

# **Water Conservation and Water Demand Management**

**SARPA**

**12 JULY 2013**

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Water Use Efficiency

**Recognition: WRP and Re Solve  
Consulting Engineers**



# Contents of Presentation

- Definitions
- Why must we conserve water
- Fish to Tsitsikamma study
- EC and National NRW
- Meters
- Leaks
- Shools
- What to do?

# WC&DM Legal Requirement

- Basically the LAW (WS Act and Water Act) states that in searching and developing new bulk sources, the WSA **MUST** (not MAY, they **MUST**) investigate all possible sources, of which WC&DM **MUST** be one, and then the **cheapest source will be the one to develop**, and after that the next cheapest etc.

# National Problem Statement

The Honourable President Jacob Zuma statement during the 2010 State of the Nation address said

“We are not a water rich country. Yet we still lose a lot of water through leaking pipes and inadequate infrastructure.

We will be putting in place measures to reduce our water loss by half by 2014”.

# Def: Water Demand Management

- The adaptation and implementation of a strategy, (policies and initiatives) by water institutions or consumers to influence the water demand and usage of water in order to meet any of the following objectives: economic efficiency, social development, social equity, environmental protection, sustainability of water supply and services and political stability.

# Def: Water Conservation

*The minimization of loss or waste, the care and protection of water resources, and the efficient use of water*



# Four Pillars: Water Conservation

- ***Technical Interventions*** WATER MANAGEMENT SYSTEM, WATER METER REPLACEMENT PROGRAM, LEAK DETECTION, PRESSURE MANAGEMENT, REPLACE AGEING INFRASTRUCTURE, RETROFIT PROGRAMS, REMOVAL OF ILLEGAL CONNECTIONS ETC
- ***Institutional Interventions*** POLICIES BY-LAWS ETC
- ***Economical Interventions*** ACCURATE BILLING, METERING, WATER AUDITS
- ***Social Interventions*** CONSUMER EDUCATION AND AWARENESS

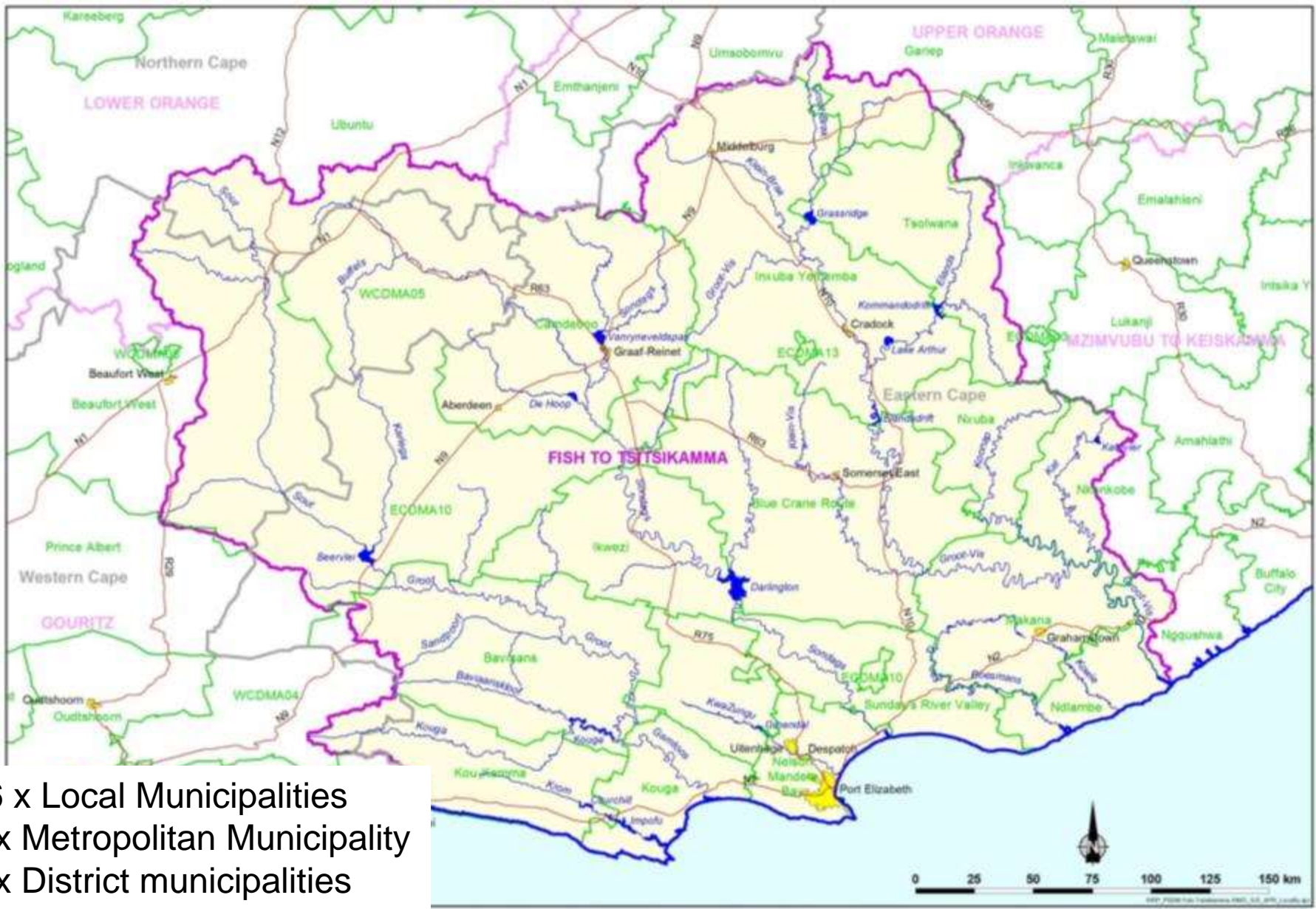
# Why Conserve?

- Water in South Africa is scarce: 65% of SA has less than 500mm/yr Average in world is 800mm/year
- Most of the water in our dams are used by the various water sectors
- Not much water left for development

# Eastern Cape Strategy



# Study Area



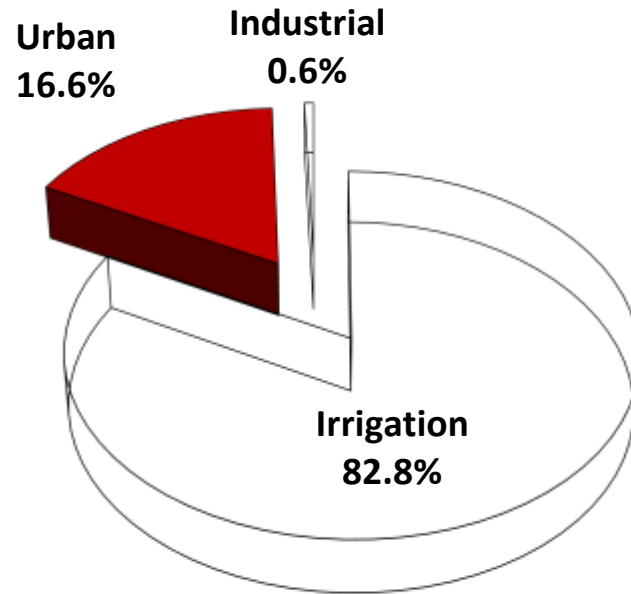
# Objectives

- To make more effective and efficient use of the existing and available water resources by all water use sectors in the study area;
- To develop realistic water saving targets for the respective water use sectors and quantify the impact on current and future water requirements in the study area;
- To enable the Catchment Management Agency (CMA) and the Department of Water Affairs (DWA) to “free-up” additional water, which can be put to beneficial use in the public interest;

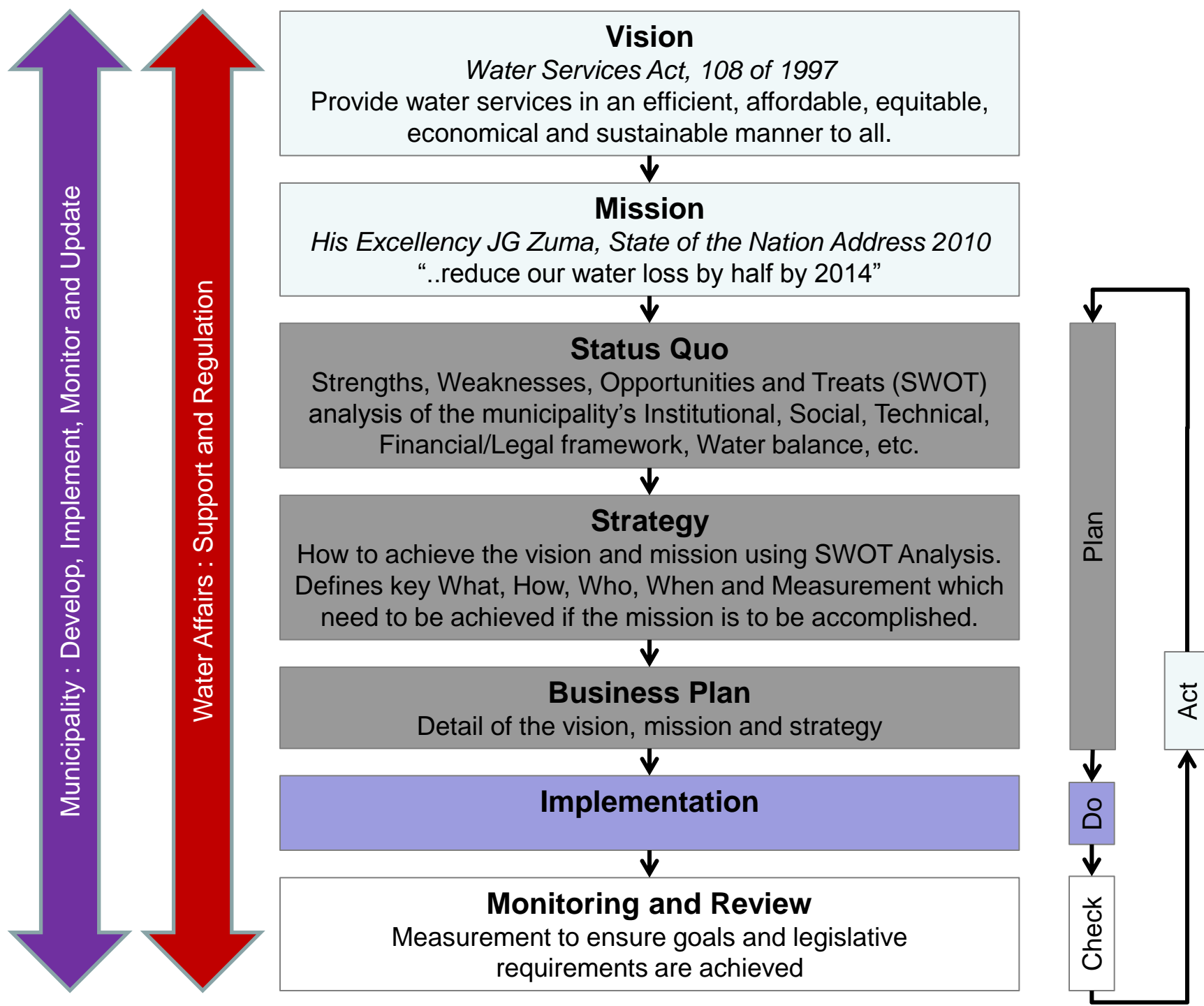
# Objectives...

