSA (2011) data sources. These figures could be directly attributed to each of the individual municipalities. Likewise, water consumption volumes and billed metered consumption were obtained from McKenzie et al (2012). The estimates relating to provision of free basic water and sanitation to household were only available at the provincial level, stating that a total of 6.3 million households are recipients of free basic water and sanitation. These household were excluded from the revenue estimation in line with current practices.

Each of the charge estimates was conducted using the individual tariff schedules for 84 of the 152 WSAs. The tariff schedules were individually listed, and classified, with like structured schedules being listed together. The estimates make use of 2013/2014 financial year tariffs. In a select number of cases, figures from earlier periods were utilized and were adjusted, to the 2013/2014 period using PPI inflation figures. Household composition, property values and the income distributions for households were obtained from StatsSA (2011). The figures were factored into the assessment, specifically to aggregate the estimates.

For the sake of reducing complexity across the wide range of tariff schedules, those schedules with comparable structures were concatenated into a simplified structure, accounting for as much variation in price and volume as was possible. Specifically, in the case of tariff schedules utilizing property sizes, a simplified schedule was compiled utilizing the City of Johannesburg tariff charges for water, sewerage and sanitation services schedule.

#### **5.2.2 Revenue Potential Analysis**

Table 5.1 shows preliminary estimates of the revenue potential of wastewater treatment in the revenue sector, based on the municipal bylaw analysis. Whilst the study made use of the best data available, the research process did encounter certain limitations in the availability of data. In addition, these figures represent the potential for revenue collection and assume that all 100% of all relevant households are billed and that 100% of all fees owed are collected. This is not reflective of actual revenue currently being collected. These figures do account for subsidies to indigent households. The preliminary findings estimate

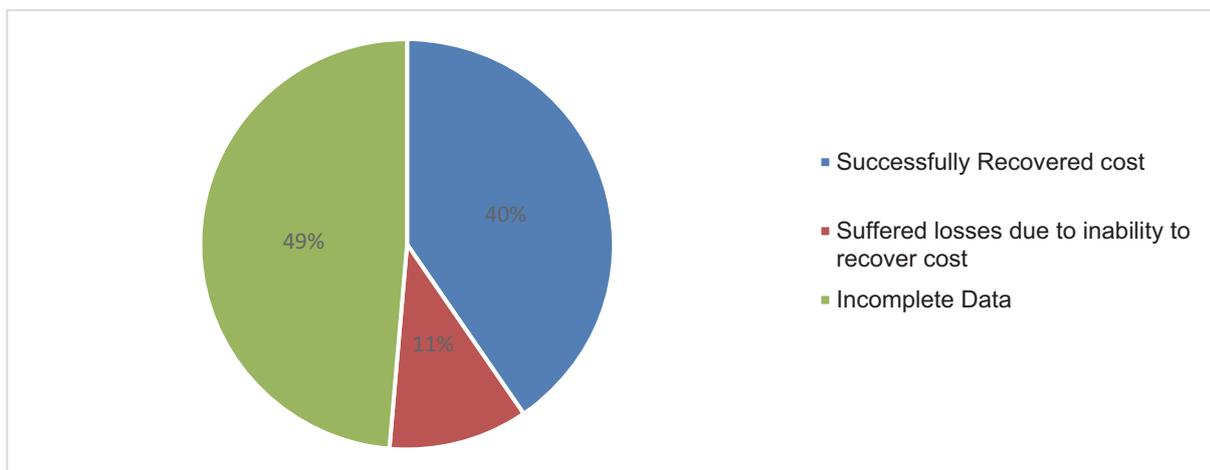
## Barriers to the Implementation of Effective Wastewater Charges

potential revenue to be between R 5.8 and R6.6 billion rand per year (including the extrapolated figures for unaccounted for household.). This estimates factors in the non-contribution of households receiving free basic water and sanitation. The result is that approximately 5 million household carry the cost of provision piped sewerage services, with the cost to the average paying household being in the region of R1,150 per month, which equates to a monthly payment of R96.00.

**Table 5.1: Preliminary estimates of the revenue potential for wastewater treatment**

Category	Potential Annual Revenue (R millions)		# of Households	Cost per HH (R/Yr)	
	Min:	Max:		Min:	Max:
Changed Household (Accounted):	4,312	4,992	3,763,139	1,146	1,327
FlatCharge	1,199	1,355	1,026,702	1,168	1,320
Volumetric	1,290	1,522	1,115,216	1,157	1,365
Fixed + Volumetric	439	509	332,603	1,320	1,530
Property Size	1,230	1,426	1,172,658	1,049	1,216
Property Value	154	180	115,961	1,328	1,552
<b>Changed Households (Unaccounted):</b>	1,457	1,719	1,271,766	1,146	1,552
<b>Free Basic Sanitation Households:</b>	-	-	9,281,202	NA	-
<b>Total</b>	5,769	6,711	14,316,107	NA	NA

The per household cost over the five estimates range from R1,049 per annum up to R1,530 per annum. The proximity of these estimates, which were conducted separately (albeit with some of the same source data), gives credence to these results. A significant consideration in compiling these estimates hinged on the “free basic water and sanitation” factor. Approximately 9.2 million household receive free basic water and sanitation. From the National Treasury database on municipal budgets the revenue and expenses on wastewater treatment was reported. This gives insight into municipality’s ability to recover their costs. This information is summarized in Figure 5.1. It is shown that of the district / local municipalities in the database 49% failed to report revenues and expenses, 40% reported more revenue than expenses and 11% reported higher expenses than revenue. This means that 11% of municipalities weren’t able to recover the costs they incurred when providing wastewater treatment services.



**Figure 5.1: Municipalities' ability to recover costs**

### **5.3 ESTIMATION OF AVERAGE WASTEWATER TREATMENT COSTS**

#### **5.3.1 Wastewater Treatment Cost Model**

A wastewater treatment cost model was developed from Green Drop data on Tshwane and eThekweni municipalities. The data was used to construct average cost curves showing the relationship between the average yearly flow, in cubic meters, and the per cubic meter treatment cost. The cost curves were then used to model the total Operations, Maintenance and Repairs (OMR) expenditure in all the reference municipalities.

A municipality's green drop data is reported on a per plant basis. The average daily flow and the OMR cost/budget for each plant as reported in the green drop scorecards were used to calculate a per cubic meter treatment cost for each plant in a municipality. Also the average daily flow figures were converted into average yearly figures to be in line with the expenses which are reported in per annum spending. For each municipality, the per cubic meter treatment cost was plotted against the average yearly flow of each of their plants. This was done using both the actual and budgeted OMR spending figures. The cost curves were used to estimate for the treatment cost per cubic meter based on average yearly flow for each WSA.

An average was then taken between the reference municipalities' equations to give an estimated treatment cost per cubic meter based on average yearly flow equation. The average equation was then applied to all plants in the Green Drop dataset to calculate the cost to treat for each plant which can then be aggregated to finally give us total cost to treat water in all our reference municipalities. Data availability was a limitation to this model as not all plants were able to accurately report the average daily flow and for the total cost calculations we made the assumption that the plant is operating at 100% capacity, i.e. its daily flow is equal to its design capacity.

#### **5.3.2 Estimates of the Total Cost of Wastewater Treatment**

The average cost of treating wastewater was modelled to provide an estimate of the total cost of wastewater treatment by municipalities in South Africa. For accurately calculating the total cost of treatment first it has to be determined if there exists a relationship between the operating capacity of a plant and the unit cost of treatment of wastewater.

Figures 5.2-5.5 show the average budgeted cost graphs for Operation, Maintenance and Repair (OMR) expenses, as well as the average actual cost graphs for Operation, Maintenance and Repair (OMR) expenses are presented after.

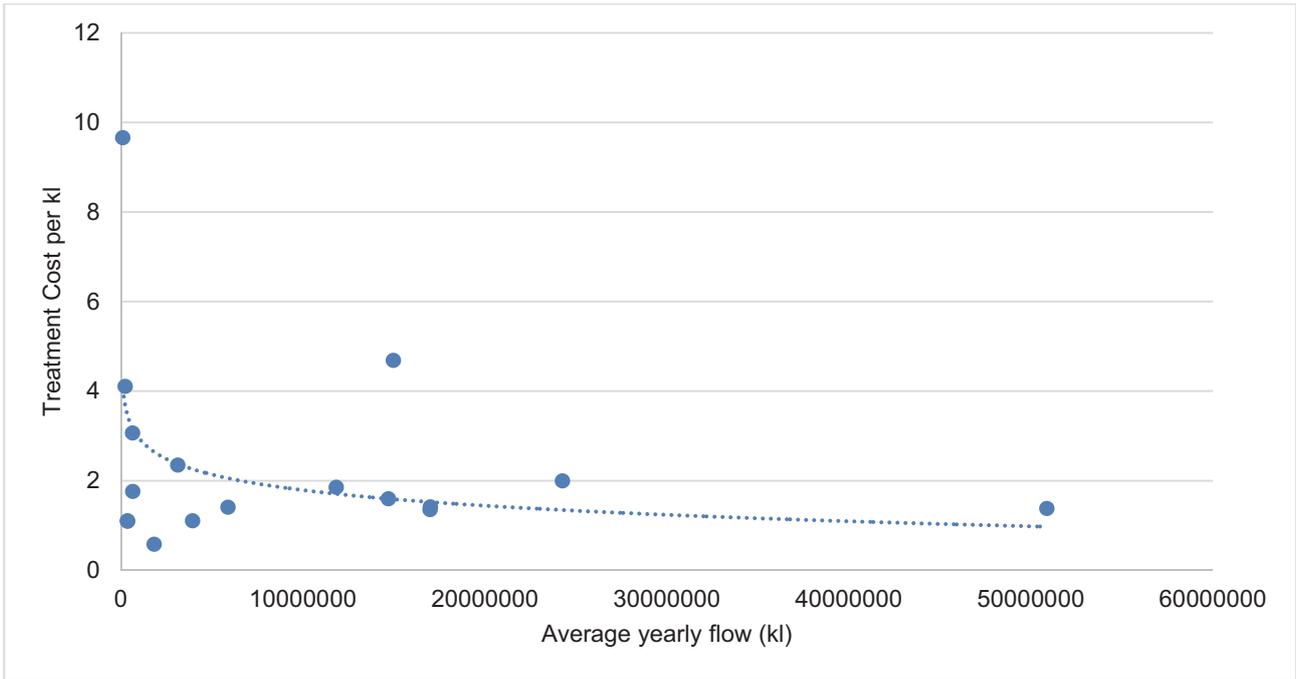


Figure 5.2: Tshwane treatment costs based on average yearly flow using budgeted OMR expenses

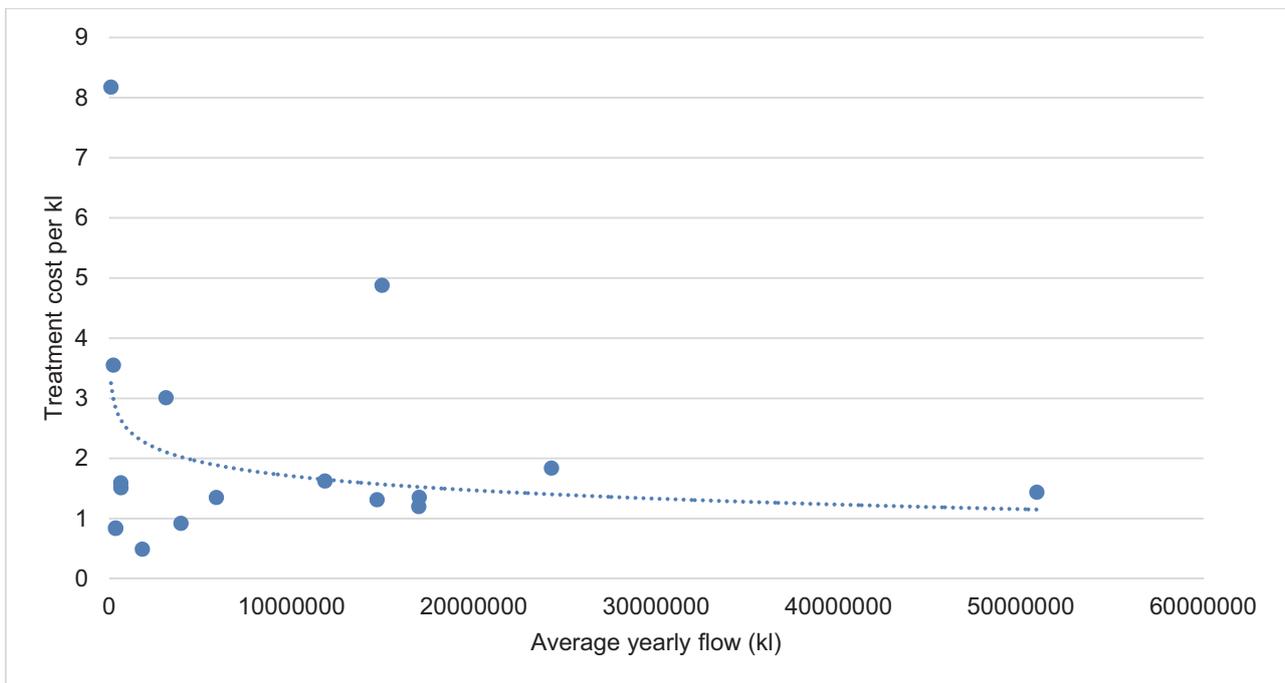


Figure 5.3: Tshwane treatment costs based on average yearly flow using reported actual OMR expenses

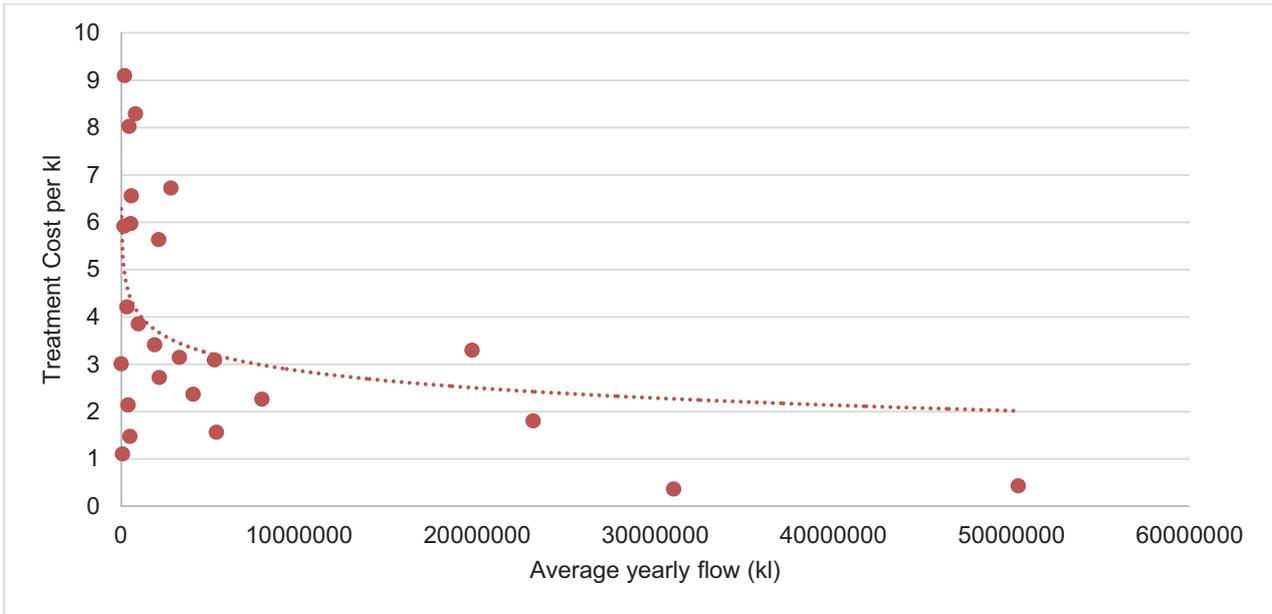


Figure 5.4: eThekwini treatment costs based on average yearly flow using budgeted OMR expenses

