

6th REGIONAL AFRICAN WATER LEAKAGE SUMMIT 2016
 Assessment of Apparent Water Losses due to metering inaccuracies
 Mthokozisi Ncube

DBSA VULINDLELA AUDITORIUM, MIDRAND
 GAUTENG, SOUTH AFRICA
 23 - 24 August 2016

Participating and supporting organisations:

Overview

- Introduction
- Consumption Patterns and On-site Leakage
- Meter Testing Results
- Metering Error
- Key Takeaways

Introduction

DEPARTMENT OF WATER AND SANITATION
 16 AUGUST 2009

INTEGRATED RIVER WATER SYSTEM - LIMITING THE USE OF WATER IN TERMS OF ITEM 4 OF SCHEDULE 2 OF THE NATIONAL WATER ACT OF 1998 FOR URBAN AND INDUSTRIAL PURPOSES IN THE EXHAUSTED AREAS OF THE DAMS SUPPLYING THE INTEGRATED RIVER WATER SYSTEM AND FROM THE OVERFLOW

1. Matter: In my capacity as Acting Director-General of the Department of Water and Sanitation, I have given preference to the recommendations of the Auditor-General of the Republic of South Africa (AGSA) in my report on the audit of the Department of Water and Sanitation's financial statements for the year ended 30 June 2008. I have found that the Department of Water and Sanitation has not taken sufficient steps to ensure that the water supply system is not overburdened by the release of water from the major dams and is taken from the integrated river flow system.

The Minister of Water and Sanitation may in terms of item 4 (1) of Schedule 2 of the National Water Act of 1998 (NWA) limit the use of water in the area concerned if the Minister is reasonably satisfied that a water shortage exists within the area concerned. This power has been delegated to me in terms of section 2(1)(c) of the Act.

Therefore in my capacity as the Director-General of the Department of Water and Sanitation, I hereby order that the use of water in the area concerned shall be limited to the following:

- 10% of consumption on urban water use in the abovementioned areas;
- 20% of consumption on industrial water use in the abovementioned areas;
- The balance required from the area of the release and further release.

In exercising the powers, I have given preference to the recommendations of the Auditor-General of the Republic of South Africa (AGSA) in my report on the audit of the Department of Water and Sanitation's financial statements for the year ended 30 June 2008. I have found that the Department of Water and Sanitation has not taken sufficient steps to ensure that the water supply system is not overburdened by the release of water from the major dams and is taken from the integrated river flow system.

Nothing in this order shall be construed as affecting the rights of the public as contemplated in section 4 of the Promotion of Access to Information Act of 2000 (PAIA), which have been exercised in connection with the release of this information to the public. I have decided that it is reasonable and justifiable in the circumstances to release this information to the public in terms of section 32(1)(b) of the Constitution of the Republic of South Africa of 1996.

This order overrules any other previous authorisation or water restrictions issued by the Department relating to this area.

ACTING DIRECTOR-GENERAL
 DATE: 16/08/2009

Introduction

System Input Volume, m ³ /yr	Authorised Consumption, m ³ /yr	Billed Authorised Consumption	Billed Metered Consumption (including water export)	Revenue Water, m ³ /yr
			Billed Unmetered Consumption	
		Unbilled Authorised Consumption	Unbilled Metered Consumption	
			Unbilled Unmetered Consumption	
			Unauthorized Consumption	
			Metering Inaccuracies	
Water Losses, m ³ /yr	Real Losses	Apparent Losses	Leakage on Transmission and/or Distribution Mains	Non Revenue Water, m ³ /yr
			Leakage and Overflow at Utility's Storage Tanks	
			Leakage on Service Connectors up to point of Customer metering	

Introduction

TABLE 3
Suggested apparent loss percentages for a typical system

Illegal connections	Meter age and accuracy			Data transfer		
		Good water quality	Poor water quality			
Very high	10%	Poor > 10 years	8%	10%	Poor	8%
High	8%					
Average	6%	Average 5- 10 years	4%	8%	Average	5%
Low	4%					
Very low	2%	Good < 5 years	2%	4%	Good	2%

Seago et al. (2004) Benchmarking leakage from water distribution systems in South Africa. Water SA (30) 5

Introduction

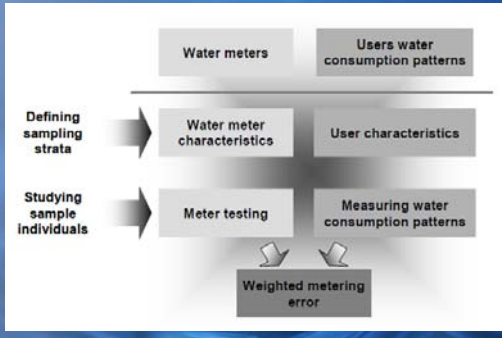
Table 1 Proposed default values for apparent losses for developing countries