- To conserve water and avoid or delay the implementation of further expensive schemes for transfers and storage which may not be necessary if water is used efficiently; and
- To provide necessary information to support the implementation of compulsory licensing and related water allocation reforms.

# Sector Water Use in EC



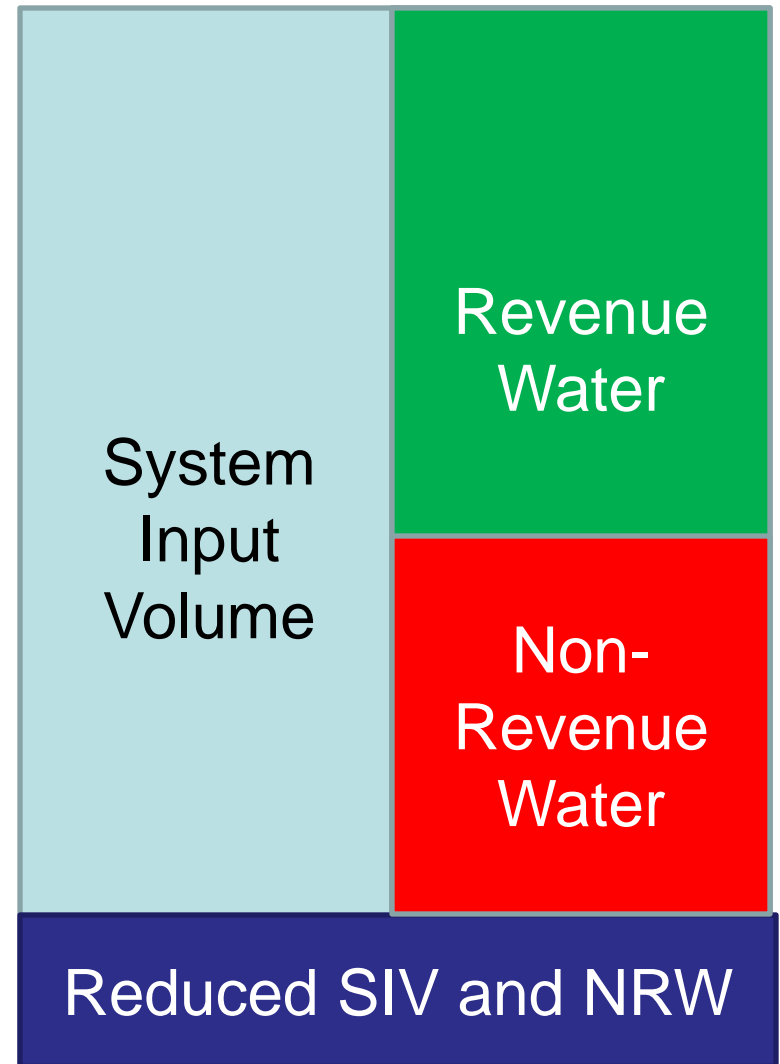
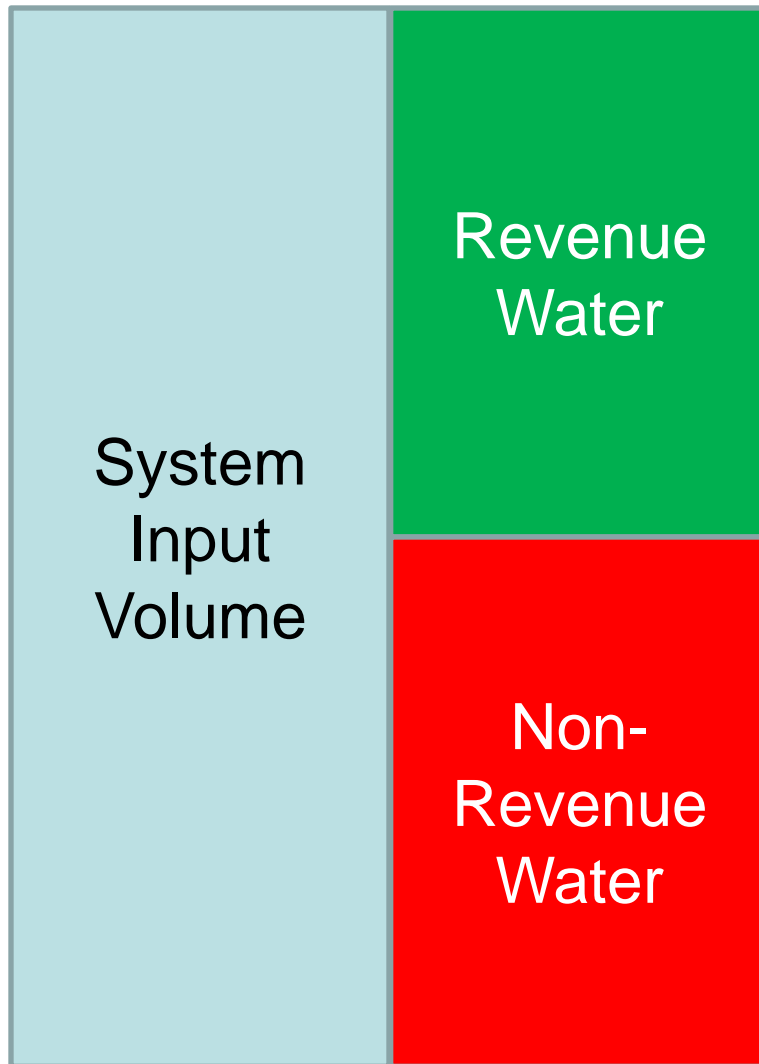
# WC/WDM Strategy Approach



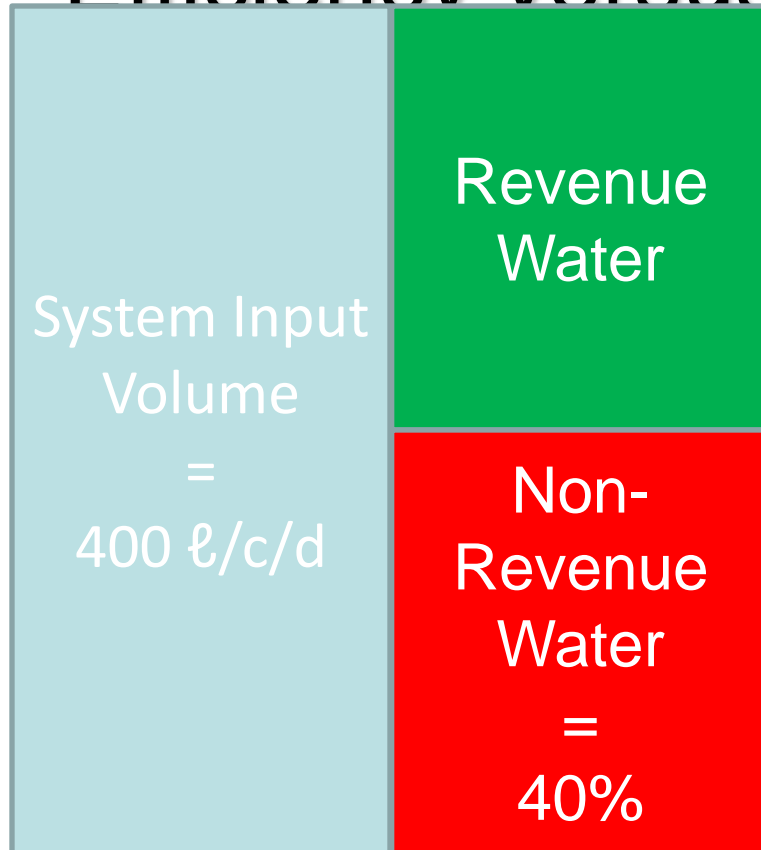
# STANDARD IWA WATER BALANCE

System Input Volume	Authorised Consumption	Billed Authorised Consumption	Billed Metered Consumption	Free basic Revenue Water
			Billed Unmetered Consumption	Non Revenue Water
		Unbilled Authorised Consumption	Unbilled Metered Consumption	
	Water Losses	Apparent Losses	Unbilled Unmetered Consumption	
			Unauthorised Consumption	
			Customer Meter Inaccuracies	
		Real Losses	Leakage on Transmission and Distribution Mains	
			Leakage and Overflows at Storage Tanks	
			Leakage on Service Connections up to point of Customer Meter	

