

Water conservation strategies at Gauteng municipalities

Obby Masia and Dr Louwrence Erasmus

Water conservation is becoming an increasingly urgent practice as the earth's water resources are depleting and so much of it is wasted. A study was done on the water management strategies and practices of the municipalities in Gauteng to determine how effective these are.

The water situation is so dire that government should not only focus on water conservation, but also on water demand management.

The status quo

The provision of water services is the responsibility of a water services authority (WSA), which comprises local, district and metropolitan municipalities. The Water Services Act (Act 108 of 1997) defines a water services provider (WSP) as an institution that is responsible for the operation of the water works that supplies water services to the end consumers (South Africa, 1999).

Mogale City and Emfuleni are the two local municipalities in Gauteng that consume the most water. Among the metropolitan municipalities, the City of Johannesburg (CoJ), Ekurhuleni Metropolitan Municipality (EMM), and the City of Tshwane (CoT) consume about 85% of the municipal water supplied by Rand Water from the Vaal River System (Table 1). They have each developed a water conservation or demand management (WC/WDM) strategy in order to reduce demand by 15%, as set by national government.

Water loss or non-revenue water (NRW) is between 30% and 40% for the Gauteng metropolitan authorities and in South Africa as a whole.

The non-revenue water – the free basic water (FBW) municipalities supply to households and the water supplied to indigents – for Ekurhuleni was 39.9% (EMM Water Balance, 2011) or 128 848 350 kℓ/annum for the 2009/10 financial year. The total bulk water purchased from Rand Water was 322 821 747 kℓ/annum. The NRW for CoJ was 37.7% (CoJ Water Balance, 2012). The national average NRW for all South African municipalities is 37%, and 36% for Gauteng municipalities.

Smart metering technology

Smart metering technology can be broadly categorised according to the level of sophistication as follows:

- Automated meter reading (AMR)
- Automated meter management (AMM)
- Interval metering with automated meter management (AMM-IM)
- Prepayment meters (PPM)
- Advanced metering infrastructure (AMI)

→ Table 1: Rand Water bulk supply to municipalities with potential savings

Rand water area of supply	2008/09 annual demand (mm ³ /annum)	2008/09 non-revenue water (mm ³ /annum)	2005/06 target savings (mm ³ /annum)
Johannesburg	503	161	110.2
Ekurhuleni	327	124	28.3
Tshwane	214	62	20.4
Emfuleni	77	32	26.1
Rustenburg	28	9.8	3.1
Mogale City	26	7.1	1.7
Govan Mbeki	20	5.9	1.5
Matjhabeng	19	6.6	4.3
Randfontein	9	2.6	0.4
TOTAL	1 223	411	196

(Source: EMM WC/WDM, 2010)

Conceptual model

The ISO 50001 follows the Plan-Do-Check-Act process for the continual improvement of the water management system. This process can be explained as follows:

- Plan: conduct the water review and establish the baseline
- Do: implement the water management plans
- Check: monitor and measure processes and key characteristics of operations that determine the water performance against the water policy and objectives and report the results
- Act: take action to continually improve the water management systems

Water conservation and water demand management are ongoing processes that need to be planned properly, implemented and checked. Corrective actions should be taken to improve performance. The ISO 50001 follows other ISO standards, such as ISO 9000 and ISO 14000. The ISO 50001 principles were used as basis for testing this hypothesis.

The survey

In the study, it was established whether these municipalities' water conservation or water demand management strategies are being implemented successfully or result in the reduction of non-revenue water. The intention was also to determine whether smart meter technology is used in the implementation of WC/WDM strategies. Structured questionnaires were used to elicit the required information from managers and engineers at the relevant municipalities.

The majority of participants were from the Capital Expenditure sections in the municipalities – they are involved in the planning and implementation of water projects – while 32% were employees involved in operations and the maintenance of water infrastructure.

Respondents were asked to rank the biggest challenges facing the water industry. The biggest challenge was water scarcity, followed by demand management and conservation issues.

The cities of Johannesburg, Ekurhuleni and Tshwane have each developed a WC/WDM strategy. A percentage of 88% of the participants in the survey indicated that their municipality had a WC/WDM strategy based on legislation like the Water Services Act.