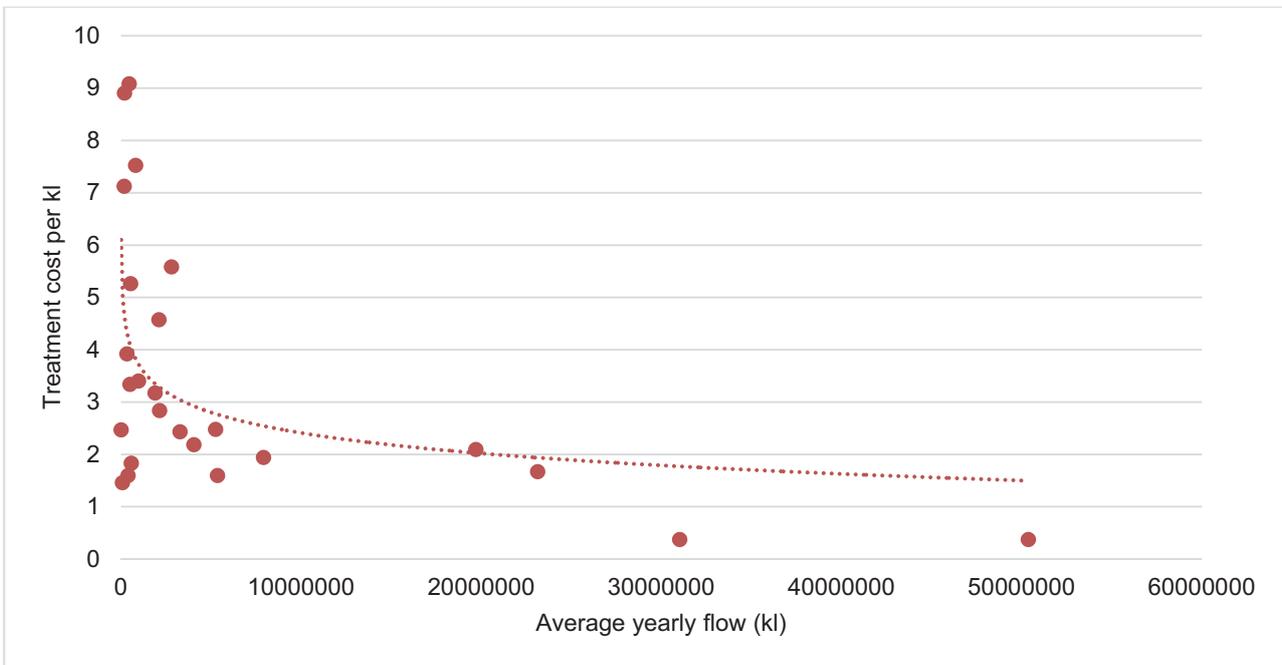
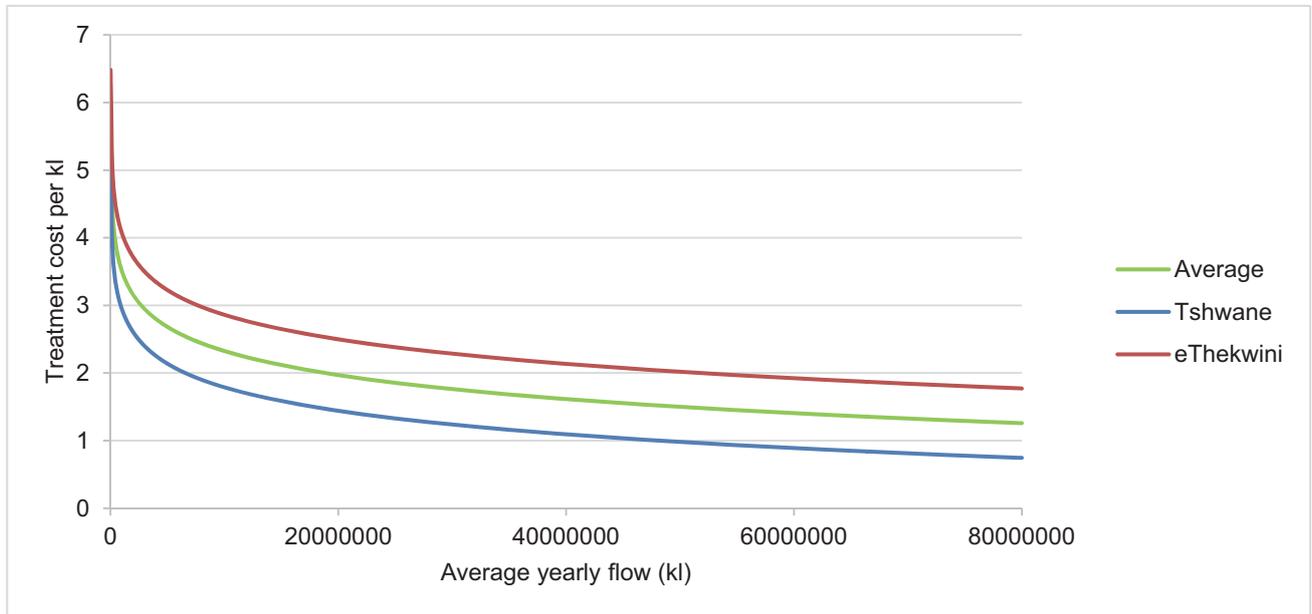


Figure 5.5: eThekwini treatment cost based on average yearly flow using reported actual OMR expenses

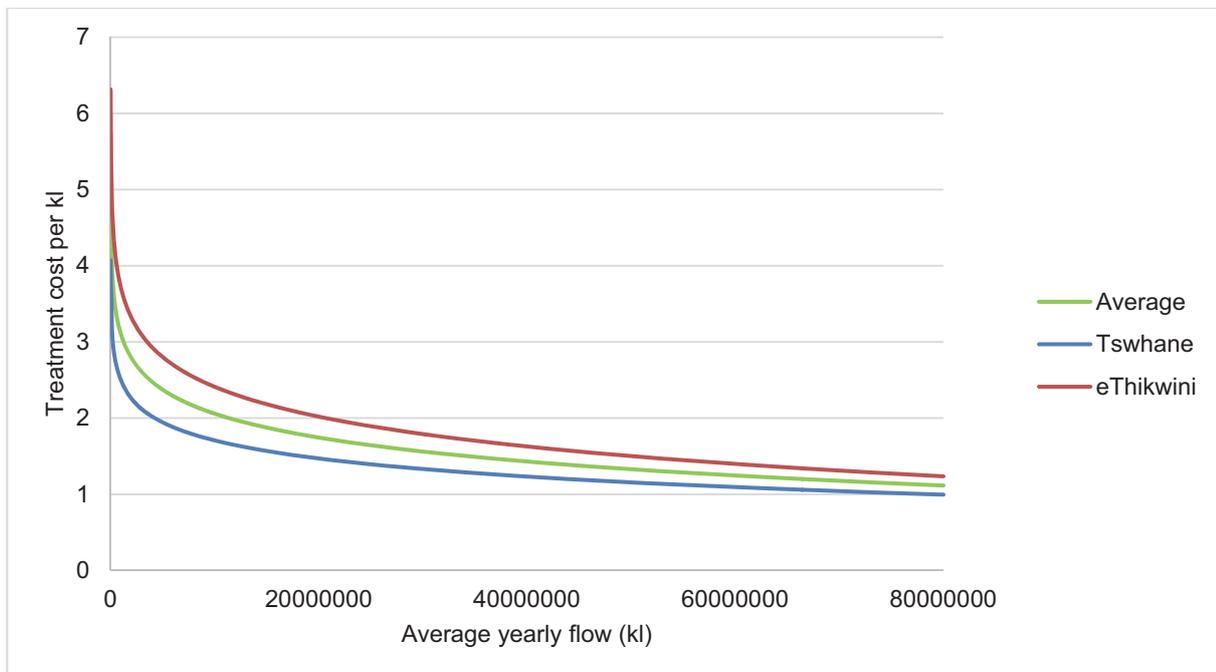
The average cost curves were used to create a generic cost curve for budgeted OMR expenses as well as for reported actual OMR expenses (Figures 5.6 and 5.7, respectively). From the average curves using the budgeted OMR expenses it was seen that treatment costs range from above R5.00 per cubic meter to below R1.26 per cubic meter where the former would be for small plants treating less than 50 000 kl per annum and the latter for large plants treating more than 50 000 000 kl per annum.

## Barriers to the Implementation of Effective Wastewater Charges

For the reported actual OMR expenses it was found where treatment costs range from above R5.00 per cubic meter to below R1.33 per cubic meter where the former would be for small plants treating less than 15 000 kl per annum and the latter for large plants treating more than 60 000 000 kl per annum. Using these treatment cost per cubic meter based on average daily flow equations the total expenditure on OMR for the reference municipalities, according to the Green Drop data, ranges between R3.63 billion and R4.10 billion.



**Figure 5.6: Average treatment cost per kl based on average yearly flow using budgeted OMR expenses**



**Figure 5.7: Average treatment cost per kl based on average yearly flow using reported actual OMR expenses**

**5.3.3 Technology of plants**

Two of the main types of technology used by different treatment plants are activated sludge and oxidation ponds. The average design capacity of plants that uses activated sludge technology is 15.2 MI/day while the average design capacity of plants that use oxidation ponds is 1.1 MI/day. For a more detailed list of descriptive statistics refer to Table 5.2 below. It can be concluded that since the largest plant using oxidation ponds is 25 MI/day while the largest using activated sludge is 435 MI/day that technology doesn't really add value to the costing model as there is a strong relationship between design capacity, i.e. the size of the plant, and the technology used.

Therefore, having a larger plant becomes synonymous to moving to higher tech plants. To confirm this conclusion in Table 5.3 it is shown how the activated sludge is more cost effective when comparing the average per unit cost as opposed to oxidation ponds.

**Table 5.2: Descriptive statistics for plant sizes (MI/day) using the two main technology types**

	Activated sludge	Oxidation Ponds
Mean	15.21	1.13
Median	3.95	0.64
Min	0.05	0.00
Max	435.00	25.00
Variance	1429.00	4.70
Count	312	174

**Table 5.3: Descriptive statistics on the per unit cost of the two main technology types**

	Activated Sludge	Oxidation Ponds
Mean	56.87	121.29
Median	3.55	13.82
Min	0.10	0.20
Max	4713.43	2289.50
Variance	144326.80	104860.40
Count	245	99

The plants that reported design capacity, plant type and annual cost are shown in Figure 5.8 below. On the vertical axis is the design capacity of the plant and the blue dots represent plants using activated sludge while the orange dots represent plants using oxidation ponds. Again we see that oxidation ponds are mostly associated with smaller plants while activated sludge plants tend to be larger.

The results suggest that the technology employed at a plant has a relatively small impact on the unit cost of treatment since the size of the plant already indirectly takes this into account.

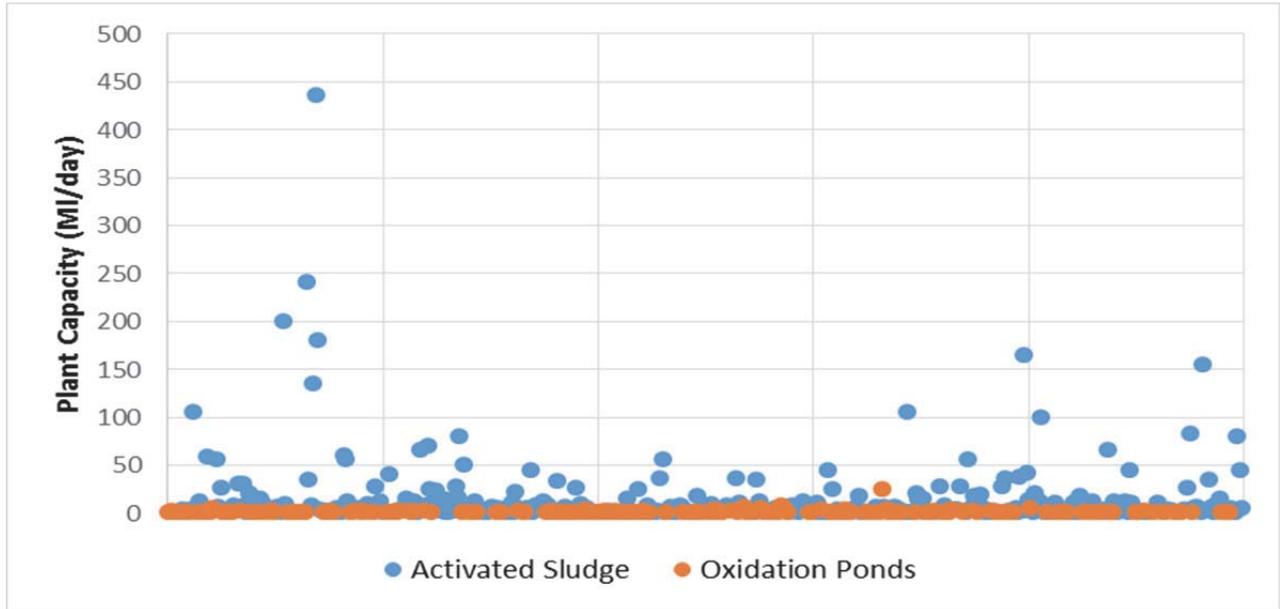


Figure 5.8: Size of plants using the two main technology types

### 5.3.4 Age of plants

From the City of Johannesburg information on the age of its different plants were obtained and compared the age and size of the plant to the unit cost of treating wastewater. In Table 5.4 a problem becomes apparent. The plants with newer units also tend to be the bigger plants and therefore it is not possible to determine whether age will add value to the calculation of costs. Another problem with using age as an indicator of costs is that many older plants have been upgraded over the years. This makes the age and unit cost of treatment even more poorly correlated.

Table 5.4: Age and size of plants against the cost of treatment

Plant Name	Age of the Plant (years)	Design Capacity (MI/day)	Unit cost of treatment (cents/kl)
Bushkoppie	15-26	240	79
Olifantsvlei	17-37	180	159
Driefontein	25-40	35	99
Ennerdale	30	8	209
Goudkoppies	35	135	132
Northern Works	4-51	435	78

## CHAPTER 6: SETTING AN APPROPRIATE WASTEWATER CHARGE

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### 6.1 INTRODUCTION

The treatment cost model and wastewater revenue model had several shortcomings, some of which included the inability to capture revenue from industrial wastewater charges, make provision for non-payment, and capture the costs of sewage pumping and collection. The setting of an appropriate wastewater charge has been demonstrated to be a complex and lengthy task requiring consideration of operations costs (which we will refer to as OPEX), infrastructure maintenance (which we will refer to as OPEX) as well as economic regulation policy imperatives. To this end a rapid wastewater charge model was developed using municipal revenue and expenditure.

In the case of economic regulation policy imperatives we understand that there may be a range of financial, economic, socio-economic and political-economy policy imperatives that relate to the demand side of the wastewater charges. For instance, subsidies to indigent households may be a sanitation service policy imperative, and this subsidy may be designed within a setting of full cost-recovery, meaning that non-indigent households would pay larger tariffs to cover the subsidy cost. In another case, a WSA may decide to provide a wastewater subsidy to attract investment to a particular development node. On the other hand, wastewater charges may be designed to contain penalty measures for cases where pollution concentrations exceed allowable standards. This would be akin to a form waste discharge charge system which attempts to use charge structure not only as a cost-recovery mechanism, but also as an economic policy instrument. Thus, many demand-side policy considerations and variables may exist. It is both the prerogative and the mandate of the WSA to consider how these factors would transform into effective subsidies for wastewater charges. Economic regulation imperatives however fall outside the scope of this study. Our main consideration relates to operations costs and infrastructure maintenance costs.

The operations costs relate to the annual operations of WWTWs and sewer pump stations. This includes a large number of fixed and variable costs including salaries, electricity, chemical costs, general repairs and maintenance and other costs. The setting of operations charges therefore requires an in-depth understanding of the actual costs required to treat wastewater, consistently to required effluent standards.

The infrastructure maintenance relates to the proactive maintenance and repair of immovable assets comprising WWTWs, sewer reticulation systems, sewer pump stations and associated infrastructure. The concepts of infrastructure maintenance and depreciation are closely related. In an ideal world, where all immovable assets are registered, correctly valued based on replacement value and depreciated over the appropriate period; an infrastructure maintenance charge may be accurately estimated, and levied on users. Such an infrastructure maintenance charge would reflect the annual depreciation of the immovable assets.

The setting of infrastructure maintenance charges therefore requires that a functional Immovable Asset Management (IAM) system is in place. In a context where only about 10% of WSA have more than 80% Green Drop compliance (2011), it is very likely that both operations charges and infrastructure maintenance charges are currently underestimating the real cost of wastewater reticulation and treatment.

In this section we develop a rapid charge setting method, using empirical evidence from WSAs who did achieve Green Drop score exceeding 80% in 2011.

## 6.2 RAPID WASTEWATER CHARGE SETTING MODEL

This section develops a rapid wastewater charge setting model. The model principally uses empirical data from the Green Drop database, the StatsSA Financial Census of Municipalities (FCM) (StatsSA, 2014). The FCM 2013/14 provides a very useful dataset that summarises all income and expenditure items, for the wastewater treatment (including sewerage reticulation) function of all municipalities. The FCM is a summary of the data contained in Annual Reports of municipalities, but also contains additional data reported by municipalities to StatsSA. Table 6.1 summarises these incomes and expenditures. For the purposes of this study, our specific interest is with the income accruing from “*Sewerage and sanitation charges*”, which was R9.76 billion in 2013/14. It is unlikely that the total expenditure of R9.99 billion is an accurate reflection of real cost – if it was most WSAs would have had Green Drop certificates (Table 6.1).