# Potential savings

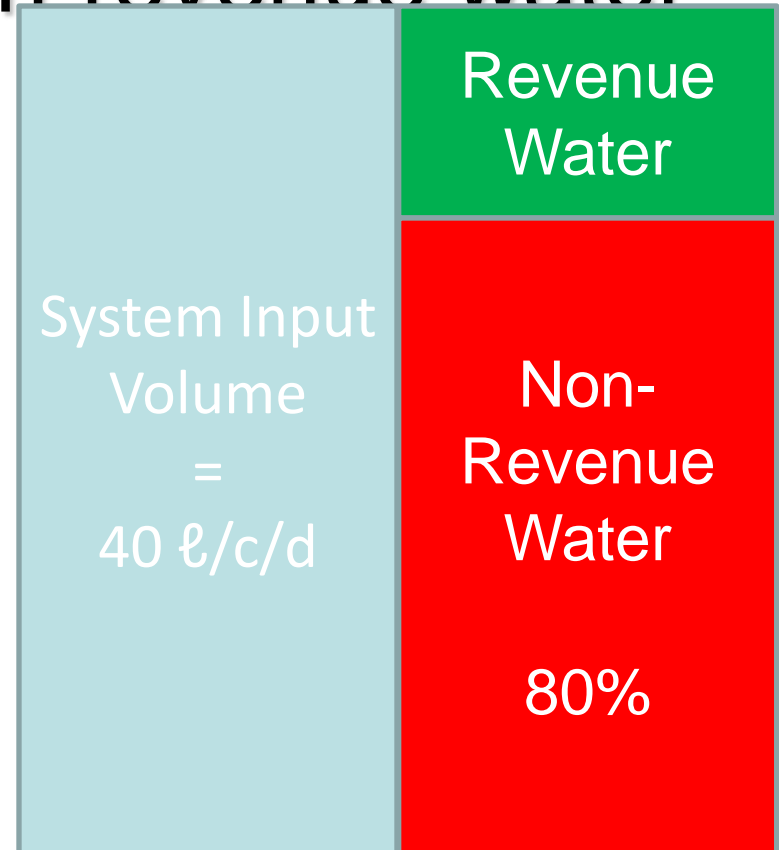


# Efficiency versus Non-revenue water



High non-revenue water and  
not efficient water use

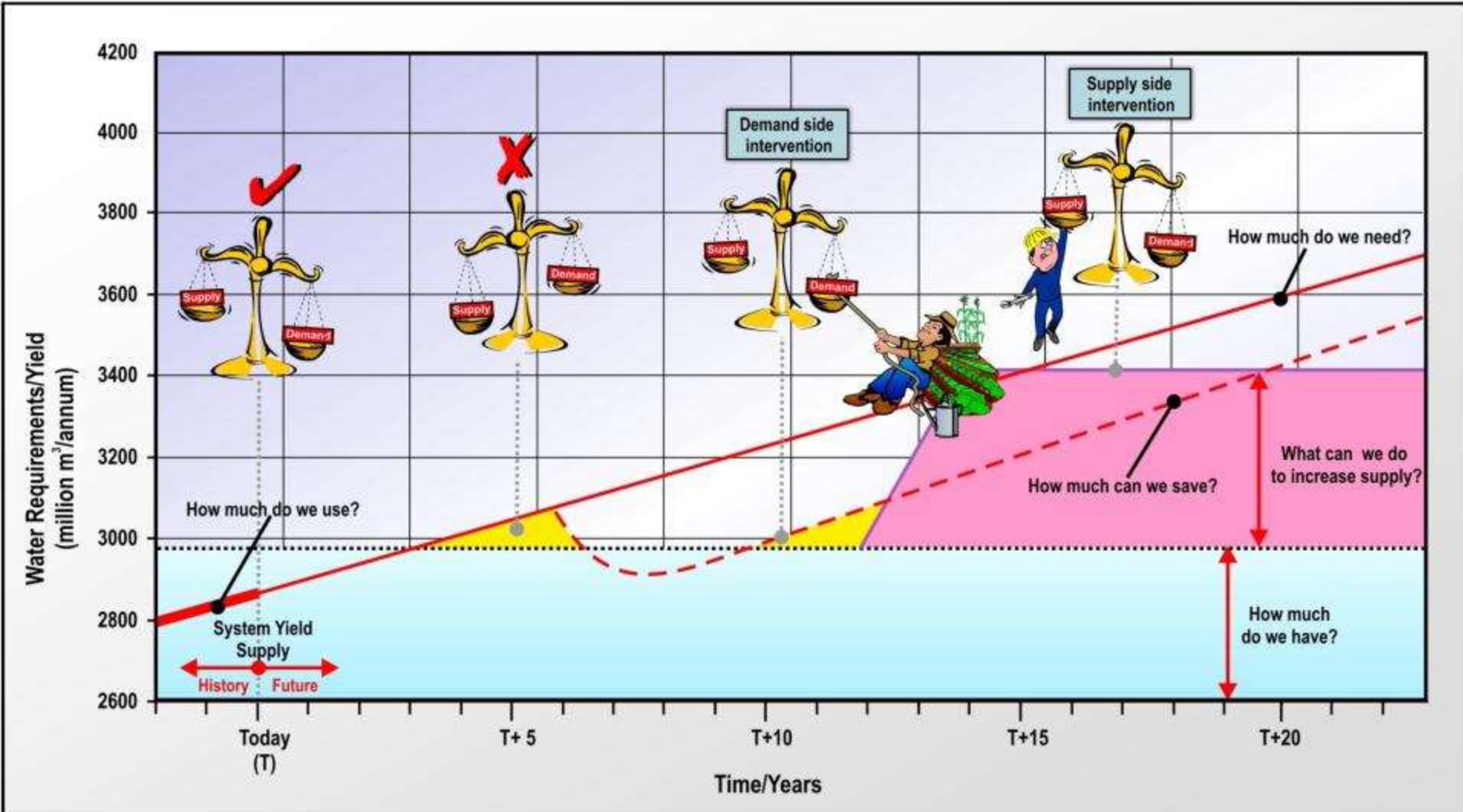
**Not Acceptable**



High non-revenue water but  
very efficient water use

**Acceptable**

# Water Resource Balance Diagram



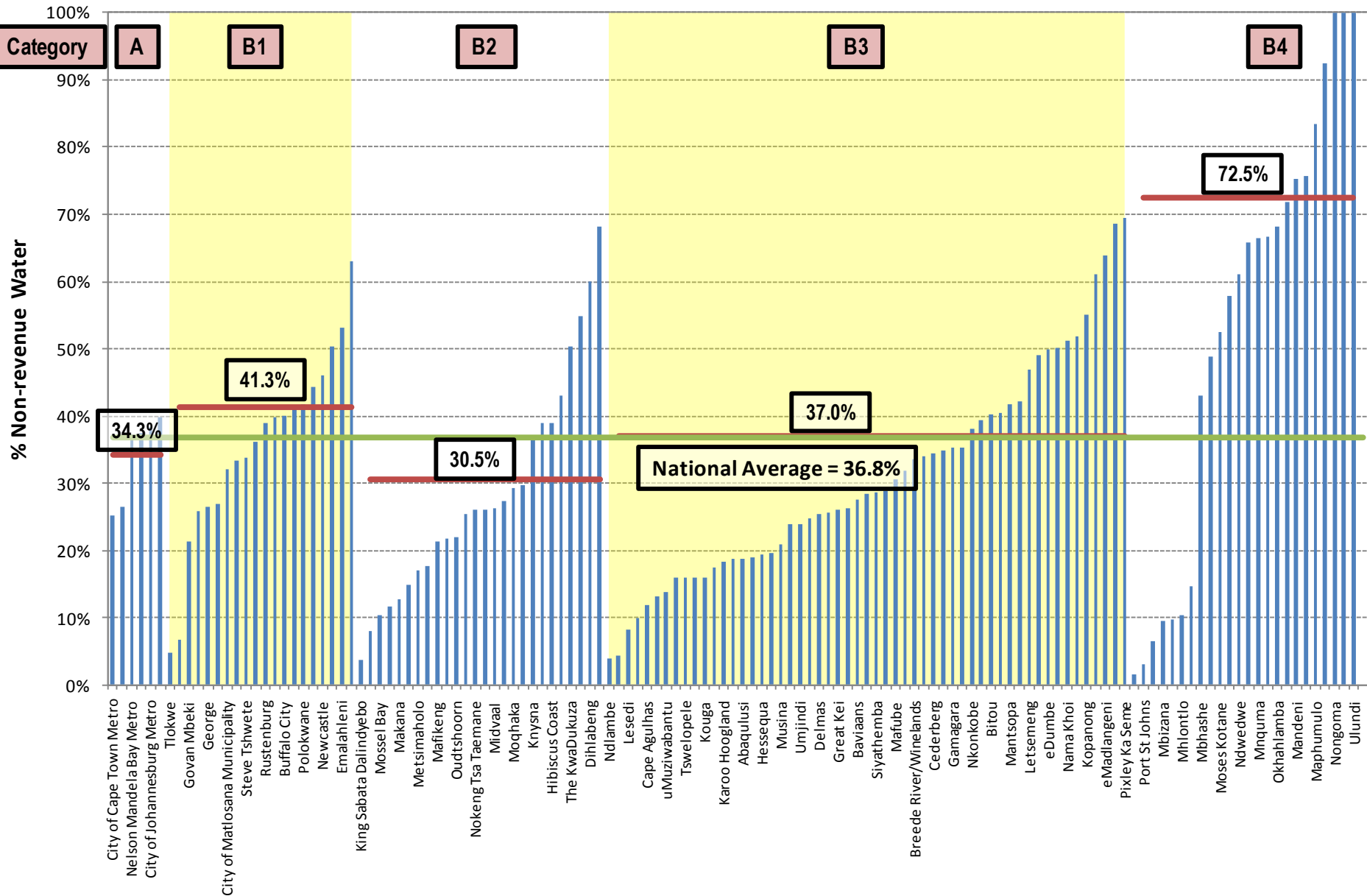
# Water Loss Indicators

Municipality	Population 2012	System input volume Mℓ/day	System input volume million m3/a	Volume NRW million m³/a	% NRW	ℓ /c/ d
Camdeboo	51 601	15.1	5.5	1.93	35%	292
Blue Crane	36 798	10.9	3.98	1.43	36%	296
Baviaans	18 476	2.7	0.99	0.37	38%	146
Ikwezi	9 232	1.5	0.55	0.3	55%	162
Kou-kamma	45 124	5.3	1.93	0.6	31%	117
Kouga	88 594	20.3	7.4	3.59	48%	229
Makana	140 120	23.1	8.44	2.28	27%	165
Sunday's River Valley	61 153	10.3	3.76	2.07	55%	168
Ndlambe	59 331	11.8	4.3	1.51	35%	199
Nkonkobe	125 302	12.6	4.6	1.75	38%	101
Ngqushwa	77 709	12.9	4.7	4.32	92%	166
Nxuba	25 087	3.5	1.29	0.77	60%	141
Inxuba Yethemba	60 296	13.3	4.86	1.94	40%	221
Tsolwana	32 819	5.5	2	0.7	35%	167