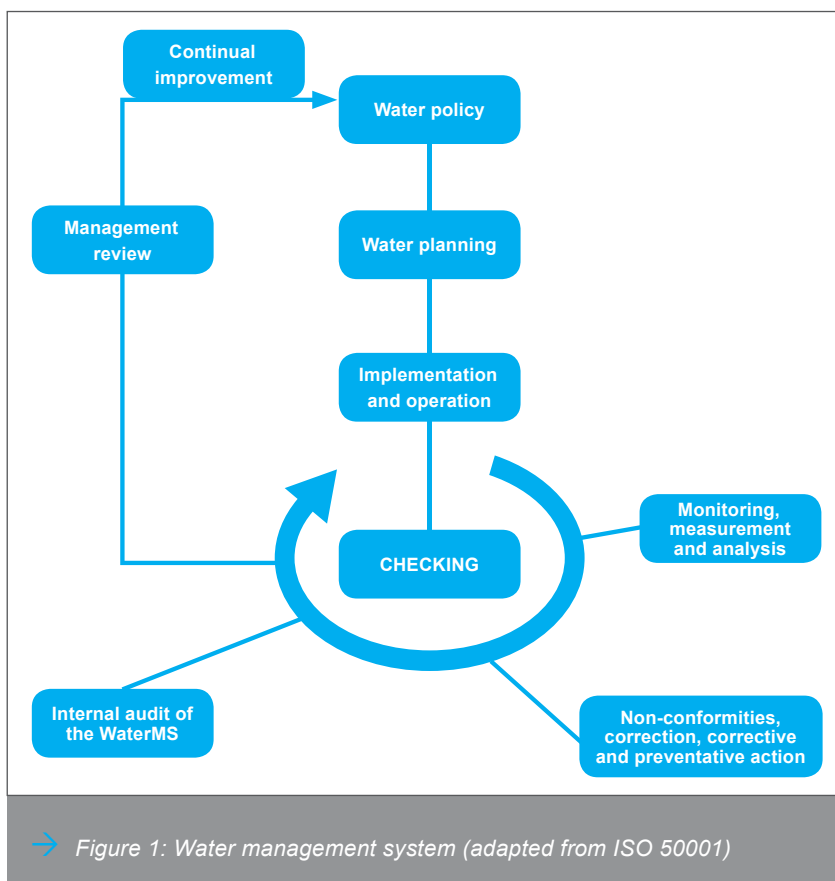
Furthermore, 86% of respondents indicated that their municipality had a section dedicated to WC/WDM, although only 71% indicated that the action plans of the WC/WDMs were being implemented. Only 73% said that a budget had been allocated for implementation.

