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# Water Theft in the City of Cape Town:
## An overview of problems and processes to counter theft

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## 1. SYNOPSIS

The City treats water in excess of 300 000 Ml per year. Metered water to consumers is in excess of 250 000 Ml per year. This water is distributed through over 10 000 km of pipelines. Unaccounted for water (UAW) is currently at just under 22% of water produced. Within the UAW percentage lies a small amount that can reasonably be attributed to water theft. Strategies to counter the theft of water are briefly discussed and generally fall under the development and monitoring within District Meter Areas (DMA's).

## 2. DESCRIPTION OF METRO'S WATER RETICULATION

Inclusive of bulk water mains, the metro has just over 10 000 km of water mains. The majority of these water mains are reticulation mains which have water connections off them. These water mains are serviced by approximately 120 reservoirs and tanks of various sizes from 650 Ml down to a few kilolitres.

The most striking feature of the reticulation is how large reservoirs feed directly into a very large network covering flat areas (Cape Flats) where the majority of the metro's consumers are situated. This can have an implication on how water theft is managed. It also has some positive implications on the location of sites where infrastructure to aid water theft has not been installed professionally.

The large integrated network located on the Cape Flats also provides challenges for the maintenance of water quality standards. (Cape Town was adjudged as having the highest water quality in the country in the recent DWAF Blue Drop water quality audit initiative). The location of District Water Metering areas has to be carefully considered so that the quality of water is not impacted on. The large network needs a continuous circulation of water through it so as to maintain water quality.

A fair portion, probably in excess of 50%, of the reticulation mains are located in roadways under the road pavement. This has the advantage of inhibiting excavations to the water main in order to make a direct illegal connection on the main.

## 3. METRO'S WATER TARIFFING STRATEGY

The metro is located in what is termed by Department of Water Affairs and Forestry, a water scarce area. The location of current raw water sources have resulted in the metro's water costs remaining generally on the low side when comparing to other areas in the country (raw water quality, pumping costs).

However, the development of new water resources is becoming more and more expensive as the City expands.

In order to curtail demand, steeply rising single erf domestic residential stepped tariffs, were employed as Water Demand Management mechanisms by some previous municipal entities that now form part of the Metro, have been adopted throughout the current Metro. In addition to this, volumetric sewage tariffs have been linked to the water consumption. (See Attachments 1 and 2 for the current 2008/09 water and sewage tariffs).

The effect of these tariffs is that, for single residential erven, at monthly water consumptions between 40 and 50 kl water per month, the actual cost of water and sewage is R22,77 kl, excluding VAT. The combined kilolitre charge either side of this consumption bracket is less, but nevertheless, the value of the commodity is established.

Traditionally, before the steeply rising single erf domestic residential water tariffs, Cape Town water was regarded as relatively cheap. Lifestyles were centred around these cheap tariffs leading to the establishment of "thirsty" gardens in many households. The sustenance of a "thirsty" garden is especially telling in the long hot and dry Cape summers.

The effect of traditionally low water charges also had its effect on the establishment of "thirsty" industries in the Cape (e.g. textiles, agriculture, food). The combined water and sanitation charges in this category of consumption is R13,58 kl plus VAT. In concerns where there is a high water consumption, the value of the water and sanitation commodity is very noticeable.

Similar values can be derived for the "Domestic Cluster" tariffs.

In all the above, the "rewards" of water theft can be substantial.

## 4. THE CAPE METRO'S WATER CONSUMPTION AND MONITORING UNACCOUNTED FOR WATER (UAW)

*While the SABS 0306: 1999 standard strongly discourages the use of percentage losses only to quantify water losses in the distribution network (litre/hour/km is the recommended measure of unit losses), available information has been used as below to approximate the level of distribution losses in the City's network*.
Using water and billing figures, the distribution losses in the overall network is 21.7% (5 777 175 kl) on a 12-month moving average basis, as tabulated in the table below. The Bulk Water losses versus the Reticulation losses are indicated as 6.3% (1 680 818 kl) and 17.9% (4 013 508 kl) respectively. The industry-standard norm of using the smoothing 12-month average and not the month-on-month data is that meter readings billed in a particular month do not necessarily reflect outflows in the same period that the inflow occurred; depending on what day meters were read, billing adjustments and the duration of storage of potable water before consumption. This methodology is being used for reporting purposes until the envisaged more accurate water audit study is completed.