Inkwanca	20 143	4.1	1.5	0.6	40%	204
Gariep	31 305	10.4	3.8	1.6	42%	333
Nelson Mandela Bay	1 320 610	245.7	89.7	26.92	30%	186
<b>Total</b>	<b>2 203 601</b>	<b>409</b>	<b>149.3</b>	<b>66.06</b>	<b>44%</b>	<b>186</b>

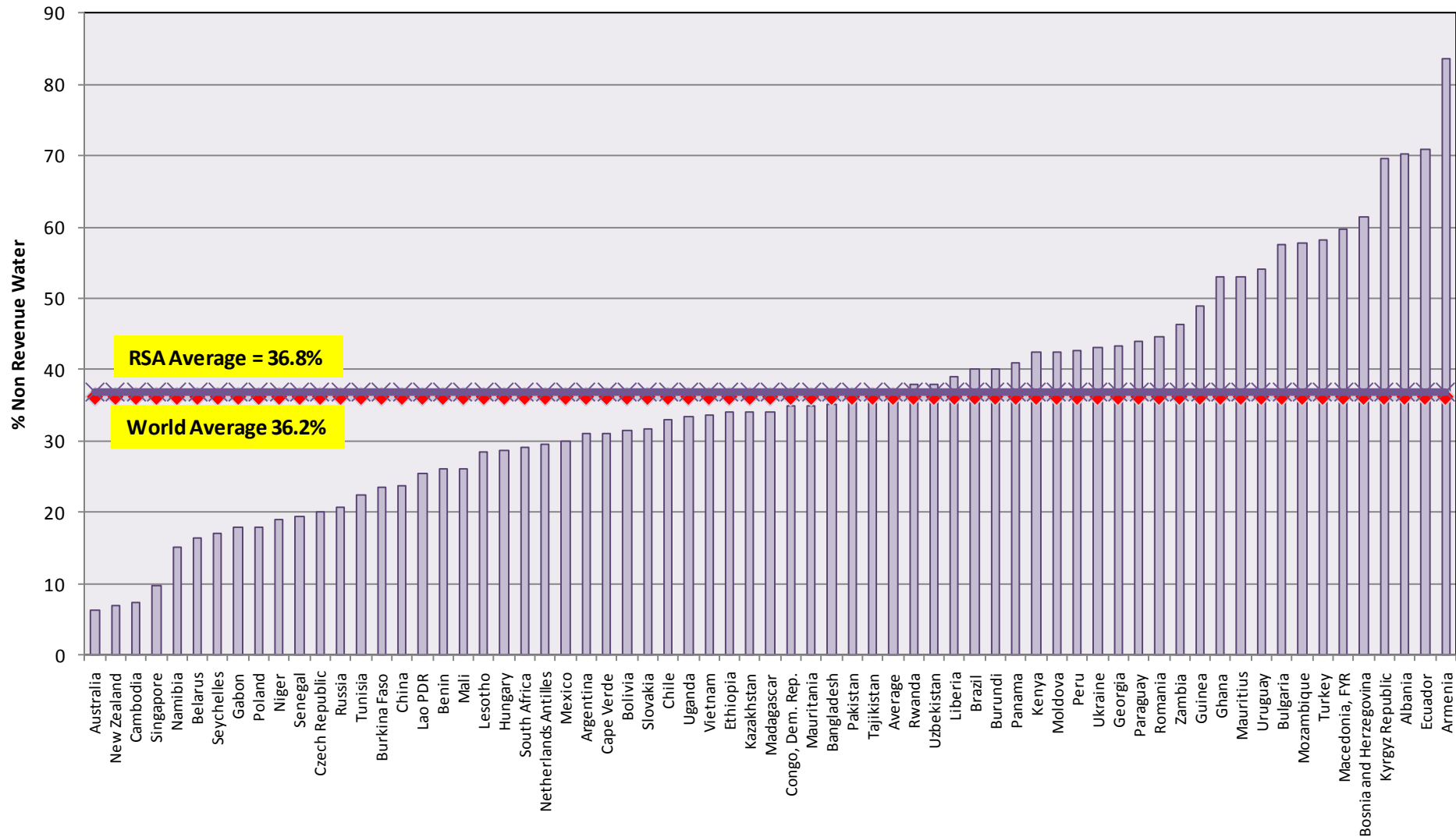
# Strategic Overview

Category	% NRW	I/c/d	% Performance Scorecard	Record Keeping
A Metro's	34.3	291	84.0	6 of 6 (100%)
B1 Major Cities	41.3	241	63.6	20 of 21 (95%)
B2 Minor Cities	30.5	229	65.7	26 of 29 (90%)
B3 Rural Dense	37.0	164	55.7	55 of 111 (50%)
B4 Rural Sparce	72.5	65	46.4	25 of 70 (36%)
National	36.8	235	59.2	132 of 237 (56%)

# % NRW Distribution / Municipal



# International NRW benchmark



# WMA Current Water Balance

Current IWA Water Balance Diagram (million m<sup>3</sup>/annum)

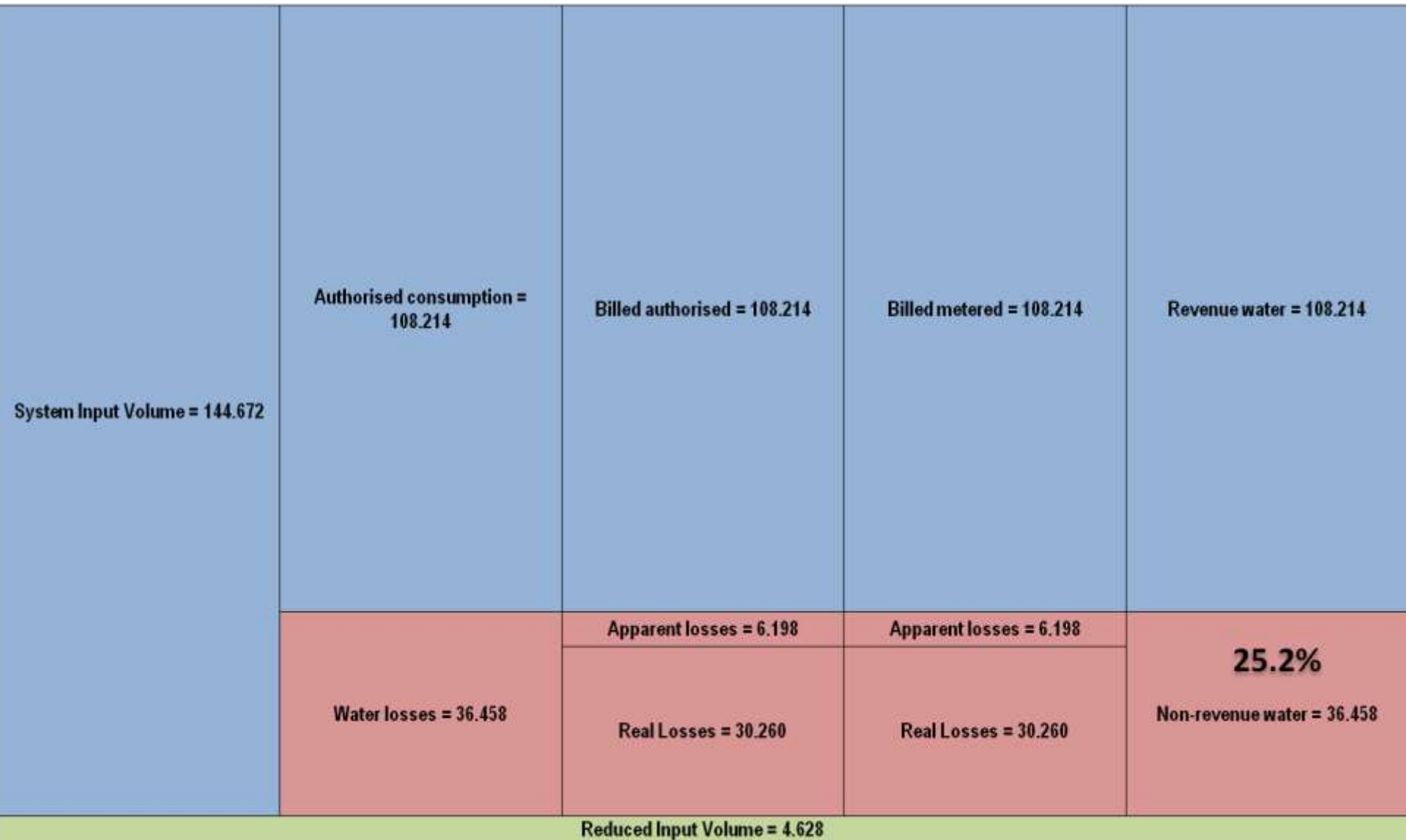
System Input Volume = 149.300	Authorised consumption = 83.242	Billed authorised = 83.242	Billed metered = 83.242	Revenue water = 83.242
	Water losses = 66.058	Apparent losses = 11.230	Apparent losses = 11.230	Non-revenue water = 66.058  44.25%
		Real Losses = 54.828	Real Losses = 54.828	