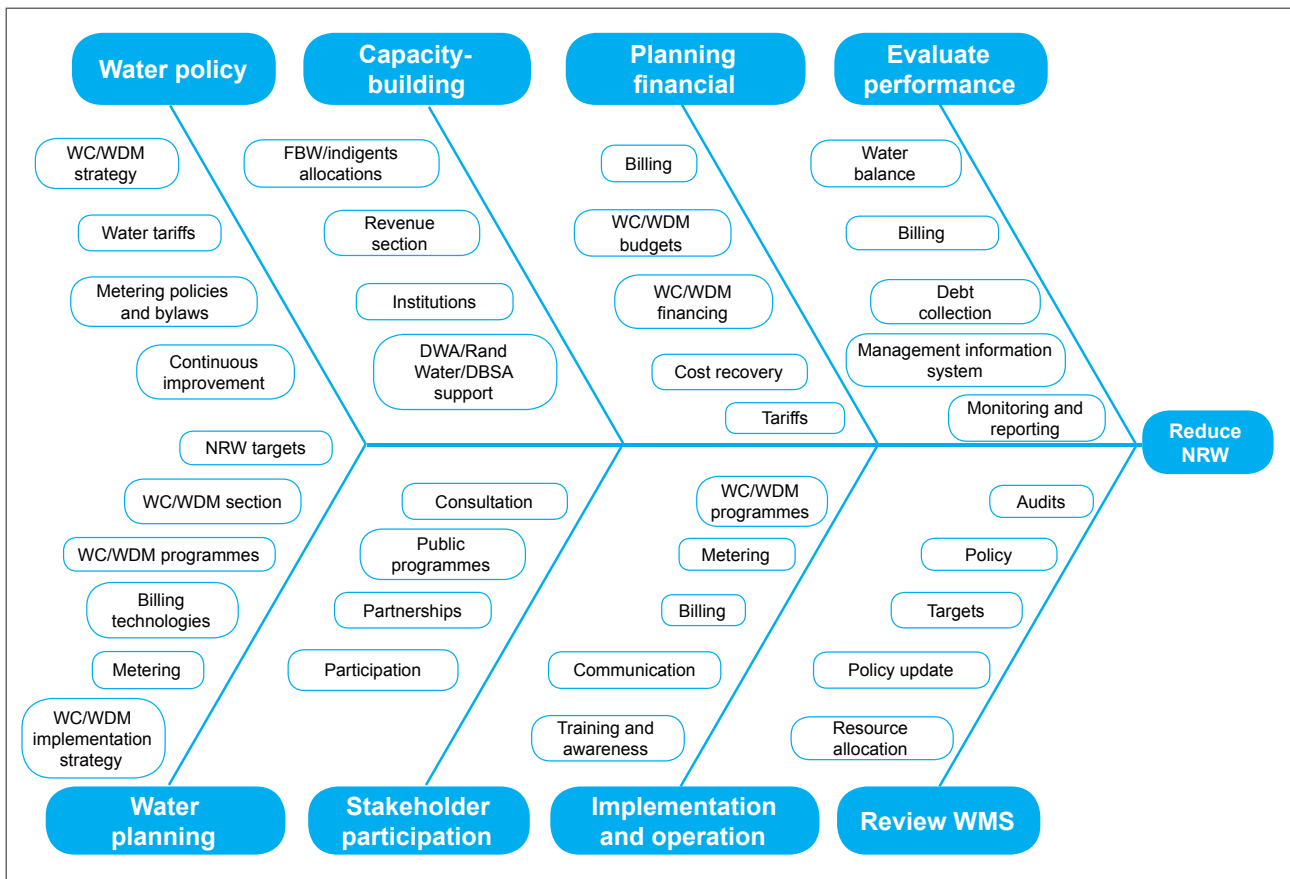
The majority of participants indicated that their municipality actively promoted water conservation. With regard to finances, less than half of respondents indicated that there was an adequate budget for operations and the maintenance of the WC/WDM infrastructure.

Some 68% of participants said provision was made for training – the implication of this is that the municipalities will be able to deal with the implementation of new metering technologies.

Meter reading and billing is the core function of a water utility, and only 46% of respondents indicated that meters were read on a monthly basis. This raises concern, as NRW cannot be reduced, due to a lack of information. It was further disconcerting that approximately half of the participants said they did not have detailed information on water leaks in households. Furthermore, only 41% indicated that they were able to manage the allocation and consumption of free water.

However, 66% of respondents said they were running educational programmes in schools to try and limit NRW, and 73% indicated that they had water-wise or similar programmes in communities. Some 78% of respondents indicated that advertising or media campaigns were used to reach the community at large and encourage them to conserve water.





→ Figure 2: Cause-and-effect diagram for the water management system

With regard to maintenance, only 66% of participants had leak detection programmes. Although 83% indicated that they performed pressure management, the amount of water lost due to leaks does not confirm this. Because the water infrastructure is 50 to 100 years old, water mains replacement programmes are vital. The majority of respondents indicated that these programmes were in place.

Residential users constitute the majority of customers for the municipalities and have to be metered in order to recover revenue. Some 66% of participants indicated that there were adequate meters for residential customers. Furthermore, 71% said there were adequate meters for industrial customers. Only 54% of respondents indicated that there were enough meters for municipal buildings and it was indicated that only 25% of municipal irrigation was metered.

The types of meters used are an important aspect. A total of 34% of respondents indicated that automatic

meter reading was used, 59% said prepaid meters were used and 22% indicated using smart meters. There is little information on customer interest in smart meters, as well as on customers using smart meters.