Unauthorized use of water	Meter age and error			Meter reading, data handling and billing errors
	With storage tanks	Direct supply		
City (> 100,000 service connections)	10%	Poor (> 10 years) - 28%	- 10%	Poor ^a 10%
Municipality (50,000-100,000 service connections)	3%			
Medium towns (5,000-50,000 service connections)	2%	Average (5-10 years) - 20%	- 8%	Average ^b 6%
Small towns (<5,000 service connections)	0.5%	Good (< 5 years) - 15%	- 5%	Good ^c 2%

^aNo management controls in place, employees are poorly remunerated and inefficient billing system.
^bManagement controls in place, fairly remunerated employees and good billing system.
^cWell functioning utility with good customer billing system.
 Percentage represents percentage of water sales or revenue water (m³).

Mullikarjuna et al. (2011) Assessment of apparent losses in urban water systems. Water and Environment Journal 25 (2011) 327-335

Introduction



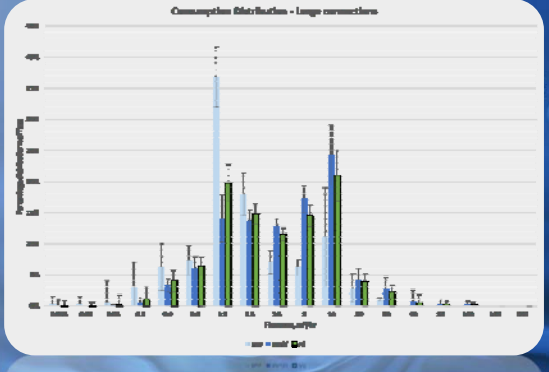
Consumption Patterns

Meter Logging

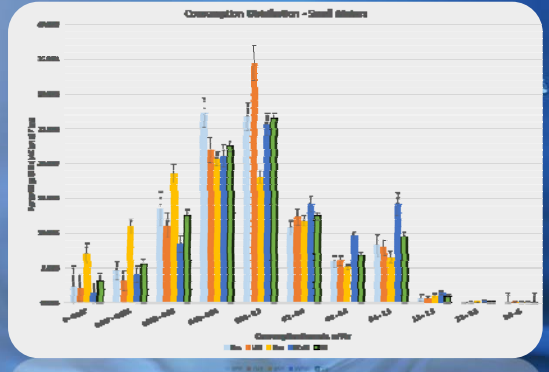
Meter Type	Logging Period	Consumer Category				Total
		Bus	Util	Res	Multi	
Large Water Meters	July 2014 – Nov 2014	16	-	-	30	46
Small Water Meters	May 2015 – Nov 2015	68	76	141	77	362
Totals		84	76	141	107	408



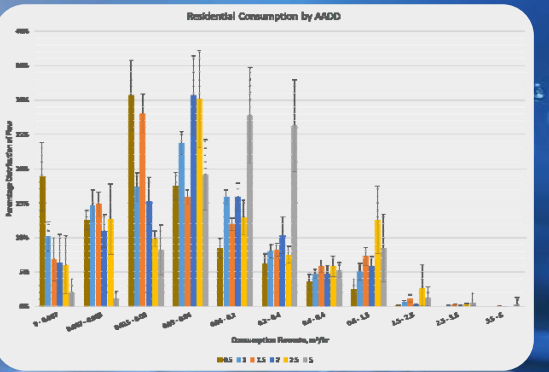
Consumption Patterns



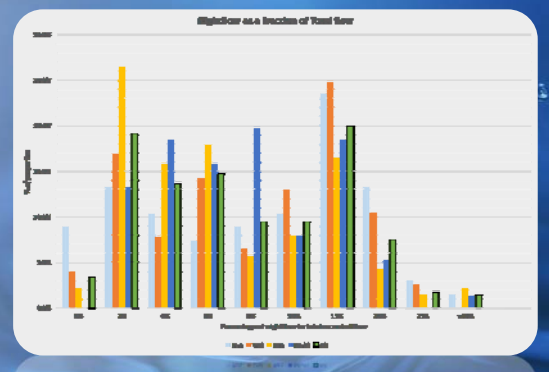
Consumption Patterns



Consumption Patterns



Consumption Patterns



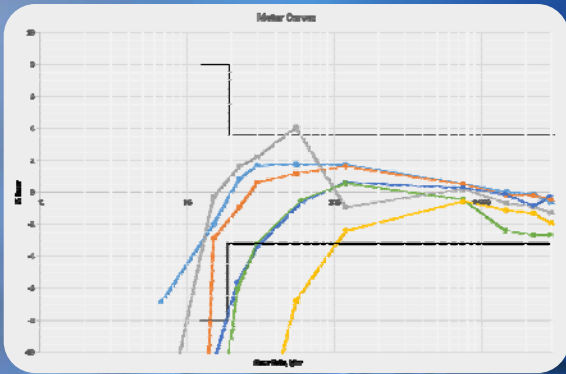
On-site Leakage

- ▲ 63% of all properties have some form or night use above the min. allowed in project
- ▲ Total leakages range from 11 - 41 m³/month per property
 - Multi residential, 40.8m³
 - Business, 28.1 m³
 - Utility, 27.2 m³
 - Residential, 10.6m³