# Potential Savings

Municipality	Total licensed yield million m3/a	System input volume million m3/a	Target Reduction (15%) million m3/a	Optimistic Reduction (20%) million m3/a
Camdeboo	6.32	5.5	0.82	1.1
Blue Crane	3.62	3.98	0.6	0.8
Baviaans	0.71	0.99	0.15	0.2
Ikwezi	1.34	0.55	0.08	0.11
Kou-kamma	1.17	1.93	0.29	0.39
Kouga	7.53	7.4	1.11	1.48
Makana	17.83	8.44	1.27	1.69
Sunday's River Valley	3.45	3.76	0.56	0.75
Ndlambe	3.78	4.3	0.64	0.86
Nkonkobe	4.6	4.6	0.69	0.92
Ngqushwa	11.74	4.7	0.71	0.94
Nxuba	0.99	1.29	0.2	0.26
Inxuba Yethemba	7.3	4.86	0.73	0.98
Tsolwana	2	2	0.3	0.4
Inkwanca	1.5	1.5	0.22	0.3
Gariep	3.8	3.23	0.19	3.23
Nelson Mandela Bay	96.14	89.7	13.45	17.94
Total	173.82	148.73	22.01	32.35

# Target water balance

Target IWA Water Balance Diagram (million m<sup>3</sup>/annum)



# Estimated National NRW

NRW Based on Available Data Sets					
Category	Population	Input (m³/a)	NRW (m³/a)	% NRW	l/c/d
<b>A</b>	<b>17 420 512</b>	<b>1 849 091 117</b>	<b>634 192 022</b>	<b>34.3%</b>	<b>291</b>
<b>B1</b>	<b>7 756 187</b>	<b>683 667 320</b>	<b>282 585 164</b>	<b>41.3%</b>	<b>241</b>
<b>B2</b>	<b>3 882 070</b>	<b>325 623 095</b>	<b>99 407 207</b>	<b>30.5%</b>	<b>230</b>
Urban	29 058 770	2 858 381 532	1 016 184 393	35.6%	269
<b>B3</b>	<b>3 845 279</b>	<b>230 642 568</b>	<b>85 229 869</b>	<b>37.0%</b>	<b>164</b>
<b>B4</b>	<b>4 245 736</b>	<b>101 138 956</b>	<b>73 334 514</b>	<b>72.5%</b>	<b>65</b>
Rural	8 091 015	331 781 524	158 564 384	47.8%	112
National	37 149 785	3 190 163 057	1 174 748 776	36.8%	235
Extrapolated	48 821 707	4 192 465 880	1 543 837 752	36.8%	235

Current National IWA Water Balance Diagram (million m3/annum)

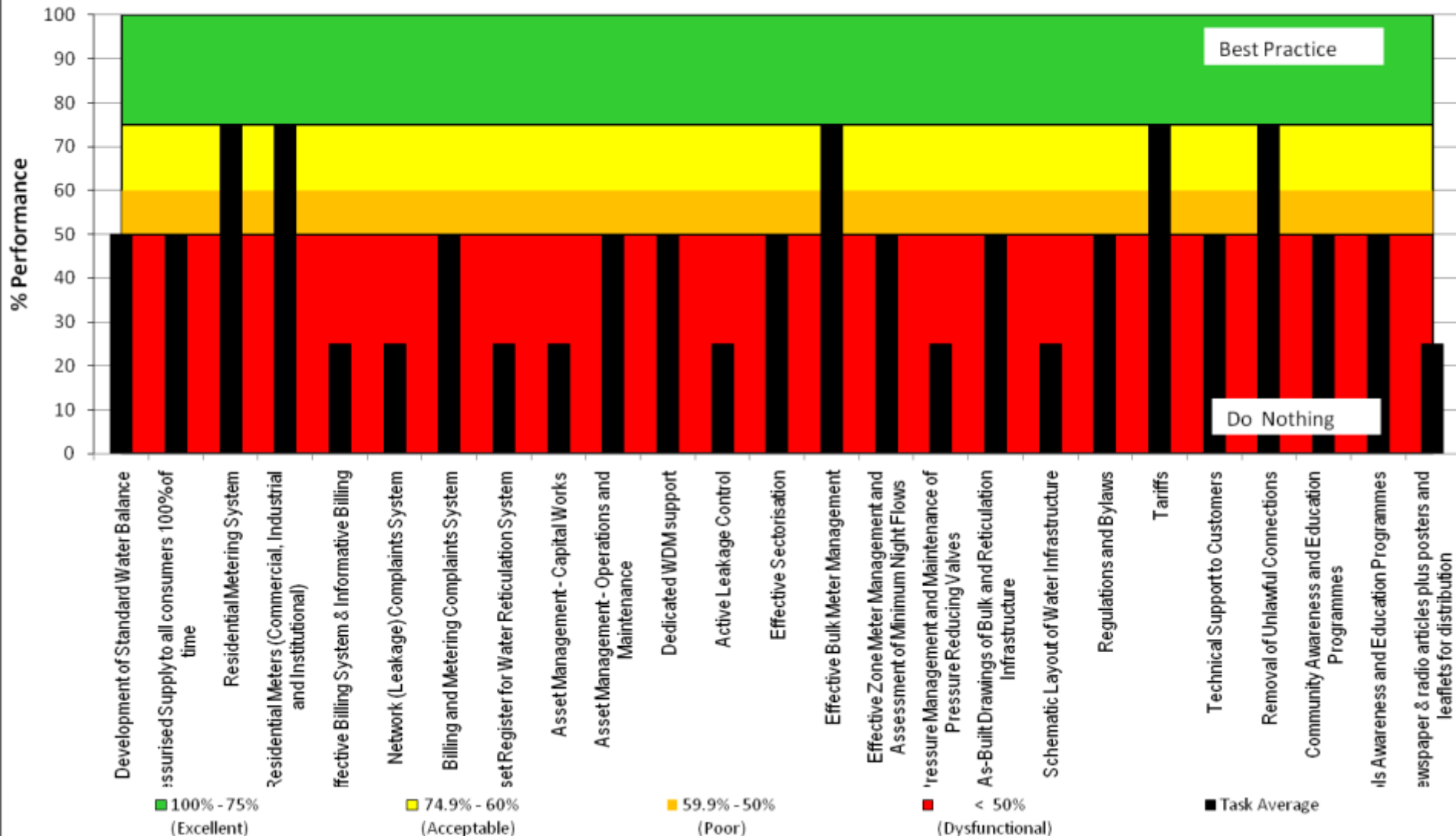


# Estimated Cost of NRW

Category	Input Rate (R/kl)	Sell Rate (R/kl)	Input Value (R million)	NRW Value (R million)
<b>A</b>	<b>R 5.00</b>	<b>R 10.00</b>	<b>R 9 245.46</b>	<b>R 3 170.96</b>
<b>B1</b>	<b>R 4.50</b>	<b>R 9.00</b>	<b>R 3 076.50</b>	<b>R 1 271.63</b>
<b>B2</b>	<b>R 4.00</b>	<b>R 8.00</b>	<b>R 1 302.49</b>	<b>R 397.63</b>
Urban			R 13 624.45	R 4 840.22
<b>B3</b>	<b>R 3.50</b>	<b>R 7.00</b>	<b>R 807.25</b>	<b>R 298.30</b>
<b>B4</b>	<b>R 3.00</b>	<b>R 6.00</b>	<b>R 303.42</b>	<b>R 220.00</b>
Rural			R 1 110.67	R 518.31
<b>National</b>			<b>R 14 735.12</b>	<b>R 5 358.53</b>
Extrapolated			R 19 827.42	R 7 210.38

# WMA Consolidated Scorecard

Municipal Scorecard for Assessing the Potential for WC/WDM in Municipalities



# Qualitative Scorecard (Strengths)

## Helpful

### Internal factors

personnel, finance, capabilities

- Positive political support, however training is required
- Formal towns and reasonably formal infrastructure
- Bulk metering in some areas
- Consumers metered and billed in most municipalities
- Policies and bylaws updated
- Positive relationship with consumers
- WSDP's and IDP's updated annually
- Visible leaks are reported and fixed
- Active WDM programmes (barefoot plumbers) in some areas
- Telemetry monitoring of the network

# Qualitative Scorecard (Weaknesses)

## Harmful

### Internal factors

personnel, finance, capabilities

- High vacancy rate in most municipalities
- Limited or no management information
- Inadequate capacity building and skills transfer
- Lack of vehicles and materials to support O&M
- No monthly monitoring of NRW KPI's
- Limited pressure management, sectorisation and old water meters in most areas
- Limited or no electronic job card system to capture and monitor leak reports
- Limited preventative maintenance in most municipalities
- No mains replacement programmes
- Intermittent supply, especially in informal and rural supply schemes
- Poor water quality in some areas

# Qualitative Scorecard (Opportunities)

Helpful

## External factors Legislation, Public, Politics

- WC/WDM Councillor training programme
- Establish NRW steering committee and monthly reporting
- Improve relationship with finance departments and access to information
- Community education and awareness
- Water tariffs are mostly not cost reflective and must be reviewed
- Utilise positive relationship with communities to improve metering and cost recovery
- Obtain water loss equipment and utilise to analyse system losses
- Informative billing
- Review policies and charters to promote WC/WDM
- High level of internal household plumbing leakages