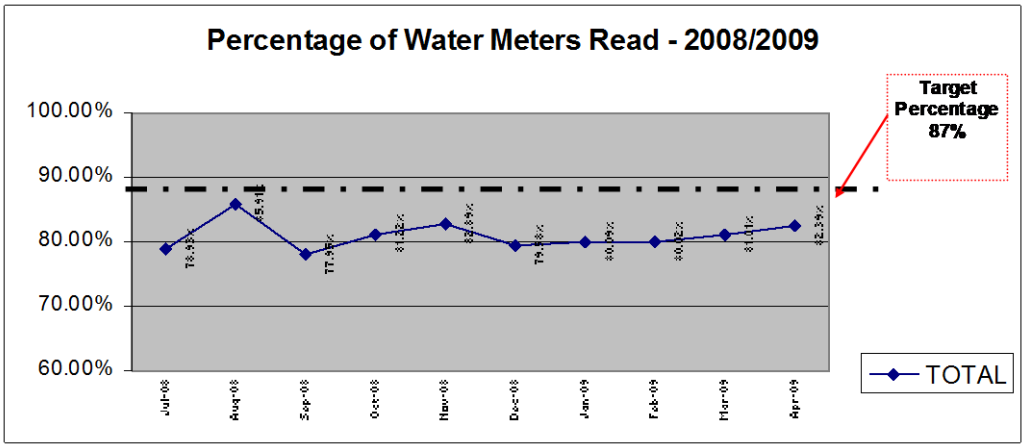
## 4.1. Overall potable water losses

| | Overall Potable Water Losses | | | | 12-month moving average | | | |
|---|---|---|---|---|---|---|---|---|
| **Month** | **Water Treated (kl)** | **Potable Water Supplied to all end consumers (kl)** | **Total Potable Water Losses (kl)** | **Total Potable Water Losses (%)** | **Water Treated (kl)** | **Potable Water Supplied to all end consumers (kl)** | **Total Potable Water Losses (kl)** | **Total Potable Water Losses UAW %)** |
| Jul'07 | 22 266 222 | 16 969 104 | 5 297 118 | 23.8% | 25 831 728 | 20 691 336 | 5 140 391 | 19.9% |
| Aug'07 | 21 815 939 | 19 272 624 | 2 543 315 | 11.7% | 25 882 221 | 20 857 289 | 5 024 932 | 19.4% |
| Sept'07 | 22 564 640 | 16 370 651 | 6 193 989 | 27.4% | 25 862 613 | 20 748 638 | 5 113 975 | 19.8% |
| Oct'07 | 26 652 300 | 19 502 803 | 7 149 497 | 26.8% | 25 975 705 | 20 758 489 | 5 217 216 | 20.1% |
| Nov'07 | 26 063 479 | 19 734 089 | 6 329 390 | 24.3% | 25 914 217 | 20 808 891 | 5 105 325 | 19.7% |
| Dec'07 | 29 977 404 | 21 787 867 | 8 189 537 | 27.3% | 25 932 520 | 20 949 749 | 4 982 771 | 19.2% |
| Jan'08 | 31 302 600 | 28 046 018 | 3 256 582 | 10.4% | 25 848 844 | 21 126 082 | 4 722 763 | 18.3% |
| Feb'08 | 28 938 158 | 24 843 497 | 4 094 661 | 14.1% | 25 943 714 | 21 088 873 | 4 854 841 | 18.7% |
| Mar'08 | 31 310 205 | 23 564 893 | 7 745 312 | 24.7% | 26 081 277 | 21 136 188 | 4 945 090 | 19.0% |
| Apr'08 | 27 731 456 | 25 847 196 | 1 884 260 | 6.8% | 26 210 851 | 21 377 237 | 4 833 614 | 18.4% |
| May'08 | 24 712 321 | 20 517 358 | 4 194 963 | 17.0% | 26 287 769 | 21 299 249 | 4 988 520 | 19.0% |
| Jun'08 | 22 220 573 | 20 094 982 | 2 125 591 | 9.6% | 26 296 275 | 21 379 257 | 4 917 018 | 18.7% |
| Jul'08 | 23 156 962 | 17 040 788 | 6 116 174 | 26.4% | 26 370 503 | 21 385 231 | 4 985 272 | 18.9% |
| Aug'08 | 23 396 545 | 15 762 395 | 7 634 150 | 32.6% | 26 502 220 | 21 092 711 | 5 409 509 | 20.4% |
| Sept'08 | 22 463 952 | 17 938 728 | 4 525 224 | 20.1% | 26 493 830 | 21 223 385 | 5 270 445 | 19.9% |
| Oct'08 | 26 829 322 | 18 204 311 | 8 625 011 | 32.1% | 26 508 581 | 21 115 177 | 5 393 404 | 20.3% |
| Nov'08 | 26 456 049 | 21 802 326 | 4 653 723 | 17.6% | 26 541 296 | 21 287 530 | 5 253 766 | 19.8% |
| Dec'08 | 30 423 744 | 19 055 812 | 11 367 932 | 37.4% | 26 578 491 | 21 059 859 | 5 518 632 | 20.8% |
| Jan'09 | 32 470 840 | 26 132 346 | 6 338 494 | 19.5% | 26 675 844 | 20 900 386 | 5 775 458 | 21.7% |