It is therefore also unlikely, that the income from “*Sewerage and sanitation charges*” is sufficient, as they do not cover the total expenditure. (It is not clear from the FCM where the “*Grants and subsidies are used*”, but as far as this study is concerned we are interested in setting appropriate charges, independent of grants and subsidies. As discussed above, subsidies relate to demand-side measures and therefore fall outside the scope of this work). Consequently, several questions emerge. Firstly, is the operations charge component sufficient to cover the cost of operations, and secondly, is the infrastructure maintenance component sufficient to cover the depreciation based on replacement costs? In addition, a weaker economy of scale and household density increases the cost of wastewater management in rural municipalities (Section 4.7.2).

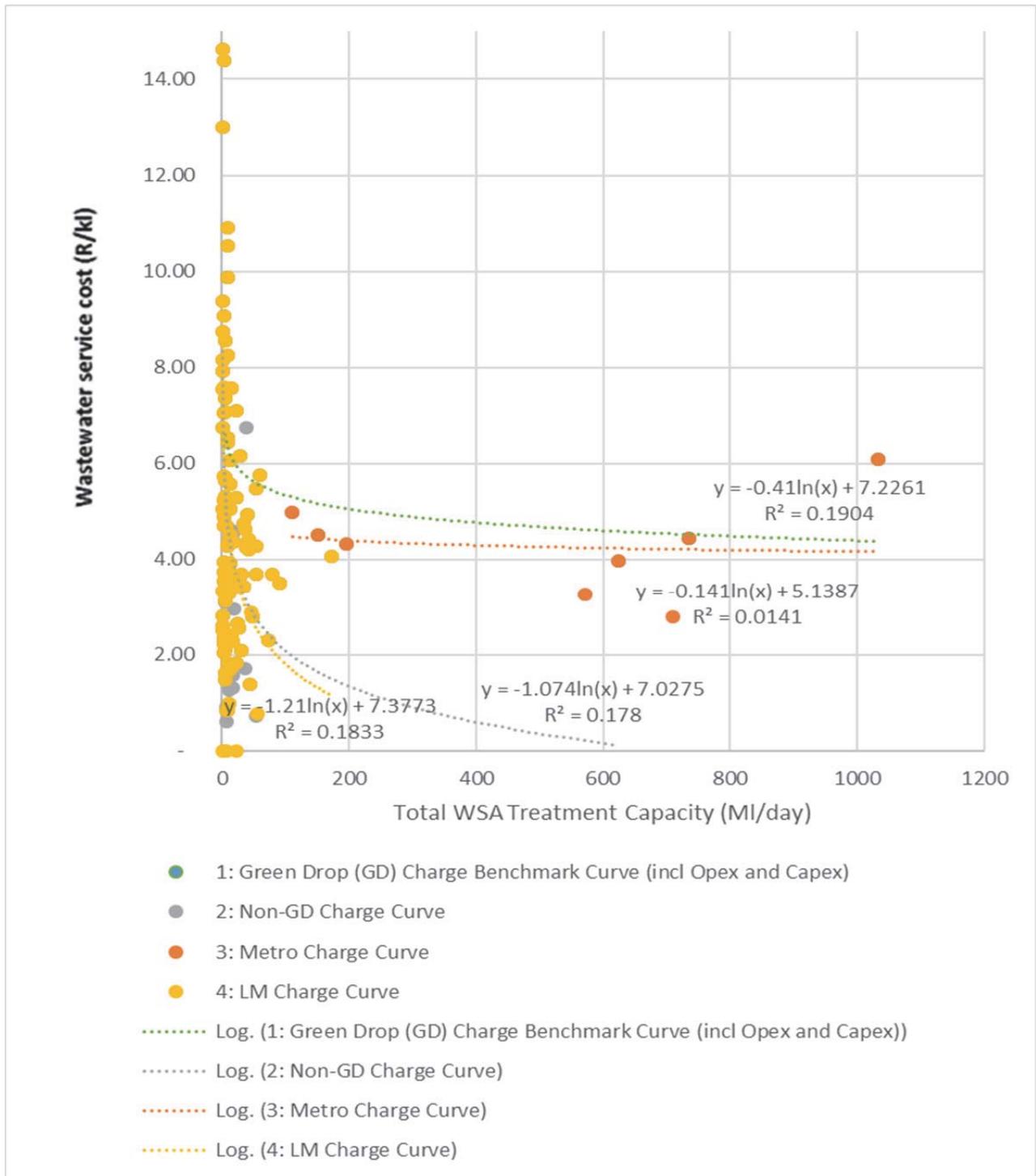
These questions were addressed by developing a set of marginal cost of wastewater reticulation and treatment curves, using the empirical evidence of a combined Green Drop and FCM database (Figure 6.1). Marginal cost of wastewater reticulation and treatment curves were estimated by calculating the per unit “*Sewerage and sanitation charges*” and assuming a downward sloping curve. Plant treatment capacity was used as volume unit. This provided a weighted average “*Sewerage and sanitation charge*” that is the effective charge collected by the municipalities, and formed the basis for the analysis of marginal costs. These costs were then segmented by Green Drop compliance (>80%) and metropolitan municipality (MM) and non-metro municipality (NM).

**Table 6.1: Summary of income and expenditure associated with wastewater treatment functions for all South African municipalities in the 2013/14 financial year.**

Sewerage and sanitation charges	R 9,762,553,000
Grants and subsidies	R 4,908,623,000
Other income	R 582,692,000
Total income	R 15,253,868,000
Total expenditure	R 9,986,721,000

**Table 6.2: Summary of the weighted average charges for the marginal cost of wastewater reticulation and treatment curves derived from the Rapid Wastewater Charge Setting Model and represented in Figure 6.1.**

Description	R/kl
1: Green Drop (GD) Charge Benchmark Curve (incl Opex and Capex)	5.66
2: Non-GD Charge Curve	4.52
4: Metro Charge Curve	4.29
5: Non-Metro Charge Curve	4.79



**Figure 6.1: Marginal cost of wastewater reticulation and treatment curves derived from the Rapid Wastewater Charge Setting Model**

Figure 6.1 presents the resulting marginal cost curves. In all cases the unit cost decreases marginally with increasing treatment capacity. Logarithmic trend lines provided the best fit for the data. The  $R^2$  values are relatively low confirming a large variation in the samples, likely from many sources.

**Curve 1** is a “benchmark” curve derived from the sample of unit charges of municipalities with Green Drop score exceeding 80%. Analysis of this data shows that these municipalities included operational costs as well as depreciation in their expenditure structures. The weighted average unit cost for this sample is R5.66/kl (Table 6.2), which therefore includes both Opex and Capex charge items. The Capex component is R1.61/kl.

**Curve 2** is the non-Green Drop (non-GD) charge curve, derived from the sample of unit charges of municipalities with Green Drop score lower than 80%. The weighted average unit cost for this sample is R4.52/kl (Table 6.2). This is on average R1.25/kl lower than the corresponding Curve 1. Thus, Green Drop compliant WSAs’ wastewater charges exceed non-Green Drop compliant WSAs by approximately 28%.

**Curve 3** is the metro municipal charge curve, derived from the sample of unit charges of metropolitan municipalities. The weighted average unit cost for this sample is R4.29/kl. This is on average R1.37/kl lower than the corresponding Curve 1. Thus, Green Drop compliant wastewater charges in metropolitan municipalities exceed non-Green Drop compliant metropolitan municipalities by approximately 31%.

**Curve 4** is the non-metro municipal charge curve, derived from the sample of unit charges of local municipalities. The weighted average unit cost for this sample is R4.79/kl. This is on average R0.50/kl higher than the corresponding Curve 3. Thus, local municipality wastewater charges exceed that metropolitan municipalities by approximately 10%.

The marginal cost curves derived above can be used to estimate an appropriate weighted average wastewater charge for a WSA, forming the basis for the resulting benchmark estimates.

Figure 6.2 provides a graphic representation of these benchmark charges. Firstly, when considering the Opex charge components only, there exists a median with a lower and an upper limit. This demonstrates and confirms that WSAs, depending on the installed capacity, location and other variables, may have an Opex charge that falls with a band ranging between R3.62/kl and R5.78/kl. Secondly, when adding Capex charge estimates using FCM depreciation benchmarks, the median and its corresponding lower and an upper limits demonstrates and confirms that WSAs, depending on the installed capacity, location and other variables, may have a combined Opex and Capex charge that falls with a band ranging between R5.23/Kl and R7.39/kl.

The above analysis can be used to assess the appropriateness of current charges, to estimate the replacement cost of wastewater reticulation and treatment systems and its can also be used to as a rapid wastewater charge assessment tool for estimating interim charges in the absence of appropriate cost and asset replacement value data.

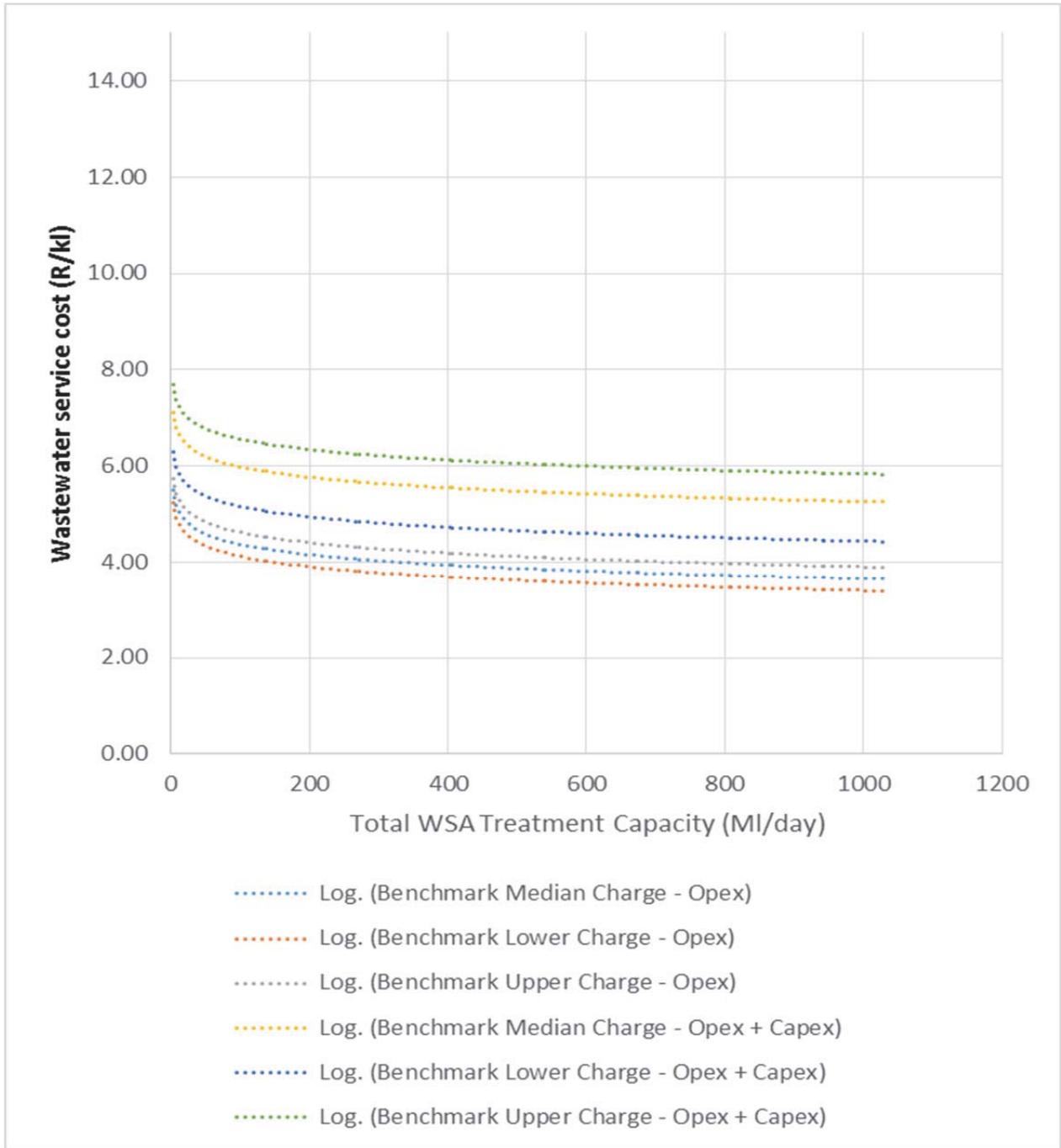


Figure 6.2 Benchmark marginal cost of wastewater reticulation and treatment curves for estimating Opex and Capex unit costs for different WSAs. The areas between the Opex and Capex curves (respectively) indicate the likely ranges of unit costs applicable to a WSA.

### 6.2.1 Marginal cost of wastewater reticulation and treatment curves derived from the Rapid Wastewater Charge Setting Model

By applying the Benchmark median charge for Opex and Capex (Figure 6.2) to all the WSAs in the country, we can estimate the likely income required from wastewater charges to achieve a Green Drop score that exceeds 80% for all WSAs. The resultant total income earned from this weighted average tariffs is R13.68 bn per year, which exceeds the current income of R9.54 bn per year reported by the FCM by 43%. This provides strong empirical evidence that the current wastewater charge structure is inadequate and under-recovers on likely actual costs. This likely explains many of the pervasive problems associated with achieving Green Drop certification. Although the addition of grants and subsidies alleviate this problem to some extent, the current charge structure is clearly not sustainable.

### 6.2.2 Estimating the replacement cost of wastewater reticulation and treatment systems

By applying the Benchmark median charge for Capex to all the WSAs in the country, we can estimate the likely replacement value of wastewater reticulation and treatment systems for all WSAs. At a Capex unit charge of R1.61/kl, and assuming a weighted average depreciation rate of 4.3% per year (as reported by the City of Cape Town’s Annual Report) this results in an estimated replacement value of R88.99 billion, which far exceeds the estimate of R28 billion made in the 2009 Green Drop Report (DWS 2010).

### 6.2.3 Rapid wastewater charge assessment

Converting the benchmark Opex and Capex charge curves (Figure 6.2) to table format enables a rapid wastewater charge assessment. The table below demonstrates typical benchmark charge estimates for metropolitan municipalities and local municipalities, separately, for different installed treatment capacities. These results form and inform the wastewater charge setting guideline.

**Table 6.3: Guideline rapid wastewater charge assessment (R/kl).**

Total WSA Treatment Capacity (Ml/day)		5	10	25	50	100	200	500	1000
Metro	Opex	5.28	5.06	4.78	4.56	4.34	4.12	3.84	3.62
	Opex + Capex	6.89	6.67	6.39	6.17	5.95	5.74	5.45	5.23
Non metro	Opex	5.78	5.56	5.28	5.06	4.84	4.62	4.34	4.12
	Opex + Capex	7.39	7.17	6.89	6.67	6.45	6.24	5.95	5.73

## 6.3 CONSIDERATIONS FOR COST EFFECTIVE WASTEWATER MANAGEMENT

### 6.3.1 Technical Considerations

To design a wastewater treatment facility that is functionally appropriate whilst cost effective is a complicated process which demands engineering insights and a deep understanding, by the designers, of the unique contextual considerations that will impact on the cost and functionality of the proposed plant. There are seven elements that are critical for the technical selection of a wastewater treatment plant, which include reliability; simplicity; efficiency; land requirements; affordability; social acceptability and sustainability. These 7 elements may be summarized in the following 3 step process:

## Barriers to the Implementation of Effective Wastewater Charges

1. To determine the treatment regime required (in consideration of what is being treated and the extent to which it needs to be treated).
2. To make consideration for the socio-economic factors driving development (Proximity to urban/rural areas, forecast growth in economic activity, municipal capacitation, including finances, human resources, etc.)
3. To determine a treatment regime that can suitably remove or modify the components found in wastewater in order to meet emissions requirements.

This process of consideration is of great importance. Most non-metro municipalities located in low income areas discharge effluent that does not meet the minimum local discharge standards. This excess effluent that is discharged carries its own cost, through the health and hygiene impact on communities, and through the impact on the local environment.

The challenge is that treatment facilities need to remain functional and relevant well throughout their design life. And with design lifespans approaching 50 years in some cases, it stands to reason that the biggest challenge when making the decision to install a wastewater treatment plant is related to forecasts of the types of industrial and economic activity that will take place of the years to come.