# Qualitative Scorecard (Threats)

## Harmful

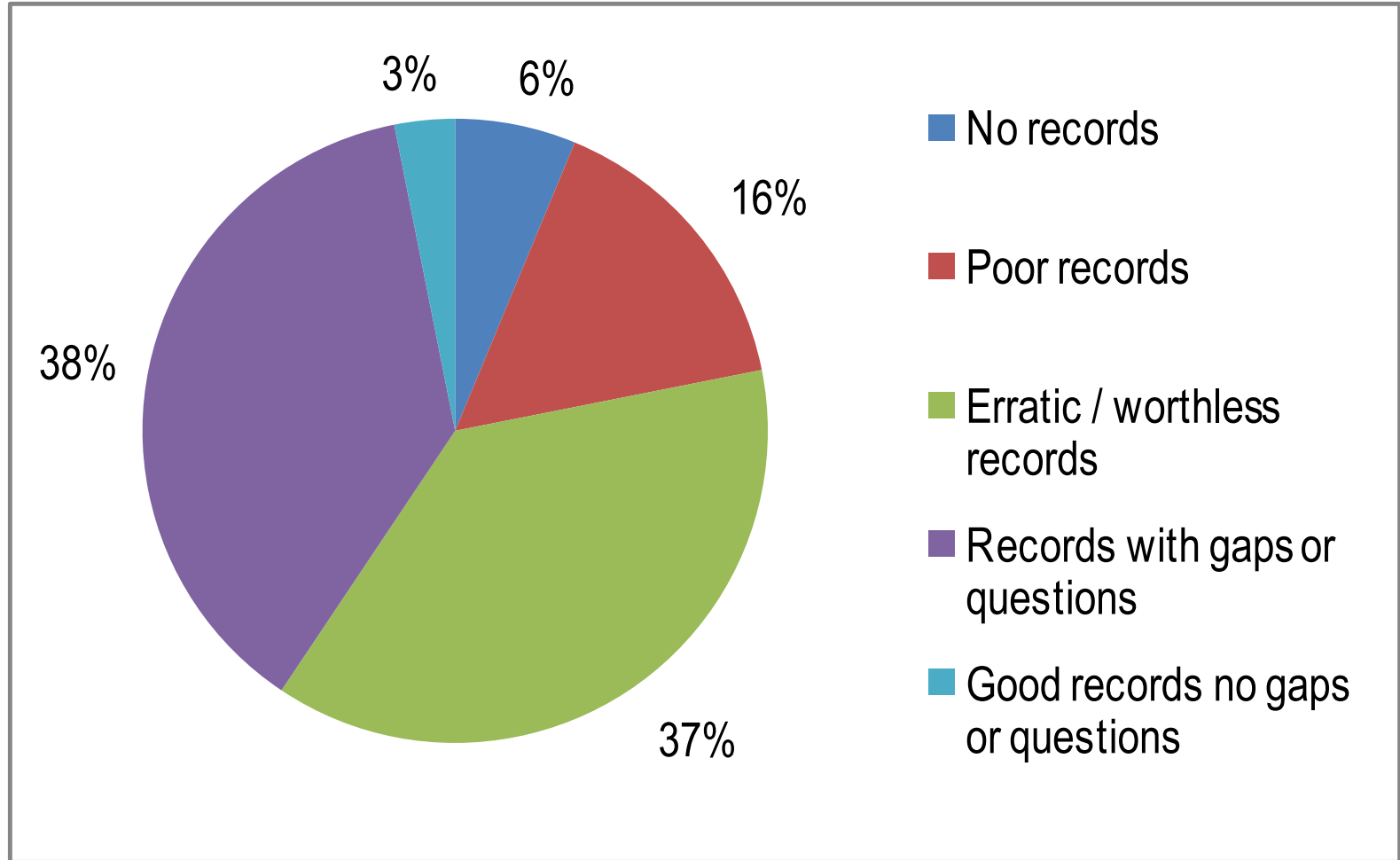
### External factors Legislation, Public, Politics

- Poor relationships between the technical and finance departments
- Very old infrastructure in most areas
- Lack of funding - municipalities are grant dependent
- Institutional arrangements / Service level agreements
- Rural water supply schemes difficult to monitor and implement metering and billing
- High indigent consumer base in most municipalities
- Infrastructure vandalism and illegal connections
- Non payment of services
- Limited water resources in some areas

# Common Challenges

- High vacancies
- Lack of necessary skills and capacity
- No collaboration between departments
- Limited / no management information
- Non-compliance with legislation and regulations
- Poor services and customer care
- Lack of community support in certain areas
- Lack understanding of water business
- Metering / billing and cost recovery

# 6 Year Record Keeping Summary



# Importance of WDM data

- Water balance should be calculated by municipality on monthly basis to :
  - Monitor system input volume
  - Monitor water losses
  - Monitor non-revenue water
  - Assess water security (Supply vs demand)
  - Monitor progress made with national (half water losses by 2014) and regional targets (IVRS project 15%).

**Should not be considered DWA data!!**

# Recommendations

- Municipalities must be made aware that WDM is a strategic issue in a water scarce country and impacts significantly on water for growth and development
- Only continuous monitoring, analysis and feedback will improve results
- Municipalities must take ownership of WCWDM
- Study provides baseline for future monitoring

# Current and Future Actions (1)

- Study has provided a better understanding of the NRW situation
- Dir: Water Use Efficiency is working with DWA regional offices and municipalities on Water Demand Management to increase awareness and:
  - Train staff on calculation of water balance
  - Update / improve available municipal data
- Standardise understanding of NRW and inclusion of cost recovery

# Current and Future Actions (2)

- Educating Stats SA to ensure data quality improves with future surveys
- The team will be working more closely with:
  - Municipalities
  - Stats SA
  - Department of Cooperative Governance
  - Auditor General

# **METERING**

## **EXAMPLES FROM DIFFERENT MUNICIPALITIES**

**TO METER IS TO KNOW  
TO KNOW IS TO  
MANAGE**

**BULK METERS  
ZONE METERS  
DOMESTIC METERS**

# No Meters: No record No Income



© 2011 Afrigis (Pty) Ltd.  
Image © 2011 GeoEye

Google  
2010

Imagery Date: 11/18/2010 2004

33°53'02.33" S 25°34'47.36" E elev 56 ft

Eye alt 1713 ft

# No Meters: No Records No income









# House built over meters



# Meter Locations



# Meter Vegetation -



# Vandalised/ Damaged Meters



# Poor/ Damaged Meter Installations



# Poor Meter Installation



05.10.2011 13.30

# Meter Not Counting



# Broken Meter

# Covered Meters:





## MUNICIPALITY READINGS

32637	2011/07/04	32637	2011/06/01	32637	2011/05/04	32637	2011/03/30	32637	2011/03/02
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**BEFORE BEING PUMPED:  
FLOODED**