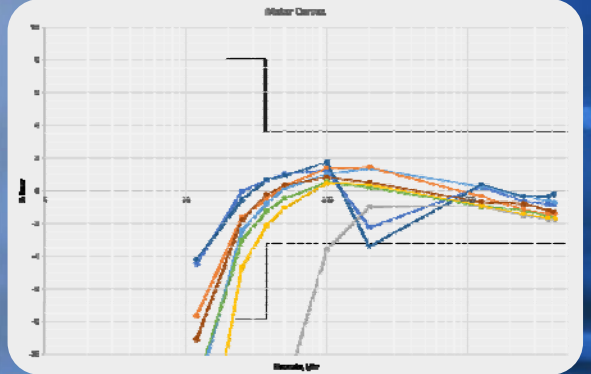
Meter Testing

- ▲ 202 small bore meters removed from use for testing
 - About 123 were successfully tested at 10 flow rates
 - Depressurising the meters over a long time likely led to the leaks in the rest of the plastic meters

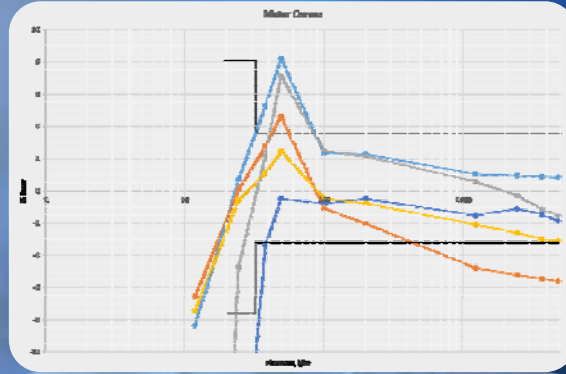
Meter Testing



Meter Testing



Meter Testing



Metering Error

Meter	No	Ave Age	Ave Reading	Weighted Meter Accuracy				Average
				Res	Bus	Utility	Multi	
15mm	85	10.9	3129	90.95	93.57	95.16	95.17	93.70
Model 1	10	14.8	1193	88.23	90.96	92.68	92.73	91.14
Model 2	51	9.6	2774	91.46	94.08	95.59	95.66	94.19
Model 5	18	7.5	3110	91.61	94.00	95.46	95.28	94.08
20mm	35	12.6	6776	83.33	86.76	89.43	89.23	87.19
Model 2	17	8.7	2867	80.51	83.73	85.52	85.91	83.90
Model 3	14	19.9	11565	86.35	90.03	93.60	92.45	90.61
Grand Total	123	11.51	4138.00	88.85	91.71	93.61	93.54	91.92

- ▲ For domestic consumers, on average
 - 9% error for 15mm and 16.8% error for 20mm
 - Unknown sizes , ave domestic is 11.2%

▲ If nothing is known, a conservative 8%?

Metering Error

Global Averages can be misleading

Consumption Category	Monthly Ave, Ml	Meter Error, %	Meter Error, Ml	Monthly Cost, (R12/M)
Water Consumption - Business	3 830 024	8.29%	317 509	R 3 810 108.04
Water Consumption - Residential	12 148 367	18.93%	2 091 097	R 28 988 083.96
Water Consumption - Utility	1 129 268	6.39%	72 351	R 504 215.36
Water Consumption - Multiple Dwelling	4 225 743	6.46%	276 213	R 3 314 556.83
Totals	21 619 069	12.49%	2 960 981	R 24 310 908.83
Global Averages (Ave Weighted Error)	21 619 069	8.08%	1 746 820	R 20 561 840.74

July - Dec 2013 Data

- Ratio of 15mm:20mm:25mm meters?
- Homogenous groups may have peculiar trends
 - Meters, Consumers

Key Takeaways

- Metering error in JW estimated at 9.3% of billed volume
 - with average sample meter age of 11.5 and reading of 4,100
- Metering Standards, Policies, Guidelines must be based on empirical data
 - E.g. Standardisation on Class C 15mm
- Better information on meters and consumers will improve estimation and management

Key Takeaways

- Empirical estimation is time consuming and costly
 - Plastic meters may need testing immediately to avoid material fatigue on re-pressurising
- Planned routine testing and consumption characterisation may not be that expensive
- Rethink, carefully, global water balances that don't incorporate variations in consumers and meters

Key Takeaways

- Thou shall know your meters!
 - They are not all created equal
- Thou shall know your consumers!
 - Different consumers segments may require different meters



The End

Thank You!



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