*Forecasting effluent emissions:* Domestic effluent is relatively consistent in its make-up relative to industrial effluent. Forecasting growth in the domestic effluent category is largely about increases in volume. Forecasting effluent for the industrial sector is highly unpredictable. The nature of effluent emanating from the industrial sector can vary widely in its volume and chemical make-up.

*Efficiency versus Robustness / Longevity:* One of the decision that must be taken when installing a WWTW is whether to design the plant for efficiency and efficacy or to design the plant for robustness and longevity. These two factors are not always trade-offs of one another, but in terms of the operational burden that the operation places on the parent municipality, they tend to be.

Highly efficient plants are generally required by plants that have to process large volumes of effluent quickly and effectively. Such plants require a greater level of assurance with regards to the quality of the treated effluent that they produce. Plants requiring high levels of efficacy and efficiency often need to make allowance for land use, as they are usually located in dense urban areas.

However, in less prosperous areas, emphasis might be given towards robustness and longevity of the plant, over efficacy and efficiency. Such a facility might design a plant to treat effluent with minimal available human capacity, and with fewer mechanical components requiring regular maintenance. The emphasis in this case would be to operate a plant with minimal human and chemical intervention.

*Wastewater sludge as a potential raw material:* There is the potential for wastewater sludge to be processed into useful byproducts. Sludge may be utilized for its thermal or chemical properties. Internationally the perspective has shifted towards sludge being a valuable resource. If the same could be achieved locally, it could potentially alter the decision making process with regards to the installation of wastewater treatment facilities.

### 6.3.2 Depreciation Estimates

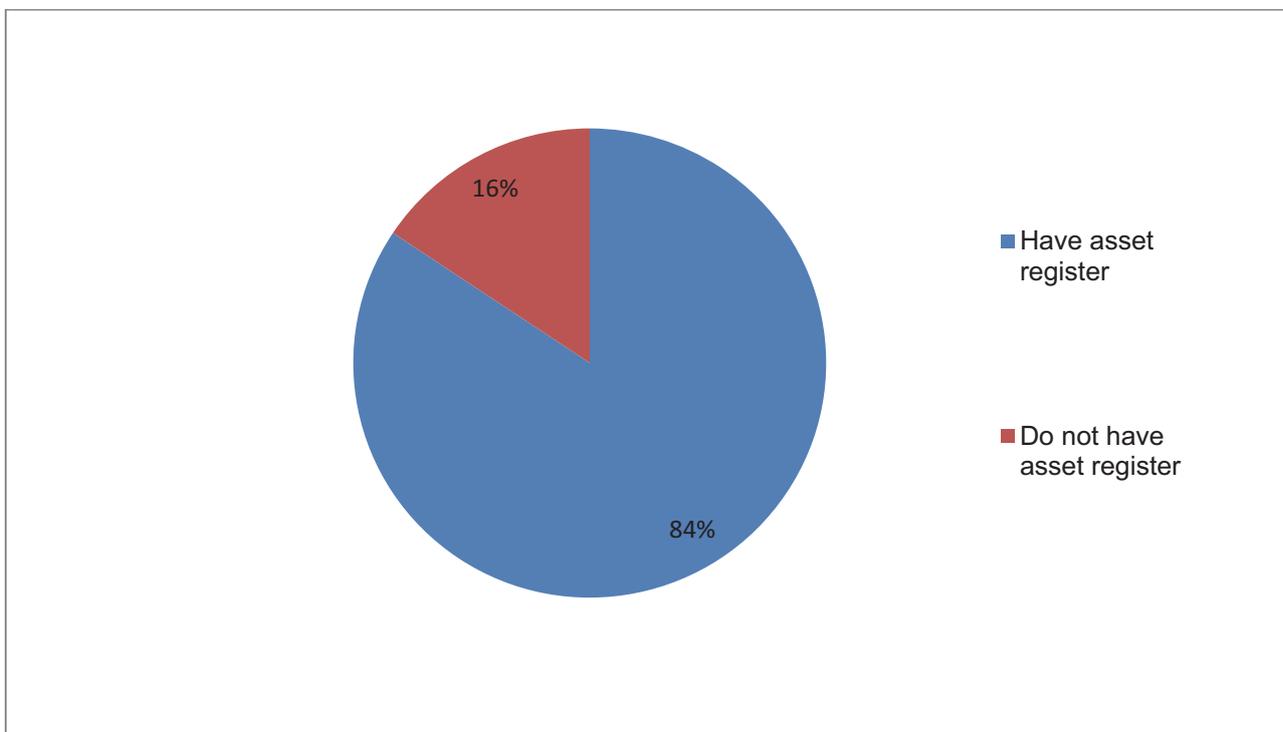
Depreciation is the systematic reduction in the value of asset representing the consumption of its economic benefits (National Treasury, 2004). Depreciation allows the asset purchase costs to spread over its useful life, such that instead of costs being overstated in the year of purchase, they can provide a more realistic reflection of programmes costs over the assets lifespan. Considering that the financial stability of municipalities requires covering the costs of the reduction in the value of these assets over time, it is essential that depreciation is factored into wastewater charges.

## Barriers to the Implementation of Effective Wastewater Charges

There are numerous provisions for depreciation costs to be recovered in wastewater tariffs, including:

- The Municipal Systems Act in which Section 74 on tariff policies state that tariffs must reflect replacement costs.
- The Water Services Act which states that for the purpose of striving to be financially viable, a water board must make reasonable provision for the depreciation of assets.
- The Draft Water Services White Paper states that revenue requirements for water services must take into account depreciation charges.

A requirement to accurately calculate the depreciation of assets is an asset register. The Green Drop System scores municipalities on Wastewater Asset Management, based on the proof of an asset register, as well as whether they contain the replacement value for assets. Most municipalities have asset registers (Figure 6.3), but in most municipalities, depreciation is not being recovered by tariffs and not being used to manage the replacement of assets (Jacoby, 2013).



**Figure 6.3: The prevalence of asset registers for wastewater treatment plants at South African municipalities (data courtesy of DWA 2013)**

The depreciation of assets can be accounted for in many different ways, according to National Treasury's Accounting Guideline (National Treasury, 2014), the most common being:

- Straight line: An arithmetic technique that divides the asset value by the useful lifespan of the asset.
- Reducing balance: An arithmetic technique in which the asset is depreciated by a depreciation rate.
- Unit of production: A method in which the value of the asset is consumed as a function of its productivity.

The Department of Public Works provides a guideline (DPW, 2012) on how depreciation and maintenance costs should be calculated (Table 6.4). Although the recommendation is for different components to be depreciated at different rates, the lack of data on system components necessitates that for the purpose of modelling a single asset approach should be taken. Thus the economic model factors in depreciation as 5% per annum using a design life of 20 years.

**Table 6.4: Life cycle cost of assets (DPW, 2012)**

Design life	20 years
Depreciation and maintenance costs of concrete structures	5%/year
Depreciation and maintenance costs of steel structures and steel pipelines	8%/year
Depreciation and maintenance costs of plastic structures and pipelines subject to direct sunlight at any time of the year	20%/year
Depreciation and maintenance costs of surface mounted plastics and pipelines not subjected to direct sunlight at any time of the year	10%/year
Depreciation and maintenance and maintenance of buried UPVC and plastic pipelines	5%/year
Depreciation and maintenance costs of electric motors and switchgear	10%/year
Depreciation and maintenance costs of mechanical equipment e.g. Aerators, rotating discs, valves, pumps etc.	8%/year
Depreciation and maintenance and maintenance costs of electronic equipment	15%/year

For depreciation to be included in the wastewater charges, it needs to be applied to the capital costs of wastewater treatment works. However, data on the replacement values of wastewater treatment works is scarce. The 2009 Green Drop Report estimated the capital replacement costs of wastewater treatment to be >R23 billion. According to the National Investment Framework for the Water Sector, the total capital replacement value for potable water distribution and sanitation at the local government level is in the order of R275 billion (DWA, 2013). These vastly different figures suggest that the replacement values of wastewater treatment assets are poorly understood.

Further investigation of the specific challenges municipalities face when including depreciation into wastewater charges highlighted the difficulty in calculating replacement values for assets. The majority of municipalities use historic costs (Jacoby, 2013) in their calculations as it has many advantages that include, being based on actual values, transparent, easier calculation and being suitable for financial accounting (Shugart and Alexander, 2009).

Another constraint is the belief that the use of replacement values in the depreciation calculations will require raising wastewater charges to unaffordable levels. For example, eThekweni municipality calculates the historic cost to be approximately R 4 billion whereas the replacement values to be approximately R 19 billion. Similarly, Johannesburg Water estimates that the historic costs for its infrastructure to be approximately R 7 billion and the replacement values to be approximately R50-R60 billion. The vast gap between these two values suggests that municipalities using historic values are inadequately provisioning for future infrastructure costs, but it is possible to compensate for this with grandfathering of old infrastructure and sharing the costs of new infrastructure across all consumers.

## CHAPTER 7: CONCLUSIONS AND RECOMMENDATIONS

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### 7.1 INTRODUCTION

All data collected in from municipal bylaws, questionnaires and alternative sources were captured electronically and stored in a Microsoft Excel based database. Data was classified and collated to a municipal scale. The database used municipality codes as the unique identifier. Analyses were then conducted on this standardised format.

### 7.2 SUMMARY OF FINDINGS

The summary presented below includes findings from municipal assessments, as well as outputs of the national workshop held in February 2015 regarding considerations for setting effective wastewater charges are summarized below. Outputs are collated according to key themes and include:

- Understanding the cost of treatment
- Need for Asset Management
- Need to Ring Fence Water Services
- Consideration for Context Specific Differences
- Understanding Consumer Behaviour and Demand Elasticity
- Stakeholder Consultation and Generating Consensus

#### 7.2.1 Understanding the Cost of Treatment

Determining the cost of treating wastewater is the most fundamental step towards determining what a wastewater treatment charge should be. The charge structure itself is the manner in which that cost is distributed among a set of consumers.

However, costing of wastewater treatment services is a highly technical process that within the often resource constrained South African context is not given adequate consideration. Understanding the cost associated with wastewater treatment requires that the following issues be understood:

##### *Cost differences between Metros and District Municipalities*

The cost associated with the treatment of wastewater is often higher for district municipalities than it is for larger local and metro municipalities. The following two reasons were given for why this may be the case:

- a. Proximity to poverty
- b. Too small for economies of scale

*Proximity to poverty:* Rural regions are subject to a form of poverty that is deeper and more effectual than that which is the case in urban areas. An example was given, by a member of the workshop of a district municipality that had 14 wastewater treatment plants within their jurisdiction. The participant explained that in their particular municipality it was necessary for them to employ a set of security guards for each of the plants in order to prevent theft of equipment and vandalism of the plant itself.

## Barriers to the Implementation of Effective Wastewater Charges

*Inefficiencies at the local level:* Municipal operations at the local and district municipal level may be subject to a range of inefficiencies due to the relatively small scale of their operations. The inefficiencies that are experienced at this level are well documented and include:

- **HR Shortages:** A lack of sufficient and adequately trained staff at the local level means that internal operations will likely run at a sub-optimal level.
- **Lack of adequate treatment capacity:** The lack of capacity to treat wastewater at the local level negatively impacts the cost of wastewater treatment. Plants that are operating overcapacity are most likely not operating at the most efficient level.

The result is that several smaller municipalities are struggling to operate and maintain their services infrastructure in a sustainable and cost effective manner, which can lead to deterioration of assets and disruptions in service delivery, all of which have cost and revenue implications. Financial constraints, institutional deficiencies and personnel acquisition and retention challenges present in the smaller municipalities (although these factors are not exclusive to these areas) contribute to and compound these issues.

*Lack of cost/price transparency:* Cost transparency refers to a situation where both the purchaser and seller of goods are aware of the cost of producing a good that is subsequently sold at certain price. Cost breakdown are tightly guarded secrets, as they allude to the gross margin that a particular firm may be carrying. However, this need to maintain secrecy on profit levels is an impediment to the derivation of suitable charge structures for wastewater treatment.

The matter pertains particularly to instances where the treatment of wastewater is outsourced to a Water Service Provider (WSP) or a Professional Services Provider (PSP). There are cases where WSP/PSP's do treatment on behalf of a municipality and in such cases it is difficult to get the service provider to reveal cost of providing that service.

*Cost Accounting:* Cost accounting is the process of collecting, analysing, summarizing and evaluating various alternative courses of action and the costs associated with those courses of action. In the simplest sense, cost accounting is used to compute the unit costs of a given product or service in order to report the cost of inventory on the balance sheet and the cost of goods sold on the income statement.

The challenge faced by municipalities is that accounting for costs (costs directly associated with and completely allocable to a given service/product as well as costs that may only partially attributable to a given service/product) requires an investment of time and resources, which may not always be available in a resource constrained municipal context.

A few of the reasons provided for why cost accounting is not undertaken include:

- The batch processing of expenses without allocation of specific expenses to department/functions/processes is less effort.
- Lack of appropriate asset management measures which are required as inputs into cost accounting.
- The software used by municipalities is set up for annual reporting and is not immediately suitable for cost accounting.
- The treatment of the wastewater may be outsourced to a WSP or a PSP, in which case the municipality in question will most likely not have access to the necessary data.
- **Highly Technical Nature of Wastewater Services:** The technical nature of wastewater services means that the costs associated with the service, for the purposes of planning and forecasting, can be difficult to communicate to financial experts.

The lack of accounting for wastewater treatment costs means that entities forgo several benefits of this form of accounting which include the access to detailed cost information, facilitation of planning, disclosure of

operating efficiency, ability to do cost comparisons and the establishment of standard costs for service provision.

*Benchmarking:* Benchmarking is the process of comparing one's business performance metrics to the industry standard or to the best practices of other companies. There are currently no benchmarks set for performance in the water services sector, particularly with regard to the setting of reasonable charge structure and understanding services costs.

### 7.2.2 Need for Asset Management

The broad definition of asset management refers to any system that monitors and maintains items of value to an entity or group. The term may apply to both tangible assets such buildings and equipment, or it may be applied to intangible concepts such as intellectual property or goodwill. It is the systematic process of deploying, operating, maintaining, upgrading and disposing of assets in a manner that fits with the profit motive of the management entity.

The term is most commonly used in the financial world to describe people and companies that manage investments on behalf of others. It is also a commonly used term in the engineering environments where asset management refers to the management of assets to achieve the greatest return on productive assets such as plants and equipment. In this context the focus shifts to the process of monitoring and maintaining facilities with the intention of providing the best possible service/performance to a given client or set of users.

*Maintenance of Asset Registers:* The asset register is the foundation of an asset management framework that keeps asset information as well as an historical record of both financial and non-financial information over the life cycle of the asset. The asset register records this information to facilitate:

- Asset planning
- Meeting accounting standard and legislative compliance
- Performance monitoring and accountability

Asset management strategies and capital budgeting processes are all reliant on accurate and up-to-date information all of which should be informed by the asset register. It is an essential component in determining the likely condition of assets, planning for replacement or refurbishment of assets and for determining the life cycle costs by asset, program or business activity.

The general consensus among the workshop panellists was that current asset management strategies currently in practice were insufficient, with resource constraints being stated as the primary reason for this being the case. The following points were raised:

*Allocations to the Capital Reserve Fund (CRF):* The CRF is an entity used by financiers to accumulate funds for the replacement, refurbishment and augmentation of existing wastewater infrastructure. Resource shortages at certain levels, means that allocations to the CRF are often forgone in favour of more immediately pressing matters.

*Depreciation:* The treatment of depreciation as it relates to water services infrastructure

*The Case of Sekhukhune District Municipality:* Representatives from the Sekhukhune District Municipality presented an example of how they had, after a number of years, managed to put the necessary structures into place to acquire a clean audit qualification. The municipality as an up to date asset register and had managed to begin to save funds for future system refurbishment and augmentation by accumulated cash in a capital reserve fund.

The representative stated that in order to achieve this they had to prioritize these activities over other activities that were more urgent but less important. Resources were committed up-front to the development of the asset register, and funds were allocated to the Capital Reserve Funds before other needs were addressed.

*The Case of Water Sector Privatization in the UK:* In the United Kingdom, following the privatization of the water sector, the first 10 years or so were devoted almost purely to building comprehensive asset database and to designing and implementing appropriate asset management strategies.

### 7.2.3 Need to Ring Fence Water Services

Ring fencing is a financial concept that can have slightly different meanings depending on the context within which it is used. In the context of the water services sector ring fencing refers to instances where the revenue generated from the provision of water services is separated from other revenue streams and reallocated back to water services in order to ensure ongoing service provision. In essence it is when a regulated public utility business financially separates itself from a parent entity that engages in non-regulated business activities. Ring-fencing is conducted primarily for the protection of consumers of essential services such as electricity and water from financial instability in other departments of the parent entity.