**AFTER BEING PUMPED:  
ILLEGIBLE**

# **LEAKS**

**EXAMPLES FROM  
DIFFERENT  
MUNICIPALITIES**

**A LEAK IS NOT ONLY A  
LOSS OF WATER BUT  
ALSO A LOSS OF  
INCOME**

**VISIBLE LEAKS  
INVISIBLE LEAKS**

# Valve Leak



# Reservoir Overflows



# REPAIR!!!! Comparison of Flow



# Standpipe Leak: REPAIR!!!!



# Missing Taps



# Leaks on Properties



30 09 2011 10:38

01 10 2011 08:41

# Poor installations

**Wasteful installation**





**Leaking Toilet  
(Faulty Meter)**

# Infrastructure Leak



# Infrastructure Leak



**Water Loss**

**13.1 kl/hr**

**(3.64l/sec)**

# Infrastructure Leak



# Sewer Overflow



# Sewer Overflow



# Field Work

## Valves



# Leak Detection



**65 kl/day**

# When others work on your service

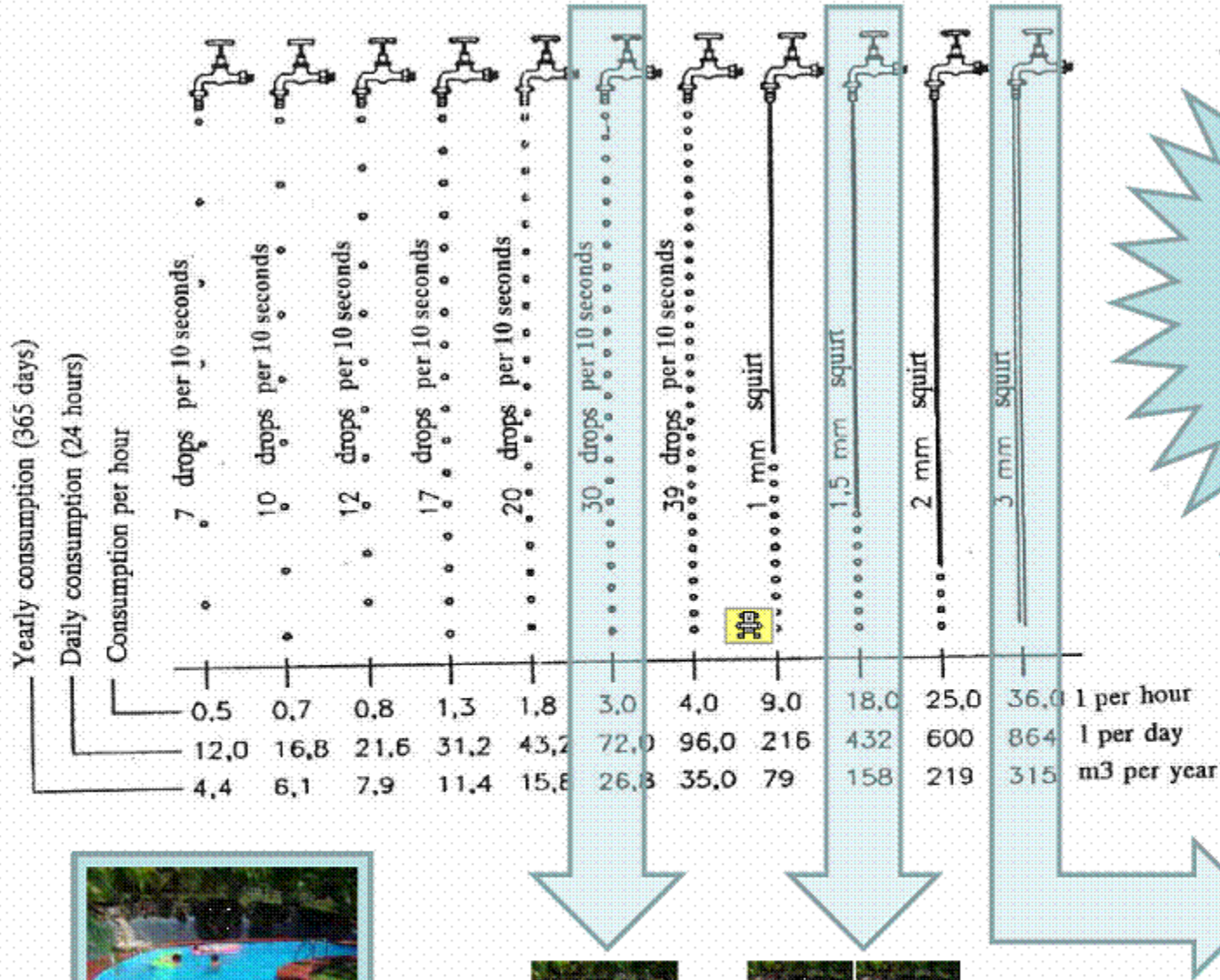




20.07.2011 16:53

**Solar Geyser with missing tubes**

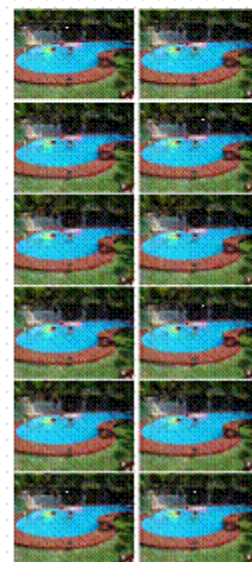
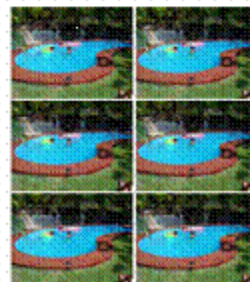
# Impact of water leaks



How many swimming pools does your leaking tap fill



1x Swimming pool = 25 m<sup>3</sup> of water







# SEWER LEAK!!!!



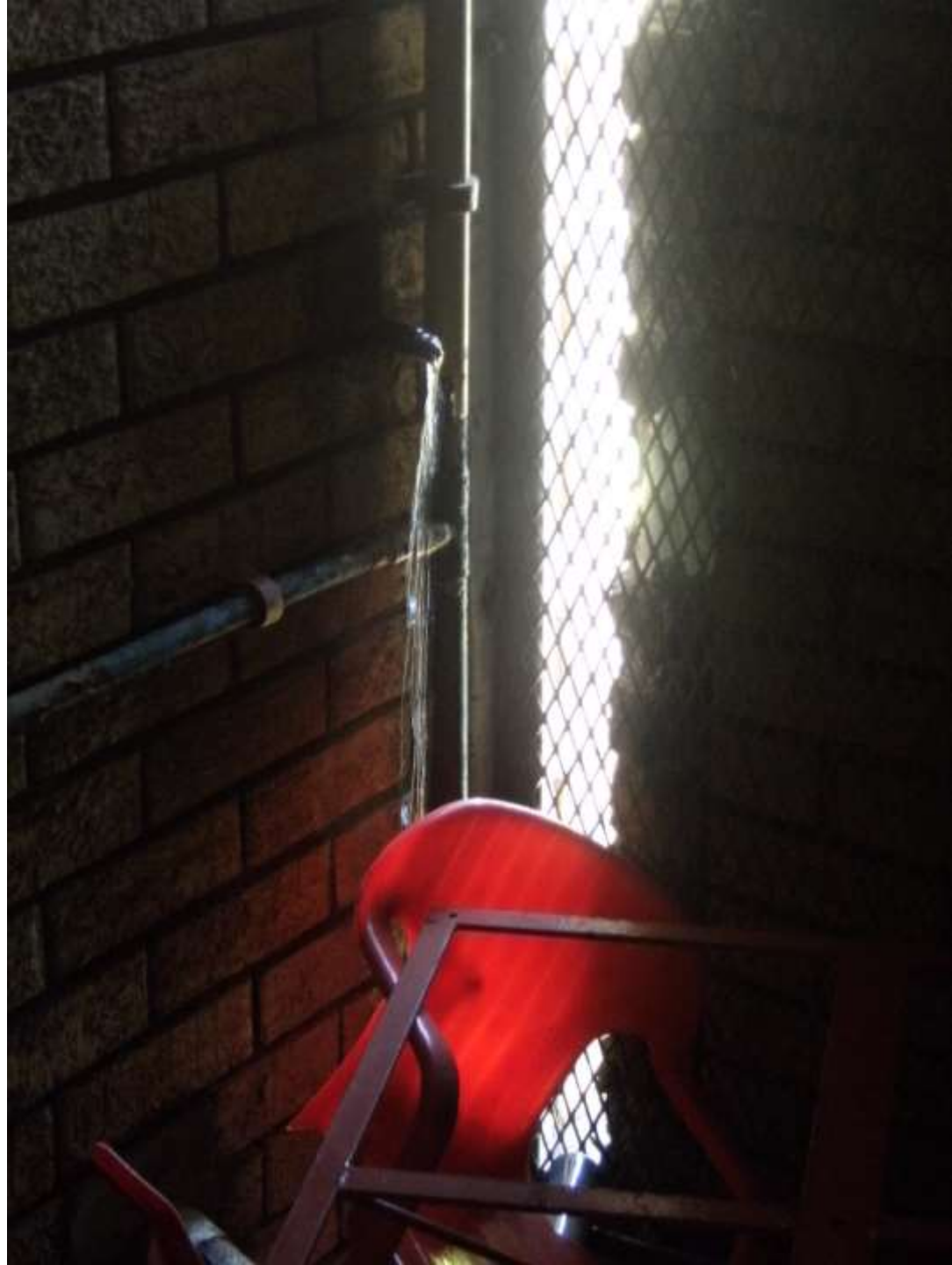


# Effluent Disposal



# SCHOOLS

- **Wasting almost 10% of Country's water**









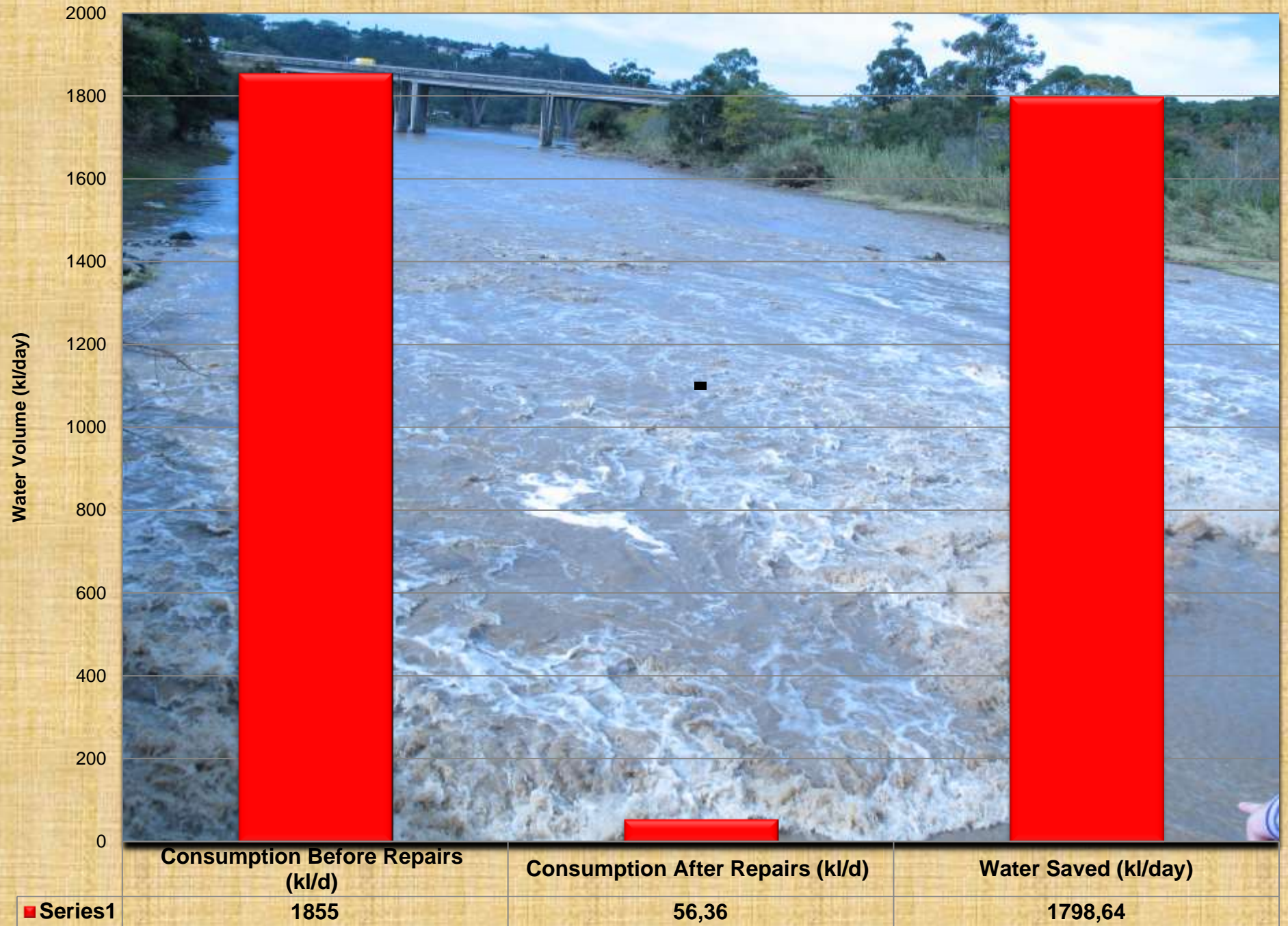
# SAVINGS IN AVERAGE METERED CONSUMPTIONS