Respondents were asked about their primary motivation for implementing smart meters. Most indicated that it was for efficient billing, followed by assisting households to be more aware of the quantity of water they use, and alleviating pressure on a limited resource.

Municipalities' major concerns regarding smart meters are the reliability of the technology, capital costs, operating costs, security, customer engagement and compatibility between the new and existing systems. The major benefits of smart meters were seen as enabling early leak detection, supplying customers with tools to reduce and monitor water use, and providing more accurate rates.

Findings

This study dealt with water conservation/water demand management at large, with the emphasis on smart metering technology. The non-revenue water at Gauteng municipalities remains at 36% to 40%, which is unsustainable.

According to the survey results, the municipalities have WC/WDM strategies in place, but it seems that they are not being implemented or only on a small scale. There are no dedicated sections responsible for WC/WDM at most of the municipalities, and separate budgets to implement WC/WDM have not been allocated. The dedicated WC/WDM sections can be used to coordinate all the activities that are currently being performed by different sections.

Although participants indicated that their municipalities actively promoted water conservation, it can be assumed to be ineffective, as the NRW remains high.

Households consume most of the water supplied by municipalities, and consumer education campaigns should be intensified. The top industrial customers need to be prioritised, as they can easily buy into water-saving programmes. Leak detection, pressure management and mains replacement are major activities that should form part of the daily operations of municipalities. Consumer metering should also be intensified to determine reliable water balance calculations. Tariff structures and billing procedures are in place at most municipalities, but their implementation might be a problem due to it being done by finance departments, which are run separately from the water departments. Prepaid metering is currently in use in Johannesburg, and the other municipalities need to follow suit to manage water consumption by households.

Prepaid metering, automatic meter reading (AMR) and some smart metering technologies are already in use in Gauteng. This indicates some potential for growth in the use of smart metering technology. The billing of water use is crucial to ensure a reduced demand for water. If customers are not billed correctly for water use, they will continue to abuse the scarce resource and lose trust in the municipalities. Smart metering technology and metering technology in general can be used to reduce apparent or commercial losses.

The way forward

Rand Water, municipalities and the Department of Water Affairs (DWA) need to conduct further research on the use of appropriate WC/WDM strategies for the Gauteng water supply. A standard approach should be introduced to all the municipal Vaal River System users. Municipalities and their customers should start taking WC/WDM seriously and work together in order to reduce the NRW. The DWA should put policies and strategies in place that will support municipalities in water loss programmes. Special attention should be given to research on the water demand and supply in Gauteng

because of its huge economic activities. The municipalities need to invest in updated billing technology and advanced metering in order to reduce NRW.

A common approach towards implementing WC/WDM is needed for all the municipalities and it should become compulsory. The stakeholders need to share resources and knowledge on WC/WDM planning and implementation. The DWA needs to consolidate the overall implementation of water demand reduction strategies, so that correct measurements can be taken on the entire system. Currently, each municipality is conducting its own operations and these do not necessarily focus on reducing NRW. It is the responsibility of government to provide its citizens with sufficient and efficient water resources.

The municipalities do not seem to have technology acquisition and management strategies for metering technology. The role of consulting engineers in the acquisition and management of metering technology in South African municipalities should be researched. Furthermore, research should be conducted on the use of system engineering in WC/WDM management programmes due to a lack of operations and maintenance of water infrastructure. The adoption and implementation of billing systems in municipalities also require further research.

Prepaid metering should be more widely adopted by municipalities and smart metering technology developments should be monitored by government for future consideration. Government needs to consider the standardisation of smart metering communication technologies the same way it was done in Europe. This will assist smart metering technology developers, producers and utilities to have a common direction towards the implementation of smart metering technologies in South Africa. A huge amount of research is currently being done on advanced metering infrastructure across the world, and the local industry needs to monitor these developments closely. 📌

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About the authors



Dr Louwrence Erasmus is associated with the Graduate School of Technology Management. He is a registered professional engineer and an advisory board member of Third Circle Asset Management. He currently works as a principal systems engineer at the CSIR.

Mr Obby Masia completed his master's degree at the Graduate School for Technology Management in 2012. He is an engineer, specialising in water management at the Ekurhuleni Metropolitan Municipality.