Although ring-fencing of revenue generated by water services is legally required, the practice of doing so does not appear to be the norm. There are a number of obstacles to the implementation of proper ring-fencing and these include:

- *Lack of Cost Accounting:* The actual cost of providing the service is not known and accounting facilities are configured for annual reporting not cost accounting.
- *Highly Technical Nature of WWT:* The technical nature of wastewater treatment (WWT) means that the costs associated with WWT, for the purposes of planning and forecasting can be difficult to communicate to financial experts.
- *Cross-subsidization and cash flow management:* In a stressed financial context the revenue generated by municipal services is used as a buffer to manage cash flow or to fund other non-revenue services.
- *Poor intra-departmental communications:* Budgeting practices may be hampered by a lack of adequate communication between financial and technical departments. Technical departments are required to submit proposed budgets to the financial department, however the general impression is that financial departments do not adequately communicate/negotiate with technical departments when setting budgets.

### 7.2.4 Considerations for Context Specific Differences

WSAs and their associated wastewater management strategies occur across a range of socio-economic and geographical contexts. The variation between regions has meant that wastewater management strategies have been designed differently, according to the nuances of the given region.

The heterogeneous nature of municipalities means that a “one-size-fits-all” approach to setting wastewater charges is not appropriate. A strategy intended for the design of wastewater charges need to be applicable in all possible context in South Africa. The workshop panellists expressed a number of opinions related to this particular matter. These opinions are summarized here:

- *Technological and Asset Differences:* Municipal wastewater treatment plants are constructed based on a set of local wastewater treatment requirements and according to a range of other contextual considerations. Plants may be designed to be robust, with emphasis focusing on the long term

## Barriers to the Implementation of Effective Wastewater Charges

functionality of the plant, or they may be designed to be efficient, with the emphasis being on peak plant throughput. The range of contextual consideration that go into plant design influence the asset management strategy associated with a particular plant, and thus are of material importance to the setting of charge structures.

- *Population Flux:* A number of municipalities charge a fixed annual rate to fund water treatment. Whilst these mechanisms are not particularly effective at differentiating between classes of services users, the approach is necessary in certain area due to the relatively large seasonal fluctuation of the population (i.e. holiday destinations). In such a context there is a risk attached to the utilization of volume based charged structures as they might generate insufficient revenue.
- *Outsource wastewater treatment:* there are a number of cases where municipalities outsource wastewater treatment to a water board or other WSP. In such instances the municipality may not have access to the financials related to the cost of treatment.
- *Capacity to implement:* South Africa is host to and exceedingly wide variety of geographic and socio-economic contexts, the context of a given municipality and its capacity to implement reforms and projects needs to be taken into account.

### 7.2.5 Understanding Consumer Behaviour and Demand Elasticity

Consumer behaviour is the study of individuals, population or organizations and the processes they use to select, secure, use and dispose of goods and services. It is the study of the decision making processes of consumers. Households and businesses are consumer of water services, thus within this context consumer behaviour looks at the factors that influence the consumption of water services by households and businesses.

Within the context of the workshop, particular emphasis was placed on the extent to which pricing and charge structures affect (a) the consumption patterns of households and business, and (b) the extent to which the consumption patterns impact on revenue generation for service provision. This particular relationship is best captured in the concept of demand elasticity.

*Demand elasticity:* Demand elasticity is the measure of the shift in the quantity demanded of a particular good or service relative to a shift in a particular explanatory factor. The price elasticity of demand measures how the quantity demanded of a particular good or services shifts relative to changes in price of the good or services.

The particular example provided by the workshop panellists was of instances whereby a sudden tariff spike for water services resulted in a greater than proportionate decrease in the consumption of those services, resulting in a reduction in the amount of revenue collected by a given municipality. Thus an increased in charges for services do not always result in an increase in the revenue generated by municipalities. The point being that often the rates are increased to cover for a shortfall in revenue for a particular service, however if the behavioural response by consumers cuts the expected revenue from the rate hike, leaving us the exact problem we started in of in.

Understanding this relationship between the price of services provided and the consumption of those services is thus an essential component of setting charges and designing charge structures.

### 7.2.6 Stakeholder Consultation and Generating Consensus

Stakeholder consultation is the process by which an organization consults with individuals or organisation that may be affected by the decision that are made or who are in a position to affect the implementation of their decision. Such individuals/organizations may oppose or support the decision, be influential within the organization or within the community in which they operate or hold relevant official position that affect the decision making process.

## Barriers to the Implementation of Effective Wastewater Charges

The generation of consensus is a related but somewhat broader perspective than consultation alone. Generating consensus (not referring to the manufacturing of consent) is a process by which stakeholder consultation, information dissemination and proactive stakeholder negotiation can steer the consensus of a given group of stakeholders towards a point of agreement that is reflective of the needs of the group, not of the individuals.

The process of generating consensus may be disaggregated into several distinct factors which include:

- a. Political Will
- b. Awareness
- c. Training and Education
- d. Consultation

With respect to these considerations the workshop panellists expressed the following considerations:

*Political Will:* Political will, often described as the “ghost in the political machine”, is the motive force that generates political action. Political will refers to the collective result of the costs and benefits associated with the passage of a given law, and aims to achieve a balance between incentives and disincentives among the stakeholders involved. That being said, the following factors were highlighted by the workshop panellists:

- Need to achieve “buy-in” from those in political or major decision making positions. Their consensus or agreement with a given course of action is essential to driving the agenda forward.
- The process of consulting with such individuals and organization assists in generating “ownership” of the particular matter at hand.
- Those driving the process of political consultation need to be aware of information, awareness and knowledge gaps that need to be addressed.
- Cost implications need to be clearly communicated.

*Awareness:* You need to take into account the stakeholders you are working with, their level of awareness with regard to pertinent issues, and the perspectives that they hold relative to the issue in question.

*Education, training and information dissemination:* A broader educational awareness is necessary so that people and practitioners may recognize the interconnectedness of the water sector to a great many other sectors in the South African socio-economic context.

*Consultation:* Consultation is the action or process of formally consulting or discussing. Within the complicated socio-political context of South Africa, the process of consultation is fraught with sensitivities. The following key factors were highlighted by the workshop panellists:

- One of the difficulties of consulting with stakeholders regarding the pricing of services is that they are usually not interested in communicating with the relevant authorities until after price increases have come into effect.
- Initiatives that enact highly strict performance parameters without phasing them in over time, whilst making very little consideration for the available capacity to address those issues are exactly what South Africa needs to avoid. The following statements were made in reference to this point:
  - “An example of this might be when the blue/green drop standards were raised so rapidly. The requirements for inland plants are far too strict. This is breaking the credibility of the blue/green drop programs. Even if you meet all the requirements, if you drop the water supply for just 2 weeks you will lose your blue/green drop accreditation.”
- “If you realize that you don’t have the resources to meet a stipulated goal, then eventually you will just stop trying to succeed.”
- The evaluation of LM’s and DM’s need to be done independently. The latest Green Drop data has not been made available to the public, because the organizations doing the monitoring are the same organizations that stand to be discredited when bad results are presented.”

- “The situation is exacerbated by the fact that negative news can have very negative consequences for our decision makers and politicians. Negative news needs to be made available to the public, because that is what shapes the development agenda. The situation is driving high turnover rates in senior posts, which is a significant impediment to developing informed and well trained senior staff with a deep institutional knowledge.”

### **7.3 RECOMMENDATIONS**

The cost of provisioning wastewater services is the baseline for setting wastewater charges. However, to ensure adequate recovery of those costs (i.e. generating revenue from service provision) it is necessary to consider the suite of supporting services affect a municipality’s ability to appropriately assess, plan and implement effective wastewater charges. Based on the barriers identified in this study, broad recommendations on the key focus areas are made below. It must be noted however, that sufficient political will is the overarching prerequisite for the following goals to be achieved.

#### **7.3.1 Understanding the cost of treatment**

The cost of treatment is dependent on a range of endogenous and exogenous cost factors. Endogenous factors are under the direct control of the process municipality and can be managed internally. Exogenous cost factors are not under the direct control of the municipality but need to be taken into account nonetheless. Factors that would need to be considered include plant technology employed, the condition of the plant, and life expectancy of the treatment plant, volumes of influent and the required water quality standards for plant effluent.

#### **7.3.2 Need for Asset Management**

All water and wastewater systems are made up of assets, some that are buried assets and some that are visible. These are the physical components of the system and can include: pipe, valves, tanks, pumps, treatment facilities, and any other components that make up the system. The assets that make up a water or wastewater system generally lose value over time as the system ages and deteriorate. The deterioration of assets can result in increased maintenance costs, less effective water treatment and poorer levels of service delivery.

The intent of asset management is to ensure the long -term sustainability of the water or wastewater utility. By helping a utility manager make better decisions on when it is most appropriate to repair, replace, or rehabilitate particular assets and by developing a long-term funding strategy, the utility can ensure its ability to deliver the required level of service perpetually.

#### **7.3.3 Need to Ring Fence Water Services**

Ring fencing ensures that revenue generated from the provision of water services is separated from other revenue streams and reallocated back to water services in order to ensure ongoing service provision. The path to ring fenced water services however requires many different intermediary steps, many of which are discussed in the other points in this discussion. The main steps however are accurately costing the provision of services as well improved communication between financial and technical departments.

#### **7.3.4 Consideration for Context Specific Differences**

While great opportunities to learn from other municipalities exist, the heterogeneous nature of municipalities means that a “one-size-fits-all” approach to setting wastewater charges is not appropriate. As such, municipalities need to evaluate the unique differentiators affecting their ability to deliver wastewater services. This requires municipalities to understand the how their assets and technological differences affect current and future costs. Municipalities also need to be aware of different factors that affect demand for their services as well as provisioning for future development. As such, in the exceedingly wide variety of geographic and socio- economic contexts, the context of a given municipality and its capacity to implement reforms and projects needs to be taken into account.

#### **7.3.5 Understanding Consumer Behaviour and Demand Elasticity**

To ensure that wastewater charges are adequate, fair (equitable), transparent and affordable, municipalities require an in depth knowledge of their customer base and market. Information required includes the share between industrial, commercial and residential wastewater and the quantities and quality of each waste stream. While cost recovery is essential, municipalities need to understand the financial situation of its customers to ensure that the charges are affordable. A detailed profile of the market can allow municipalities to optimize the balance between cost recovery and revenue generation considering price sensitivity can be created using progressive charge structures such as block tariffs.

Understanding how the client base will grow and evolve over the long term is an essential input into planning for infrastructure development. As the client base grows and evolves, the required capacity for wastewater treatment will increase and the potential for revenue to be extracted from that market will/should grow as well.

Estimating market demand and total revenue potential is closely affiliated with a thorough knowledge of the client base, but focuses specifically on how the consumer demand responds to service pricing and a range of seasonal and market related factors. Factors that need to be considered include the demographic composition, income profile, income elasticity of demand, seasonal fluctuation of demand, etc.

#### **7.3.6 Stakeholder Consultation and Generating Consensus**

Wastewater services encompass a set of activities and responsibilities that is inclusive of, but not limited to, the collection and treatment of wastewater. The other services that complete that basket of activities labelled wastewater services include capacity planning, human resources development, infrastructure development, client base research and stakeholder communications.

The wide range of activities that constitutes treatment services covers a number of municipal departments and as such, the implementation of all of the various tasks will require a degree of coordination to ensure that the entire process is synergistic.

Maintaining reasonable client expectations can be a critical factor in ensuring compliance among the client base. It stands to reason that a client base that is well informed of the level of services they will receive and the associated costs of enjoying that service are considerably more likely to pay for the service that they received. The failure of municipalities to communicate charges or the charge setting process can result in customers perceiving that a municipality is providing poor services, and reduces their willingness to pay. Customers need to be made aware of the charges for the service as well as the charge setting process, to ensure that the process is inclusive and transparent.

## REFERENCES

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- AMCOW. 2011. Water Supply and Sanitation in South Africa: Turning Finance into Services for 2015 and Beyond. An AMCOW Country Status Overview.
- Asano T., Smith R.G. and Tchobanoglous G. (1985) Municipal wastewater: Treatment and reclaimed water characteristics. Irrigation with Reclaimed Municipal Wastewater – A Guidance Manual, G.S. Pettygrove and T. Asano (eds). Lewis Publishers Inc., Chelsea, Mississippi.
- Bailey, T. 2004. Waste Discharge Charge System: The Implications on Wastewater Quality Management and Monitoring. Proceedings of the 2004 Water Institute of Southern Africa (WISA) Biennial Conference 2 May 2004 ISBN: 1-920-01728-3 Cape Town, South Africa
- Bailey, W.R. and Buckley, C.A. 2004. Modelling Domestic Water Tariffs. Proceedings of the 2004 Water Institute of Southern Africa (WISA) Biennial Conference 2 May 2004 ISBN: 1-920-01728-3 3 Cape Town, South Africa
- Boland, J. J., & Whittington, D. 2000. Increasing Block Tariffs versus Uniform Price with Rebate. Political economy of water pricing reforms, 215.
- Burger, A. 2012. A preliminary investigation into the formulation of wastewater tariffs in selected South African Municipalities. Prime Africa Consultants.
- Burger, A. and Pearce, D. 2013. Revenue Potential of Waste Discharge Charge System. Water Research Commission Report
- Cadmus Group *et. al.* 2002. A Study of Best Practices in the Water and Wastewater Sector for the Ontario Super Build Corporation.
- Dettmer, W.H. 1997. Goldratt's Theory of Constraints: A Systems approach to continuous improvement. American Society for Quality.
- DPW. 2012. Small wastewater treatment works DPW design guidelines. Department of Public Works.
- DWA. 2002. Implementation of Catchment Management in South Africa. The National Policy. First Edition (Final Draft).
- DWA. 2003. Strategic Framework for Water Services. September 2003.
- DWA. 2004. National Water Resource Strategy First Edition, September 2004
- DWAF. 2005. Water and Sanitation Business: The Roles and Responsibilities of Local Government and related Institutions. The Department of Water Affairs and Forestry.
- DWAF. 2007. Strategies for the waste discharge charge system: version 1.9. Pretoria. Department of Water Affairs and Forestry.
- DWAF. 2007. Training Manual for Resource Water Quality Objectives (RWQO) Model. Pretoria. Department of Water Affairs and Forestry.

## Barriers to the Implementation of Effective Wastewater Charges

DWA. 2012a. Proposed new Water Management Areas and Catchment Management Agencies. Department of Water Affairs.

DWA. 2012b. Report on the Status of sanitation services in South Africa. Department of Water Affairs.

DWA. 2013. Strategic Overview of the water sector in South Africa. Department of Water Affairs

DWS. 2013. Framework for Economic Regulation of Water Services in Municipalities. Department of Water Affairs.

Eberhard, R. 2005. Administered Prices: Water. National Treasury

Green Drop Report 2009, The Department of Water Affairs

Green Drop Report 2011, The Department of Water Affairs

Green Drop Score Card 2012/2013, The Department of Water Affairs

Grosskopf, M., Pegram, G., Van Niekerk, A. & Herold, C. 2003. "Towards a Strategy for a Waste Discharge Charge System", Water Quality Management Series, Sub-Series No. MS 11, DWA, 2003

Hajispyrou, S., Koundouri, P. & Pashardes, P. 2002. Household demand and welfare: implications of water pricing in Cyprus. *Environment and Development Economics*, 7, 659-685.

Hoskings *et al.* 2011. Investigating the mechanism and processes used in setting water services tariffs. WRC Report No. 1871/1/11. Pretoria. Water Research Commission.

Jacoby, K. 2013. Recognising and managing the key challenges in water service delivery. Water Research Symposium July 2013.

Mckenzie, R., Sigalaba, Z.N. & Wegelin, W.A. 2012. The State of Non-Revenue Water in South Africa. WRC Report No. TT 522/12

Morris, Glenn E. and András Kis. 2004. Assessment and Development of Municipal Water and Wastewater Tariffs and Effluent Charges in the Danube River Basin. Volume 1: An Overview of Tariff and Effluent Charge Issues and Proposals. Danube Regional Project. September, 2004.

Muller, M. 2007. Nedlac Administered Prices Study on Economic Inputs: Water Sector.

National Treasury. 2004. Asset Management Framework

National Treasury. 2008. Municipal Government Capital Asset Management Guideline.

National Treasury. 2013. The state of local government finances and financial management as at 30 June 2013.

National Treasury. 2014. Accounting Guideline GRAP 17: Property, Plant and Equipment

## Barriers to the Implementation of Effective Wastewater Charges

Olmstead, S., Hanemann, W. & Stavins, R. 2003. Does Price structure matter? Household water demand under increasing-block and uniform prices. Research Gate Publication 228916287

PMG. 2013. The Municipal Systems Act booklet. Parliamentary Monitoring Group. <http://www.pmg.org.za/bills/municipalsystemsact.htm>

SALGA. 2011. Local Regulation Guideline: How municipalities can enhance local regulation of water services. South African Local Government Association August 2011.