SCHOOL LEAK REPAIR PROJECT: SAVINGS					kl/hr			R 7.46
No.	School Name	Leak Repair Status	Date School Repairs Completed	Billing History	Pre-Repairs Avg. Consumption	Post-Repair Avg. Consumption	Savings in Average Consumption s	Savings in Average Consumption s (R/annum)
1	Enkwenkwezini PS	Complete	10-Dec-12	Yes	26.2	12.1	14.2	R 925 607
2	Canzibe PS	Complete	19-Dec-12	Yes	2.2	1.7	0.4	R 28 100
3	Joe Slovo PS	Complete	17-Dec-12	No				
4	Phakamisa SS	Complete	5-Dec-12	No				
5	Nokwezi PS	Complete	30-Nov-12	Yes	17.1	8.8	8.3	R 541 188
6	Republiek PS	Complete	23-Jan-13	Yes	10.1	0.8	9.3	R 606 626
7	Stephen Nkomo Pri. Sch.	Complete	23-Nov-12	Yes	3.5	1.4	2.1	R 139 895
8	Ashton Gontshi PS	Complete	24-Jan-13	Yes	2.9	0.3	2.6	R 171 409
9	Ntlemeza PS	Complete	13-Dec-12	Yes	3.2	2.8	0.4	R 26 693
10	Mingcunube PS	Complete	24-Jan-13	Yes	3.0	2.0	0.9	R 61 511
11	Mzamomhle Special S	Complete	30-Nov-12	No		0.6		
12	Bayview PS	Complete	1-Mar-13	Yes	17.5	6.3	11.2	R 731 433
13	Adolph Schauder PS	Complete	20-Feb-13	Yes	0.2	0.1	0.1	R 5 881
14	Strelitzia PS	Complete	15-Mar-13	Yes	11.3	2.7	8.6	R 560 382
15	Bertram SS	Complete	4-Mar-13	Yes	6.2	4.4	1.8	R 116 326
16	Jubilee Park PS	Complete	30-May-13	Yes	0.7			
17	Phakamile PS	Complete	25-Jan-13	Yes	5.7	1.4	4.3	R 281 932
					154.1	45.4	64.22	R 4 196 983
					kl/hr	kl/hr	kl/hr	R/annum





PHOLAPARK : CONSUMPTION BEFORE vs AFTER INTERVENTION



# COST BENEFIT ANALYSIS

- Interventions beyond the meter were carried out on 170 Indigent properties in Dimbaza (Phola Park) at a cost of **R253 400**, which is an average of R1 490 per household.
- Actual water savings after intervention is 50 700 kl/month **10 000 JoJo Tanks**, which equates to 610 000kl/year **122 000 JoJo tanks**. Money savings per year is R3 365 000 based on bulk water tariff of R5.5/kl, which is used for purchasing water from the bulk water services provider.
- The Payback period =  $253400/280500$   
= 0.9 month **Less than one month!!!**

# Domestic Sector

- BCM:
- WCDM Project in Dimbasa
- Relocation of Water Mains
- Indigent Plumbing
- Installation of water meters
- Visual leak inspections
- Installation of Bulk Meters
- Community Awareness
- Replacement of leaking standpipes

Erf	Average Consumption before repairs (kl/month)	Average Consumption after repairs (kl/month)	Water Saved (kl/month)	Amount save at R5.086/month
<100kl/month				
7182	166	6	160	R 813.25
7265	164	3	161	R 820.88
7284	115	21	94	R 479.10
7290	334	5	329	R 1 672.28
7331	101	4	98	R 495.89
7360	344	7	337	R 1 715.00
7345	362	1	361	R 1 835.54
7344	453	4	449	R 2 285.65
7348	113	1	112	R 569.12
6924	139	24	115	R 584.38
7123	129	2	127	R 646.94
7154	340	12	328	R 1 666.17
7146	83	2	81	R 410.44
6964	157	7	150	R 762.90
6740	232	3	229	R 1 162.66
6658	368	3	365	R 1 858.42
6315	371	10	361	R 1 835.54
6311	125	14	111	R 563.02
6231	284	4	280	R 1 422.05
5970	141	9	132	R 669.83
5749	284	4	280	R 1 425.10
5469	150	5	145	R 738.49
7346	237	10	227	R 1 155.03
7140	94	11	83	R 421.12
6922	85	7	78	R 398.23
			5192	R 26 407.02
>1-100kl/month				
7091	48	1	47	R 241.08
7094	69	0	69	R 350.93
7104	58	2	56	R 285.32
7163	88	5	83	R 422.65
7038	77	2	75	R 381.45
7130	44	1	43	R 219.72
7117	95	29	66	R 337.20
6958	72	3	69	R 349.41
6503	78	1	77	R 390.60
6486	61	3	58	R 296.01
6789	167	3	164	R 834.61
6686	66	14	52	R 262.44
6278	82	1	81	R 411.97
6059	49	3	46	R 231.92
			986	R 5 015.30

>1-50kl/month				
7161	35	3	32	R 161.73
7165	79	7	72	R 366.19
7181	32	4	28	R 141.90
6833	49	6	43	R 216.66
7287	50	4	47	R 236.50
7310	68	6	62	R 312.79
7147	59	3	56	R 286.85
6791	30	2	28	R 140.37
6669	41	3	38	R 190.73
6725	35	10	25	R 126.64
6635	45	1	44	R 222.77
5460	49	2	47	R 239.55
			520	R 2 642.69
>1-30kl/month				
7086	28	2	26	R 129.69
7100	25	3	22	R 111.38
7105	30	7	23	R 115.96
7185	19	7	12	R 62.56
7156	35	15	20	R 100.70
6743	28	20	8	R 42.72
			111	R 563.02
>1-20kl/month				
7093	11	5	5	R 27.46
7099	249	3	246	R 1 249.63
7162	10	4	6	R 28.99
7006	10	8	2	R 10.68
7064	68	2	66	R 335.68
7051	50	14	35	R 180.04
7124	7	5	2	R 9.15
7121	11	8	2	R 12.21
7119	20	9	11	R 56.45
7113	9	9	0	-R 1.53
7109	14	5	9	R 44.25
7155	17	10	7	R 33.57
7153	170	3	167	R 849.87
7151	13	7	6	R 30.52
7145	9	4	5	R 24.41
6980	12	5	7	R 33.57
6534	117	23	94	R 477.58
6633	39	5	34	R 172.42
6357	56	10	47	R 236.50
6253	80	25	55	R 280.75
6066	11	4	7	R 33.57
6067	29	7	23	R 114.44
6090	16	3	13	R 65.61
6090	16	3	13	R 65.61

6083	132	4	128	R 653.04
			<b>988</b>	<b>R 5 024.46</b>
<b>1-6kl/month</b>				
7087	1	3	-2	-R 12.21
7088	9	6	3	R 15.26
7062	5	3	2	R 9.15
6945	4	4	0	R 1.53
7131	4	3	1	R 3.05
7120	5	1	4	R 19.84
7150	4	3	1	R 3.05
6986	5	3	2	R 10.68
6522	41	2	39	R 196.83
6214	60	4	56	R 286.85
6306	20	1	19	R 94.60
6252	45	9	36	R 183.10
6474	30	1	29	R 149.53
			<b>189</b>	<b>R 961.25</b>

7 985      R 40 613.74  
 95824.8      R 487 364.93

This was only for the recorded meters (93) they did retrofitting at 700 households – Possible savings 700 000m<sup>3</sup> = R3 500 000/annum

## WATER CONSERVATION/ WATER DEMAND MANAGEMENT ACHIEVEMENTS

The ongoing WC/WDM interventions in the Metro have resulted in the reduction in real losses as indicated below.

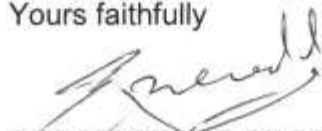
Financial year	2009/10	2010/11	2011/12
Volume treated (kl)	94 036 270	87 755 000	91 700 100
Revenue volume (kl)	58 484 000	52 501 520	58 656 520
NRW (%)	37.8	40.2	36.0
Real losses (MI)	27 560	22 961	19 272
Real Losses (%)	29.3	26.2	21.0

Comparing 2010/11 and 2011/2012 financial years, a reduction of (22 961 MI - 19 272 MI = 3 689 MI) in real losses was achieved.

At the current (2011/12) water tariff of R 6,60 per kl, the saving over 12 months equals : R 6,60 x 3 689 000 kl = R 24 347 400.

The reduction of losses over the last 2 years amounts to: 27 560 – 19 272 = 8 288 MI or 11.35 MI/day. This figure represents 30% of the goal set by the Algoa Water Resources Reconciliation Study to reduce losses by 37.5 MI/day over a period of 5 years.

Yours faithfully



**S.GROENEWALD ON BEHALF OF  
ACTING EXECUTIVE DIRECTOR :  
INFRASTRUCTURE & ENGINEERING**

**SOMETHING'S WRONG!!!**



IT IS OUR COMMON RESPONSIBILITY



And sometimes results may exceed  
our most optimistic expectations!

**THERE IS NO LIFE WITHOUT WATER**

**GOD PUT US ON EARTH TO  
MANAGE THE EARTH. ARE  
WE?**

**MAKE WC/WDM A WAY OF  
LIFE!!**