Scheepers, R. and vd Merwe-Botha, M. 2013. Energy optimization considerations for wastewater treatment plants in South Africa – A realistic perspective. ReSource 15(1):56-58.

Shugart, C. and Alexander, I. 2009. Tariff Setting Guidelines: A Reduced Discretion Approach for Regulators of Water and Sanitation Services. World Bank. Working Paper no. 8, 2009

SOUTH AFRICA. 1996. The Constitution of the Republic of South Africa Act 108 of 1996. Pretoria: Government Printer. [www.info.gov.za/documents/constitution/1996/a108-96.pdf](http://www.info.gov.za/documents/constitution/1996/a108-96.pdf)

SOUTH AFRICA. 1998. The Local Government Municipal Structures Act 117 of 1998. Pretoria: Government Printer.

SOUTH AFRICA. 1998. The Water Services Act 36 of 1998. Pretoria: Government Printer.

SOUTH AFRICA. 1998. The National Water Act 108 of 1997. Pretoria: Government Printer.

StatsSA. 2011. Census 2011. Statistics South Africa

StatsSA. 2014. Financial Census of Municipalities. P9114. Statistics South Africa. [http://www.statssa.gov.za/?page\\_id=1854&PPN=P9114](http://www.statssa.gov.za/?page_id=1854&PPN=P9114)

UNDP/GEF. 2006. Best Practice in Water and Wastewater Tariff Setting: Lessons for Water Systems in Transition Economies.

## APPENDIX B: Questionnaire

### Questionnaire: Waste water charges by municipalities

The questions in this questionnaire apply only to waste water charges and do not include dry-site and non-waterborne sanitation services.

#### Section 1: General information

1.1 Municipality:	
1.2 Municipality code:	
1.3 Province:	

#### Section 2: Water consumption

2.1 What is the total water consumption in the municipality?  
(please state the units eg. Ml/annum)

--

2.2 Are all water users metered?

Yes

No

2.3 What type of meters are used in your municipality?

Post paid

Pre paid

Other

2.4 What is the percentage split between water used domestically and industrially?  
(eg. 70% domestic; 30% industrial)

Domestic	
Industrial	
Other (specify)	

#### Section 3: Waste water treatment

3.1 How many waste water treatment plants are there in your municipality?

--

3.2 What is the percentage split between influent received from domestic and industrial sources?

(eg. 90% domestic; 10% industrial)

Domestic	
Industrial	
'Tankers' or other sources of sewage	
Other (specify)	

Barriers to the Implementation of Effective Wastewater Charges

**3.3 What are the primary industrial effluents in your municipality?**

(eg. tannery waste, abbatoir waste, pulp mill waste)

**3.4 Do you monitor electricity consumed for waste water treatment? If yes, what is the total electricity consumption?**

(please state units eg. kWh/annum)

**3.5 Are there any plans for future expansion?**

(please describe them)

**3.6 Do you monitor effluent water quality?**

Yes

No

If yes: how far back (years) do the records go?

**3.7 If you answered yes to the previous question, who is the custodian of the data?**

**Section 4: Human capital**

**4.1 How many staff in total are responsible for waste water treatment?**

**4.2 Do you think that your municipality has an adequate number of technicians working in waste water treatment?**

(please elaborate if possible)

Yes

No

**4.3 Do you think that your municipality has an adequate number of supervisors or managers working in waste water treatment?**

(please elaborate if possible)

Yes

No

**4.4 What is the level of staff training?**

(please select the appropriate box, and elaborate if possible)

- Staff are highly trained
- Staff are adequately trained
- Staff are lacking training

**Section 5: Financials**

**5.1 Do you have a budget for waste water treatment?**

- Yes
- No

If yes, how far back (years) do the records go?

**5.2 If you answered yes to the previous question, who is the custodian of the data?**

**5.3 Can you provide us with a copy of the budget?**

(A copy, preferably in an MS Excel spreadsheet can be attached via email)

- Yes
- No

**5.4 Is the budget for waste water treatment separate or combined with water provision?**

- Combined
- Separate

**5.5 Are waste water treatment functions ring-fenced?**

- Yes
- No

**5.6 What was the total budget for waste water treatment in the last financial year?**

**5.7 Are there any costs associated to waste water treatment that are not accounted for or captured in the budget?**

(eg. shared services, depreciation, indirect costs)

**6.3 What are the domestic waste water tariffs?**

**6.4 What are the industrial waste water tariffs?**

(eg. is there a formula to determine the charge)

**6.5 How were these tariff structures developed?**

**6.6 Are tariffs reviewed annually?**

Yes

No

**6.7 Who is responsible for reviewing the tariffs?**

**6.8 Describe any subsidies that poor households receive**

**6.9 Do you implement any subsidies?**

(please select the appropriate box, and elaborate if possible)

Poor/Indigent households

To attract investment

Other

None

**6.10 Are there any incentives offered by the municipality?**

(please elaborate if possible)

Yes

No

**Section 7: The Waste Discharge Charge System**

**7.1 Are you aware of the Waste Discharge Charge System?**

Yes

No

**7.2 Do you consider the WDCS a risk to municipal revenue?**

(please elaborate if possible)

Yes

No

Don't know

**7.3 Has the municipality investigated what effect the WDCS will have?**

(please elaborate if possible)

Yes

No

**7.4 Are you familiar with the Resource Quality Objectives (RQOs) set by DWA for the rivers which your waste water treatment plants discharge into?**

(if yes, please elaborate)

Yes

No

## APPENDIX B: Municipal Assessment Template

Municipal Code	Municipality Name	Province	Population (n)	Households (n)	WSA Green Drop Score 2011 (%)	Treatment Capacity (MI/day)	Average Flow (MI/day)	Peak Flow (MI/day)	Domestic Influent (%)	Wastewater Budget (R millions)	Wastewater Expenditure (R millions)	Asset Register (Y/N)	Total Water Supplied (MI/annum)	Total Water Billed (R/annum)	Flush Toilet Access (%)	Piped Water Access (%)	Sanitation employees (n)
DC44	Alfred Nzo District municipality	Eastern Cape	801344	169262	36	7.126	1.466	4.9	2.76	92.98344	4.9	4.1	2466	2466	5.1	5.8	0
DC12	Amatole District municipality	Eastern Cape	892637	237775	56	18.65	15.78	36.0	41.584	98.39142	36.0	12.9	79194	40096	14.8	12.1	23
EC107	Baviaans	Eastern Cape	17761	4610	15	2.2	1.5	0.6	1.7	98.18182	0.6	0.6	620	449	73	70.4	7
EC102	Blue Crane Route	Eastern Cape	36002	9761	5	1.36	1.285	21.0	2.537	83.93382	21.0	18.1	62652	33841	68.8	51.4	0
BUF	Buffalo City Metropolitan	Eastern Cape	755200	223568	86	151.038	103.93	27.8	298.075	87.31445	27.8	23.6	6590	2620	82.1	55.1	0
EC101	Camdeboo	Eastern Cape	50993	12400	6	5.43	3.2	7.0	8	95.85635	7.0	6.4	6590	2620	82.1	55.1	0
DC13	Chris Hani District municipality	Eastern Cape	795462	210852	35	42.19	43.69	56.3	96	91.16852	56.3	34.2	6590	2620	31.2	23.4	0
EC103	Ikwezi	Eastern Cape	10537	2915	0	1.24	0.76	0.2	100	100	0.2	0.2	69	69	69	42.1	13
DC14	Joe Gqabi District Municipality	Eastern Cape	349768	97775	30	18.7	8.945	18.0	7.931	96.39037	18.0	20.7	5600	4700	23.8	17.6	30
EC108	Kouga	Eastern Cape	98558	29447	36	8.35	5.35	21.7	8.4	83.23353	21.7	7.7	5600	4700	64.9	60.4	0
EC109	Kou-Kamma	Eastern Cape	40663	11032	14	3.716	0.97	33.1	1.2556	99.28687	33.1	32.0	1256	1256	68	68.2	0
EC104	MaKana	Eastern Cape	80390	21388	49	8.4	8.9	4.4	0	100	4.4	3.5	2040	1580	71.9	49.8	63
EC105	Ndlambe	Eastern Cape	61176	19331	41	5.16	0	0	0	100	0	0	3368	3234	35.5	36.1	0
NMA	Nelson Mandela Bay Metropolitan	Eastern Cape	1152115	324292	81	195.18	153.11	83.0	315.71	66.74864	83.0	77.9	94036	56414	87.4	74.1	195
DC15	O. R. Tambo District municipality	Eastern Cape	1364943	298229	27	15.04	9.25	16	100	100	16	0	71832	68949	10.6	8.9	0
EC106	Sundays River Valley	Eastern Cape	54504	14749	6	5.05	4.955	0.7	100	100	0.7	0.0	10000	4000	53.5	32.3	0
FS192	Ditlhabeng	Free State	128704	38593	32	31.025	20.91	15.2	34.81	83.49718	15.2	11.1	4406	4000	74.2	43.8	0
FS162	Kopanong	Free State	49171	15643	1	8.33	0	0	0	93.9976	0	0	1896	1007	82.1	46.7	2
FS161	Letsemeng	Free State	38628	11242	0	3	0	0	0	100	0	0	100	100	72.8	49.8	0
FS205	MaFube	Free State	57876	16460	10	5.925	1.28	0	0	98.96203	1.28	8.1	1974	1371	77.2	39.8	0
FS194	Maluti a Phofung	Free State	335784	100228	54	33.23	18.5	32	92.89798	15.9	13.8	Y	35930	13990	30.3	31.9	0
MAN	Mangaung Metropolitan	Free State	747431	231921	39	110.9	107.7	25.5	140.3	92.28133	25.5	20.5	79086	39305	60.7	46.1	5
FS196	Mantsopa	Free State	51056	15170	20	0	0	0	0	0	0	0	5273	3060	67.5	33.2	0
FS181	Masifonyana	Free State	63334	17575	13	8.4	1.66	1.8	100	100	1.8	0	5273	3060	67.5	33.2	0
FS184	Matjhabeng	Free State	406461	123195	14	90.1	51	64.5	87.88013	66.0	31.0	Y	34305	21927	81.1	54.8	19
FS204	Metsimaholo	Free State	149108	45757	62	43.095	35.684	127.7	62.87272	127.7	124.9	Y	15060	12476	74	71.7	0
FS163	Mohokare	Free State	34146	10793	59	3.9	0	97	0	0	0	Y	0	0	70.5	37.2	0
FS201	Moqhaka	Free State	160332	45661	41	24	17.6	21	87.29167	0	0	Y	11745	8297	85.6	57.7	93
FS185	Nala	Free State	81220	21703	20	8.5	0	0	0	100	0.9	N	0	0	69.7	40.4	51
FS164	Naledi	Free State	24314	7690	5	4.365	0	1.4	0	100	1.4	Y	0	0	84.9	31.5	2
FS203	Ngwathe	Free State	120520	37102	46	20.85	11.2	2.8	79.71223	0	1.2	Y	8304	6240	74.5	44.7	1
FS193	Nketoana	Free State	60324	17318	0	10.96	0	0	95.89416	0	0	Y	0	0	61.1	28.2	1
FS195	Phumelela	Free State	47772	12888	5	0.9	0	19.7	0	100	0	Y	0	0	59.3	30.6	50
FS191	Setseto	Free State	112597	33687	22	17.4	14	16	93.62069	0	0	Y	8561	4264	56.6	31.4	0
FS182	Tokologo	Free State	28986	8698	0	6	0.9	0	100	0	0	N	0	0	18.5	22.7	43
FS183	Tswelopele	Free State	47625	11992	47	2.5	5.7	20.9	56	0	0	Y	2864	2405	76.8	31.9	0
JHB	City of Johannesburg Metropolitan	Gauteng	4434827	1434856	90	1033	964.11	1589.48	99	356.7	318.0	Y	502956	289415	87.1	64.7	85
TSH	City of Tshwane Metropolitan	Gauteng	2921488	911536	63	572.45	459.71	864.3	82.40007	308.5	298.7	Y	265845	195427	76.6	64.2	0
EKU	Ekurhuleni Municipality Metropolitan	Gauteng	3178470	1015465	80	623.5	680.72	1245.16	86.33569	220.2	172.4	Y	322250	193973	85	57.2	0
GT421	Emfuleni	Gauteng	721663	220135	67	172	224.2	232	90.16279	177.5	49.1	Y	79559	24121	88.2	69.9	5

Barriers to the Implementation of Effective Wastewater Charges

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			(n)	(n)														
GT423	Lesedi	Gauteng	99520	29668	70	13	13	11.4	96.30769	9.8	7.3	Y	5495	5041	84.3	52.3	0	
GT484	Merafong City	Gauteng	197520	66624	78	27	20.6	26.2	99.14815	9.0	3.8	Y	10289	5800	81	52.9	0	
GT482	Midvaal	Gauteng	95301	29965	82	12.3	14.6	23.6	43.08943	1.6	1.4	Y	12054	8896	58	64.9	0	
GT481	Mogale City	Gauteng	362422	117373	67	78.1	42.491	29.757	60.5493	8.2	8.7	Y	27257	19219	78.2	54.8	58	
GT482	Randfontein	Gauteng	149286	43299	80	19.5	14.5	25	70	33.6	29.6	Y	8740	6830	79.3	61.9	0	
GT483	Westonaria	Gauteng	111767	40101	57	22	18	0	99.5			N	6404	4500	58.6	42.2	0	
DC25	Amajuba District municipality	KwaZulu-Natal	499839	110963	59	5.5	1.952	4.841	94.54545	2.5	2.5	Y			46.1	43.1	0	
ETH	eThekweni Municipality Metropolitan	KwaZulu-Natal	3442361	95713	91	710.84	449.978	798.1	82.40138	273.2	238.0	Y			63.4	60.2	0	
DC29	iLembe District municipality	KwaZulu-Natal	606809	157692	80	39.35	22.3	32.05	74.68869	57.4	46.2	Y	21720	7852	22.5	23.7	0	
KZN252	Newcastle	KwaZulu-Natal	363236	84272	71	53.5	44.903	85.294	90.65421	16.8	14.4	Y	30807	13906	55.8	50	0	
DC43	Sisonke District municipality	KwaZulu-Natal	461420	112282	55	9.94	7.3595	10.6	100	37.9	39.7	Y			17.6	14.7	0	
KZN225	The Msunduzi	KwaZulu-Natal	618536	163993	79	60.2	76.96	140	90.03322	84.5	87.6	Y			51.6	47.9	70	
DC21	Ugu District municipality	KwaZulu-Natal	722484	179441	73	38.254	30.087	98.784	94.96785	25.1	23.0	Y	32093	16400	18.2	24.6	169	
DC22	uMhlabuthuze District municipality	KwaZulu-Natal	1017763	272669	74	15.8	11.678	32.4	85.12658	17.3	25.9	Y	58492	21653	42	42.7	1	
KZN282	uMhlabuthuze	KwaZulu-Natal	334459	86609	84	39.5	18.6	24.4	96.32911	7.8	9.7	Y	42558	31060	49.7	50.3	29	
DC27	Umhlangayade District municipality	KwaZulu-Natal	625846	128195	22	6.35	4.95	0	96.06299			Y			9.9	13.4	0	
DC24	Umzinyathi District municipality	KwaZulu-Natal	510839	113469	33	17.6	15.021	28.182	90.99432	12.0		Y	43890	14016	31.9	28.7	0	
DC23	Uthukela District municipality	KwaZulu-Natal	668847	147286	38	54.35	0.5	0	89.62109			Y	42558	31060	27.2	30.5	0	
DC28	Uthungulu District municipality	KwaZulu-Natal	907519	202977	50	4.005	0.8	0.92	100			Y	22109	5087	19.1	22.3	0	
DC26	Zululand District municipality	KwaZulu-Natal	803576	157748	52	0	0	0	0	0.9	0.7	Y	3330	1600	69.7	41.9	7	
LIM366	Bela-Bela	Limpopo	66500	18068	0	8	4.8	0	100			Y			26.6	23.3	0	
DC35	Capricorn District municipality	Limpopo	1261463	342836	46	6.48	8	8.5	97.19907			Y			6.3	9.3	0	
DC47	Greater Sekhukhune District Municipality	Limpopo	1076840	263802	21	19.74	3.6	4.45	75.37994			Y	5540	4044	39.5	31.4	7	
LIM362	Lephalale	Limpopo	115767	29880	20	10.7	4.1	6.1	100	0.4	0.4	Y	3000	2700	66.1	35.7	2	
LIM365	Modimolle	Limpopo	68513	17525	43	5.5	4.2	7.5	87.27273	32.0	12.0	Y	9202	5450	25.8	20.2	10	
LIM367	Mogalakwena	Limpopo	307682	79395	28	9	8	12	90	5.2	4.8	Y			61.4	41.6	17	
LIM364	Mookgopong	Limpopo	35640	9918	67	3	2.2	3.96	100			Y			15.8	16.8	0	
DC33	Mopani District municipality	Limpopo	1092507	296320	54	36.9	14.87	157.022	95.12195	0.4	0.3	N			41.1	33.7	47	
LIM354	Polokwane	Limpopo	628999	178001	67	47.7	36.671	73.072	93.39413	66.1	4.0	Y	33555	19524	63.1	47.3	18	
LIM361	Thabazimbi	Limpopo	85234	25080	52	8.3	7.46	9	86.62651	41.7	10.8	Y			13.9	15.4	1	
DC34	Vhembe District municipality	Limpopo	1294722	335276	16	32.024	32.365	37	81.38896			N			18.9	22.6	14	
MP301	Albert Luthuli	Mpumalanga	186010	47705	17	10.9	0.75	2.96	99.77064			Y			6.8	11.9	0	
MP325	Bushbuckridge	Mpumalanga	541248	134197	30	7.36	8.88	10.44	91.03261			N			74.9	38.2	0	
MP306	Dipaleseng	Mpumalanga	42390	12637	26	14	0	0	78.57143			N			6.8	11.9	0	
MP316	Dr JS Moroka	Mpumalanga	249705	62162	59	10.06	11.021	13.03	100			Y	23400	6336	13.3	14.2	4	
MP314	Emakhazeni	Mpumalanga	47216	13722	70	7.9	6.62	4.31	99.62025			Y	2600	1160	74.4	55	19	
MP312	Emalaheni	Mpumalanga	395466	119874	42	53.8	0	0	86.72305	33.7	21.4	Y	46620	19510	68.8	54.9	105	
MP307	Govan Mbeki	Mpumalanga	294538	83874	59	41.09	39.5	56.5	92.33716	157.6	158.6	N	22240	16617	88.9	56.5	0	
MP305	Lekwa	Mpumalanga	115662	31071	19	12.5	0	0	100			N			83.6	55.2	0	
MP322	Mbombela	Mpumalanga	588794	161773	87	56.53	24.099	53.76	80.31753	0.4	0.4	Y			28.4	37.1	0	

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			(n)	(n)														
MP302	Mkhondo	Mpumalanga	171982	37433	0	7	7.4	0	88.57143	1.0			Y			39.5	30.9	1
MP303	Msakhaligwa	Mpumalanga	149377	40932	7	17.825	0	0	94.34502				N	3751	2993	70.6	53	8
MP324	Nkomazi	Mpumalanga	390610	95509	47	4.515	1.15	2.3	100				Y			7.7	21	0
MP304	Prixley ka Seme	Mpumalanga	83235	19838	51	8.8	0	0	100				Y	3685	1850	62.5	38.9	0
MP313	Steve Tshwete	Mpumalanga	229831	64971	76	35.54	24.4	80.6	100		62.4	47.9	Y	15602	10326	81.9	62.2	6
MP321	Thaba Chweu	Mpumalanga	98387	33352	81	11	7.25	9.425	92.72727				Y	5540	2653	64.2	38.8	0
MP315	Thembsile	Mpumalanga	310458	75634	30	1.25	0.61	0.76	100							6.8	16.3	0
MP323	Umjindi	Mpumalanga	69577	20255	56	8.4	0	0	95	0.8			Y	3495	2657	59.6	42	11
MP311	Victor Khanye	Mpumalanga	75452	20548	29	13	13.116	12	84.61538				Y	5343	3983	70.6	48.4	25
NW403	City of Matlosana	North West	398676	120442	52	72.8	54.762	12	82.58242	116.5	15.0	N	28550	19390	92.8	50.1	11	
DC39	Dr Ruth S Mompoti District Municipality	North West	463815	125271	22	21.6	5.32	6.4	92.01389	3.4			N			32.2	18.6	0
NW374	Kgetlengrivier	North West	51049	14673	9	3.5	2.5	3.5	99.42857	0.8	0.8	Y				51.9	34.8	0
NW372	Local Municipality of Madiheng	North West	477381	160724	7	30	13.109	0	86	35.5	32.1	Y		7230	5060	27.2	22.2	0
NW404	Maquassi Hills	North West	77794	20505	17	8.2	9.38	0	95.91463	2.6			N	3560	5060	74.4	32.2	0
NW375	Moses Kotane	North West	242554	75193	35	9	4.4	4	86.66667				N	13280	6310	12.3	18.6	15
DC38	Ngaka Modiri Molema District Municipality	North West	842699	227002	28	42.5	18.3	24	95.58824				Y	17339	11852	28	25.2	0
NW373	Rustenburg	North West	549575	199044	76	52.9	41.06	63.83	92.06049	31.7	31.7	Y	35581	21697	52.7	35.8	0	
NW402	Tlokwe City Council	North West	162762	52537	97	45	30	55	80	22.2	22.2	Y	13366	12729	80.6	56.9	0	
NW401	Ventersdorp	North West	56702	14562	3	3	2.3	3	80				Y			40.3	20	0
NC084	!Kheis	Northern Cape	16637	4146	8	0	0	0	86				N			27	16.7	0
NC083	//Khara Hais	Northern Cape	93494	23245	36	16.8	14.097	1.966	85.71429	12.2	13.7	Y			68.3	56	0	
NC092	Dikgatlong	Northern Cape	46841	11967	16	4	3.7	6.8	92.5	4.3	4.3	Y			60	30.7	28	
NC073	Emthanjeni	Northern Cape	42356	10457	21	6	3.845	5.494	100	26.9	29.9	Y	2463	1982	79.6	59.8	21	
NC453	Gamagara	Northern Cape	41617	10808	16	9.088	3.733	10	100				Y	6215	4022	77.6	59.1	2
NC452	Ga-Segonyana	Northern Cape	93651	26816	66	4.43	2.583	0	100				Y	872	2236	23.4	19.9	0
NC065	Hantam	Northern Cape	21578	6340	22	3.56	0	0.5	97.37079				Y	686	53.7	53.7	59.8	17
NC451	Joe Morolong Local Municipality	Northern Cape	89530	23707	49	1.5	0	0	100	39.2	39.2	Y			6	9.1	1	
NC082	Kai Ikarib	Northern Cape	65869	16703	9	1.456	1.5	0	98	15.2	15.2	Y			59.6	41	0	
NC064	Kamiesberg	Northern Cape	10187	3143	7	1.35	0	0	100				Y			38.8	41.7	26
NC074	Kareeberg	Northern Cape	11673	3222	44	0.75	0.6701	1.1421	100	7.2	7.2	Y		367	367	55.6	41.5	0
NC066	Karoo-Hoogland	Northern Cape	12588	3842	0	0.88	0	0	96.02273	6.8	6.8	Y	803	656	39.4	59.8	0	
NC086	Kgatelopele	Northern Cape	18687	5381	67	0.72	0.537	0	100	1.5	1.5	Y			89.2	74.4	0	
NC067	Khfi-Ma	Northern Cape	12465	3796	14	0	0	0	100				N	485	485	69	45.5	5
NC093	Magareng	Northern Cape	24204	6120	30	2	2.4	2.4	100	1.1	1.1	Y			81.2	37	12	
NC081	Mier	Northern Cape	7003	1784	27	0	0.132	0	100				N			40.6	32.6	0
NC062	Nama Khoi	Northern Cape	47041	13193	38	8	0	0	98.75			Y	3470	1691	63.5	74.9	34	
NC094	Phokwane	Northern Cape	63000	17544	53	7.9	4.9	5	95.06329	32.9	32.9	Y			68.2	37.9	0	
NC075	Renoosterberg	Northern Cape	10978	2995	28	1.155	0.9	1.8	100	3.1	3.1	N	450	500	71.7	53.4	0	
NC061	Richtersveld	Northern Cape	11982	3543	28	0.3	0	0	90	1.5	1.5	Y	364	221	69.8	68.6	8	
NC078	Siyancuma	Northern Cape	37076	9578	0	1.84	0	0	99			Y			53.4	41.4	0	

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			(n)	(n)														
NC077	Siyathemba	Northern Cape	21591	5831	22	5.7	5.37	0	99.61404	16.8	16.8	Y	1611	1148	64.9	43.1	18	
NC091	Sol Plaatjie	Northern Cape	248041	60297	76	41.5	36.4	58.4	74.21687	15.0	15.0	Y	32602	14920	82.8	61.9	4	
NC076	Thebeli lile	Northern Cape	15701	4140	56	2.9	1.5	1.4	99.08621			Y	1354	968	60	33.5	0	
NC085	Tsantsabane	Northern Cape	35093	9839	38	4.8	3.9	14	90	8.8	8.8	Y			66.7	45.3	24	
NC071	Ubuntu	Northern Cape	18601	5129	0	7.3	0.92	0	100			Y			64.3	49.2	2	
NC072	Umsobomvu	Northern Cape	28376	7841	0	2.12	2.63	0	83.01887	12.4	12.4	N			68.7	45.1	0	
WC053	Beaufort West	Western Cape	49586	13089	85	4.799	2.494	4.474	98.08293			Y	2081	1354	83.2	81.3	0	
WC013	Bergivier	Western Cape	61897	16275	71	5.208	3.644	8.012	93.02035			N			72.3	83.5	0	
WC047	Bitou	Western Cape	49162	16645	97	9.65	4.389	16.76	100	15.0	15.0	Y			75.6	58.5	0	
WC025	Breede Valley	Western Cape	166825	42527	78	33.34	24.015	34.237	86.5027	17.3	17.3	Y	14833	10865	83.5	69.3	4	
WC033	Cape Agulhas	Western Cape	33038	10162	0	2.72	2.4	0.1	96.59926			Y	2227	1962	72	81.8	0	
WC012	Cederberg	Western Cape	49768	13513	62	6.12	4.342	0	100			Y	2611	1711	74.9	75.1	0	
CPT	City of Cape Town Metropolitan	Western Cape	3740026	1068573	87	735.126	593.1028	1193.471	92.2402	470.8	470.8	Y	331062	247788	88.2	75	146	
WC023	Drakenstein	Western Cape	251262	59774	74	37.582	32.859	67.444	72.93517	41.2	41.2	Y	15975	14852	90.2	80	0	
WC044	George	Western Cape	193672	53551	91	28.408	15.696	61.46	71.13489	667.5	667.5	Y	9725	6548	82	70.3	15	
WC042	Hessequa	Western Cape	52642	15873	54	8.214	4.88	0	98.96518	120.6	120.6	Y			80.7	81	47	
WC041	Kannaland	Western Cape	24767	6212	49	2.32	2.103	3.27	100	12.9	12.9	Y			71.1	76.4	12	
WC048	Knysna	Western Cape	68659	21893	56	8.73	7.059	10.725	100	11.7	11.7	Y	3640	2300	66.8	67.3	0	
WC051	Laiingsburg	Western Cape	8289	2408	56	1.7	0.54	0	95			Y	350	350	68.1	66.3	0	
WC026	Langeberg	Western Cape	97724	25125	43	13	8.23	10.53	82.30769	30.5	30.5	Y			83	80.3	4	
WC011	Matzikama	Western Cape	67147	18835	66	5.521	4.5316	6.474	93.77141	77.9	77.9	Y			62.1	72.1	1	
WC043	Mossel Bay	Western Cape	89430	28025	89	22.575	10.243	5.307	90.55592	8.8	8.8	Y	7183	5157	83.1	77.9	0	
WC045	Oudtshoorn	Western Cape	95933	21910	42	12.2	9.94	17	100	233.7	233.7	Y			77.2	74.5	18	
WC032	Overstrand	Western Cape	80432	28010	89	12.8	6.847	12.377	100	7.3	7.3	Y	8629	6262	67.8	75.8	0	
WC052	Prince Albert	Western Cape	13136	3578	68	0.83	0.78	0	100			Y	1180	636	63.6	69.7	0	
WC014	Saldanha Bay	Western Cape	99193	28835	40	15.38	9.85	13.76	96.74902	41.1	41.1	Y	12697	10815	92.5	80.2	1	
WC024	Stellenbosch	Western Cape	155733	43420	72	21.95	25.652	76.55	78.81549	16.5	16.5	N			87.1	72.4	0	
WC015	Swartland	Western Cape	113762	29324	73	8.955	8.383	8.84	87.15801	228.7	228.7	Y	5109	4436	77.3	80.6	2	
WC034	Swellendam	Western Cape	35916	10139	31	2.33	2.31	2.61	95.75107			Y	1556	1057	77.2	78.9	0	
WC031	Theewaterskloof	Western Cape	108790	28884	65	12.402	9.932	35.936	96.76665			Y	4983	3790	80.2	73.3	0	
WC022	Witzenberg	Western Cape	115946	27419	90	12.904	9.459	11.619	86.82579	23.6	23.6	Y			86.9	78.8	50	

## APPENDIX C: Summary of key wastewater related expenditure items for WSAs (Source: StatsSA, 2014).

Name	Employee related costs	Interest paid	Bad debts	Contracted services	Depreciation and amortisation	Repairs and maintenance	Other expenditure	Total expenditure
	R'000	R'000	R'000	R'000	R'000	R'000	R'001	R'002
Baviaans LM	1,110	-	-	-	-	97	106	1,313
Blue Crane Route LM	1,981	-	-	-	2,816	126	579	5,502
Buffalo City MM	118,022	6,987	37,857	-	98,095	23,221	48,279	332,461
Camdeboo LM	2,501	-	-	-	8,661	964	6,060	18,186
Emalahleni (EC) LM	2,079	-	1,219	-	-	53	1,712	5,063
Engcobo LM	487	-	-	-	-	-	-	487
Ikwezi LM	1,382	27	160	-	448	477	768	3,262
Inkwanca LM	2,375	-	-	-	-	801	334	3,510
Inxuba Yethemba LM	3,572	-	-	-	-	1,151	3,460	8,183
Joe Gqabi DM	2,032	-	1,522	-	-	-	30,687	34,241
Kou-Kamma LM	1,311	-	-	273	-	137	4,368	6,089
Kouga LM	11,562	2,013	-	-	-	4,230	19,802	37,607
Lukhanji LM	8,809	-	-	-	-	2,410	7,023	18,242
Makana LM	16,287	-	-	-	14,657	1,098	6,263	38,305
Mbashe LM	422	-	-	-	-	349	1	772
Ndlambe LM	4,751	-	-	-	-	367	3,285	8,403
Nelson Mandela Bay MM	107,361	27,783	32,898	26,184	12,644	67,852	8,752	325,028
Nggushwa LM	551	-	-	-	11,562	-	4	12,117
Sakhisizwe LM	1,765	-	-	-	-	169	4,476	6,410
Sundays River Valley LM	2,724	-	-	-	-	277	2,595	5,596
Tsolwana LM	1,732	-	-	-	-	298	802	2,832
Dihlabeng LM	12,261	-	54,802	-	-	1,169	11,385	79,617
Kopanong LM	5,275	-	2,448	-	-	1,832	1,820	11,375
Letsemeng LM	662	-	-	-	990	95	450	2,197

Barriers to the Implementation of Effective Wastewater Charges

Mangaung MM	81,717	21,741	-	2,765	36,188	14,113	666	157,190
Mantsopa LM	7,759	-	10,635	-	3,256	563	577	22,790
Masilonyana LM	1,520	-	-	-	-	145	2,250	3,915
Matjhabeng LM	33,948	-	-	-	16,837	16,131	13,600	80,516
Metsimaholo LM	8,671	-	25,478	-	-	1,725	3,375	39,249
Mohokare LM	8,239	103	2,036	-	-	42	14,149	24,569
Moghaka LM	12,035	-	-	-	50	1,805	931	14,821
Nala LM	11,397	-	-	7,653	7,956	380	18	27,404
Naledi (FS) LM	2,258	-	-	-	-	953	2,052	5,263
Ngwathe LM	7,663	-	-	-	-	2,538	7,466	17,667
Nketoana LM	546	-	749	-	7,208	-	32	8,535
Phumelela LM	6,163	-	-	64	2,138	8,049	591	17,005
Setsoho LM	11,144	290	12,034	1,919	492	2,711	1,384	29,974
Tokologo LM	3,291	-	-	3,051	-	-	2,227	8,569
Tswelopele LM	3,883	1,776	9,760	-	-	610	1,817	17,846
City of Johannesburg MM	185,747	3,255	11,454	23,000	74,185	26,399	279,444	603,484
City of Tshwane MM	146,998	61,707	146,596	51,404	51,954	97,132	82,368	638,159
Ekurhuleni MM	72,447	89,652	65,867	14,415	99,658	23,835	287,386	657,938
Emfuleni LM	24,649	-	-	22,920	93,173	28,848	169,224	338,814
Lesedi LM	4,641	-	-	-	-	2,295	8,486	15,422
Merafong City LM	7,323	-	10,941	-	-	-	2,310	20,574
Midvaal LM	20,046	-	-	10,662	14,971	3,715	927	50,321
Mogale City LM	22,503	35	-	13,113	68	6,560	17,591	59,870
Randfontein LM	8,418	52	-	9,448	-	1,804	7,455	27,177
Westonaria LM	6,208	-	-	-	-	847	7,541	14,596
Abaqulusi LM	12,547	-	-	-	5,887	1,003	8,127	27,564
City of uMhlatuze LM	44,544	6,448	-	36,208	33,934	-	51,443	172,577
Emnambithi/Ladysmith LM	-	-	-	-	33,628	-	-	33,628
eThekweni MM	415,172	42,708	126,497	147,076	201,092	204,870	30,911	1,168,395
Harry Gwala DM	5,884	-	-	-	-	158	310	30,128
Ilembe DM	4,242	-	-	5,865	-	2,073	34,143	46,323
Newcastle LM	1	-	14	-	6,002	35	16,368	22,420

Barriers to the Implementation of Effective Wastewater Charges

The Msunduzi LM	59,530	4,212	-	-	-	13,201	3,063	50,842	130,848
Ugu DM	48,917	6,439	-	-	750	17,769	2,709	251	76,835
Ulundi LM	3,879	-	-	-	-	-	659	153	4,691
Umgungundlovu DM	-	-	-	-	-	-	1,018	3,448	4,466
Umkhanyakude DM	2,129	-	-	-	-	-	-	-	2,129
Umgweni LM	1,969	85	-	-	-	-	481	2,654	5,189
Uthukela DM	-	-	-	-	-	-	-	14,199	14,199
Uthungulu DM	919	492	747	-	-	1,005	-	43,219	46,382
Zululand DM	2,495	-	13,140	72	-	29,701	606	28,775	74,789
Capricorn DM	-	-	-	-	-	312	-	-	312
Greater Giyani LM	1,683	-	-	-	-	-	-	-	1,683
Greater Letaba LM	498	-	-	-	-	-	-	15	513
Greater Tzaneen LM	5,764	-	-	275	-	-	105	393	6,537
Lephalale LM	7,058	7	-	150	-	4,026	2,657	200	14,098
Makhado LM	-	-	-	-	-	-	10	-	10
Modimolle LM	3,808	72	-	-	-	6,771	766	3,358	14,775
Mogalakwena LM	4,177	-	-	10,753	-	3,920	3,379	642	22,871
Mookgopong LM	2,435	-	-	-	-	-	-	1,431	3,866
Mopani DM	-	251	6,069	-	-	-	9,510	830	16,660
Polokwane LM	23,734	-	-	-	-	65,841	5,376	-	94,951
Thabazimbi LM	2,805	51	-	-	-	2,283	-	3,473	8,612
Albert Luthuli LM	2,071	-	-	88	-	-	170	130	2,459
Bushbuckridge LM	-	-	-	-	-	-	1,807	-	1,807
Dipaleseng LM	2,542	-	-	-	-	-	3,007	883	6,432
Dr JS Moroka LM	39,214	-	-	-	-	-	16,268	10,965	66,447
Emakhazeni LM	4,750	-	-	-	-	-	176	-	4,926
Emalahleni (MP) LM	11,398	225	-	-	-	110,790	5,826	7,751	135,990
Govan Mbeki LM	25,834	-	12,455	-	-	-	8,329	16,903	63,521
Lekwa LM	8,165	-	-	-	-	-	1,095	213	9,473
Mbombela LM	8,961	103	-	415	-	9,942	1,025	4	20,450
Mkhondo LM	1,440	-	-	-	-	-	974	3,225	5,639
Msukaligwa LM	18,638	-	-	13,151	-	-	1,375	6,726	39,890
Nkomazi LM	892	-	-	-	-	201	3,424	16,021	20,538
Pixley Ka Seme LM	4,240	-	-	-	-	2,512	402	36	7,190

Barriers to the Implementation of Effective Wastewater Charges

Steve Tshwete LM	23,965	1,271	557	389	12,471	3,791	22,343	64,861
Thaba Chweu LM	1,094	-	-	-	-	363	205	1,662
Thembisile LM	4,074	-	-	-	-	1,562	47	5,683
Umjindi LM	1,819	187	-	-	-	193	595	2,794
Victor Khanye LM	7,762	145	1,106	-	10,325	4,947	3,369	27,654
City of Matlosana LM	28,870	1,586	-	75	36,818	4,229	32,728	104,306
Ditsobotla LM	7,676	-	-	-	-	228	1,955	9,859
Greater Taung LM	3,361	-	-	7	-	796	418	4,582
Kgetlengrivier LM	3,241	-	-	-	785	4,394	599	9,019
Lekwa-Teemane LM	9,813	-	-	-	8	652	13,746	24,219
Madibeng LM	13,174	-	-	-	-	2,692	616	16,482
Mafikeng LM	9,246	2,090	-	-	-	2,774	2,465	16,575
Mamusa LM	5,239	-	8,569	-	-	1,262	247	15,317
Maquassi Hills LM	5,384	-	-	-	-	1,140	1,380	7,904
Moses Kotane LM	738	-	1,475	329	1,917	1,169	623	6,251
Naledi (NW) LM	4,938	-	2,562	1,710	-	164	970	10,344
Ramotshere Moiloa LM	9,738	-	-	-	-	40	3,000	12,778
Rustenburg LM	8,049	1,127	-	79,367	48,057	19,260	1,067	156,927
Tlokwe LM	8,538	-	-	-	9,813	3,715	2,674	24,740
Tswaing LM	3,371	-	-	-	94	328	107	3,900
Ventersdorp LM	1,402	-	-	-	-	772	281	2,455
!Kai !Garib LM	16,745	-	-	-	-	-	759	17,504
!Kheis LM	-	-	11,004	-	-	-	-	11,004
Khara Hais LM	10,488	-	-	3,902	-	49	1,096	15,535
Dikgatlong LM	4,498	-	-	-	-	83	1,133	5,714
Emthanjeni LM	2,798	43	-	-	12,067	461	1,429	16,798
Ga-Segonyana LM	2,277	1	-	-	41	792	207	3,318
Gamagara LM	3,505	747	-	-	-	-	7,183	11,435
Hantam LM	-	-	-	-	-	-	2,442	2,442
Joe Morolong LM	-	-	-	-	-	-	6,759	6,759
Kamiesberg LM	-	-	-	-	1,339	-	1,234	2,573
Kareeberg LM	1,192	-	-	47	911	86	590	2,826
Karoo Hoogland LM	2,455	-	-	-	995	557	1,227	5,234

Barriers to the Implementation of Effective Wastewater Charges

Kgatelopele LM	2,181	-	-	-	-	-	-	-	705	101	2,987
Khâi-Ma LM	455	-	603	-	-	84	-	-	4	1,742	2,888
Magareng LM	-	-	977	-	-	-	-	-	-	3,734	4,711
Mier LM	764	-	-	-	-	-	-	-	68	2,725	3,557
Nama Khoi LM	4,790	381	-	-	-	-	-	-	628	305	6,104
Phokwane LM	2,533	-	12,305	-	5,533	-	-	-	587	3,314	24,272
Renosterberg LM	-	-	-	-	-	-	-	-	-	5,066	5,066
Richtersveld LM	968	-	-	-	-	373	-	-	394	376	2,111
Siyancuma LM	4,681	90	-	-	-	-	-	-	-	2,259	7,030
Siyathemba LM	3,487	-	-	-	-	-	-	-	247	432	4,166
Sol Plaatjie LM	27,096	1,701	-	-	-	-	-	-	8,853	10,524	48,174
Thembellhe LM	733	-	-	-	-	-	-	-	11	201	945
Tsantsabane LM	3,244	-	-	-	-	-	-	-	390	590	4,224
Ubuntu LM	2,833	69	-	-	-	-	-	-	270	3,471	6,643
Umsobomvu LM	2,696	180	-	-	-	2,842	-	-	106	451	6,275
Beaufort West LM	3,233	178	-	-	-	1,176	-	-	389	3,430	8,406
Bergrivier LM	2,517	700	94	-	-	1,746	-	-	311	5,944	11,312
Bitou LM	2,524	1,103	2,196	-	-	2,375	-	-	886	3,412	12,497
Breede Valley LM	49,481	13,792	-	-	-	4,451	-	-	6,502	3,021	77,247
Cape Agulhas LM	3,600	-	-	-	-	-	-	-	694	3,362	7,656
Cederberg LM	4,843	378	625	-	-	-	-	-	-	6,053	11,899
City of Cape Town MM	873,744	36,259	190,300	353,963	254,893	215,249	285,817	2,249,155	215,249	285,817	2,249,155
Drakenstein LM	18,796	13,193	5,516	860	17,931	6,471	4,791	67,558	6,471	4,791	67,558
George LM	21,624	5,199	3,843	-	15,825	21,195	2,740	70,426	21,195	2,740	70,426
Hessequa LM	6,496	764	310	-	4,702	936	2,283	15,492	936	2,283	15,492
Kannaland LM	1,813	198	1,153	-	1,810	-	75	5,049	-	75	5,049
Knysna LM	13,306	2,448	2,625	1,001	6,621	5,572	18,950	50,523	5,572	18,950	50,523
Laingsburg LM	270	-	71	-	713	-	100	1,154	-	100	1,154
Langeberg LM	5,433	1,511	971	-	1,018	1,217	1,850	12,001	1,217	1,850	12,001
Matzikama LM	3,384	1,675	-	246	3,387	736	6,439	15,867	736	6,439	15,867
Mossel Bay LM	12,741	-	-	3,946	1,613	5,406	14,276	37,998	5,406	14,276	37,998
Oudtshoorn LM	8,091	-	910	-	81	830	1,857	11,769	830	1,857	11,769
Overstrand LM	16,506	5,826	-	7,287	15,934	1,167	16,844	64,659	1,167	16,844	64,659
Prince Albert LM	798	-	1,625	-	499	121	822	3,865	121	822	3,865

Barriers to the Implementation of Effective Wastewater Charges

Saldanha Bay LM	12,941	1,164	5,102	-	12,694	2,451	10,193	44,545
Stellenbosch LM	25,606	3,872	870	434	22,599	-	15,036	68,426
Swartland LM	5,083	12,114	-	-	1,495	1,771	11,501	31,964
Swellendam LM	2,880	-	-	-	52	775	1,611	5,318
Theewaterskloof LM	6,181	1,698	-	-	1,277	2,875	9,405	21,436
Witzenberg LM	9,062	783	5,490	411	2,811	2,247	2,010	22,816
Total for all municipalities	3,165,427	388,987	846,237	861,181	1,621,467	977,292	2,015,924	9,986,721
%	31.70%	3.90%	8.47%	8.62%	16.24%	9.79%	20.19%	100.00%
Total for all metro municipalities	2,001,208	290,092	611,469	618,807	828,709	672,671		
%	32.64%	4.73%	9.97%	10.09%	13.51%	10.97%		
Total for all local municipalities	1,164,219	98,895	234,768	242,374	792,758	304,621		
%	30.20%	2.57%	6.09%	6.29%	20.56%	7.90%		

## APPENDIX D: National Workshop

### Workshop Format and Objectives

The intention of the workshop was to provide an opportunity for the project team to engage with sector stakeholders to discuss matters relating to the setting of appropriate wastewater treatment charges. The workshop was managed as a round table discussion and strategic planning session with the purpose of gaining insights from various experts on the barriers to implementation of effective wastewater charges. The outputs of the workshop are intended as inputs into the development of best practice guideline for Water Service Authorities, and will also be used to inform policy positions.

<p style="text-align: center;"><b>WORKSHOP ON EFFECTIVE WASTEWATER CHARGES</b> <b>Thursday, February 5, 2015</b> <b>VENUE: PRETORIA, STONE CRADLE (20 minutes from OR Tambo)</b></p> <p>8:30 REGISTRATION 9:00 WELCOME - WATER RESEARCH COMMISSION 9:10 INTRODUCTION AND PURPOSE – MS BRIGITTE MABANDLA AND FACILITATOR 9:20 BACKGROUND PRESENTATION – RESEARCH TEAM FROM PRIME AFRICA 10:00 COMMENTS AND QUESTIONS FOR CLARIFICATION – FACILITATOR 10:30 TEA BREAK 11:00 FACILITATED ROUND TABLE DISCUSSION 13:00 LUNCH 14:00 STRATEGIC PLANNING DISCUSSION</p>
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The workshop is the 3<sup>rd</sup> step in the analysis phase of this project that has thus far outlined a range of preliminary findings based on water services sector literature and data that was made available to the project team.

*Selection of Panellists:* Workshop panellists were selected based on their occupational relation to the wastewater treatment and water services sector. Water services manager from each of the WSAs were the primary target market for attendance at the workshop. Communication with the WSAs was facilitated through the SALGA head office in Pretoria, with the assistance of Mr William Moraka. Mr Moraka made available a contact list of key individuals from the WSAs and other organization available to the project team. In addition Mr Moraka advised the project by specifying a key set of individuals who he stated as being “the key decision makers” in the sector.

*Invitation and attendance confirmation:* The process to set up the workshop was intensive, with due care being taken to ensure that all relevant individuals were contacted. The process to set up the workshop was initiated at the end of August 2014, following the submission of the second project deliverable. The original date for the workshop was set for late November 2014; however the workload associated with year-end work cycles meant that the response rate to the initial workshop invitation was low. The decision was taken, with the support of the WRC Research manager, Dr Nonhlanhla Kalebaila, to move the workshop to early in 2015. The eventual date for the workshop was set as the 5<sup>th</sup> February 2015.

A total of 176 persons were invited to attend the workshop. Invitations to the workshop were sent out in phases. The initial invitational phase consisted of e-mails sent to the key individuals identified. Proceeding phases consisted of additional e-mail based invitation as well as personal phone calls to the individuals WSAs, associated organizations and key individuals. A total of 37 persons confirmed that they would attend the workshop, with a total of 24 persons attending the workshop on the day.

## Summary of Workshop Presentation

The project team presented the preliminary project finding to the workshop panellists. The presentation was compiled based on the preliminary findings for the project thus far. The key points of the presentation are summarized here:

*The background to the project was outlined:*

- Sector defined by lack of, or outdated, charge structures.
- Only 56% of WSAs have charge structure published in municipal bylaws.
- **Sources of data:**
  - *Municipal bylaws (84 WSAs)*
  - *Green Drop data (DWS. 2011; 2013) – Database*
  - *Water consumption (DWS. Various)*
  - *Municipal statistics (StatsSA, Various)*
  - *Municipal budgets (National Treasury)*
  - *Expert interviews*

*Cost estimations for Wastewater Treatment were outlined:*

- Estimated cost of water treatment in South Africa = R5.3 billion / a
- **Cost Modelling Considerations:**
  - *(1) Cost of the plant, Plant lifespan (Depreciation...), Operation, Maintenance and Repair costs.*
  - *(2) Technology of the plant, Design capacity, Average daily flow, Peak daily flow.*
  - *(3) Facility OMR budget per plant, Facility OMR actual expenditures.*
  - *(4) Domestic and industrial influence split.*

*Revenue potential for the provision of sewerage based sanitation was outlined:*

- The estimated revenue potential of piped sewerage services in South Africa = R 4.3 billion / a
- **Approach to revenue estimation:**
  - *(1) Tariff Method: Classified WSAs according to their tariff “method”*
  - *(2) System Input Volumes /or/ Property Size/Value*
  - *(3) Accounting for HH with sewerage access*
  - *(4) Accounting for subsidized HH*

Upon completion of the presentation the workshop moved into the “Roundtable Discussion” and “Strategic Planning” sessions. The proceeding chapters of this workshop report illustrates that outputs that were generated by the workshop panellists on the day.

## Outputs of the National Workshop

The workshop proceeded through 3 distinct phases:

1. *Introduction and Information Dissemination:* An Introduction to the workshop was provided by Mrs Bridgette Mabandla, who acted as the facilitator for the proceedings. A short presentation was made by the Prime Africa project research team, outlining the objectives and preliminary findings for the study.
2. *Roundtable Discussion Session:* The roundtable discussion session to the form of a “Theory of Constraints” exercise whereby panellists were taken through a rigorous process of constraint identification for matters related to the setting of wastewater charges in South Africa.
3. *Strategic Planning Session:* This strategic planning session built on the outputs generated in the roundtable discussion. The roundtable discussion was focused on the identifications of the constraints, the strategic planning session focused on properly defining the constraints and discussing, at a strategic level, possible solutions and ways forward.



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