| Feb'09 | 30 795 045 | 23 338 590 | 7 456 455 | 24.2% | 26 830 585 | 20 774 977 | 6 055 608 | 22.6% |
| Mar'09 | 29 753 877 | 26 411 799 | 3 342 078 | 11.2% | 26 700 891 | 21 012 219 | 5 688 672 | 21.3% |
| Apr'09 | 27 361 024 | 24 774 712 | 2 586 312 | 9.5% | 26 670 021 | 20 892 846 | 5 777 175 | **21.7%** |
| **YTD Avg** | **26 757 394** | **21 227 859** | **5 529 535** | **20.7%** | | | | **21.7%** |

## 4.2. Percentage of Water Meters Read

In order to establish an accurate balance between water produced and water metered to consumers, accurate, timeous and universal meter reading is essential. Meter reading statistics reflect the following:

### Status of Meter Reading



The water meter reading percentage achieved for April 2009 amounts to 82.39%.

Accessibility of meters for meter reading is a major constraint in increasing monthly meter readings.

### 4.3. Unaccounted for water in relation to water theft

In order to have a bulk assessment or estimation of the volume of water theft, one has to consider that the Unaccounted for Water (UAW) factors influencing UAW are many and include the following:

- accuracy of metering (most accurate metering at purpose designed and sized meters).
- quality of infrastructure (leakage through burst mains, leaking valves, leaking mains).
- water quality considerations (mains flushing, cleaning).
- accuracy of meter reading as a whole (estimated individual consumptions remains estimations until substantiated, sometimes only after months of estimations).
- universal water metering (in instances meters get installed some time after house occupancy).
- percentage meters read in a month.

Considering all the above, the Metro's current UAW% of 21.7% compares approximately with the following areas (as quoted from the World Bank, Water and Waste Water Utility indicators, May 1996):

| | |
|---|---|
| Brazil average | 39% |
| Canada average | 15% |
| Japan average | 11% |
| USA average | 12% |
| Australia* average | 15% |

*Water Services Association of Australia 1998

Considering the current state of equalization of infrastructure and infrastructure maintenance in the Metro, it can be concluded that there is a strong possibility that the theft of water could be on the increase.

## 5. STRATEGIES FOR THE DETECTION OF THEFT

The developing strategy for the detection of water theft is through the establishment of District Metering Areas (DMA's). A district metering area consist of ideally around 5 000 properties. The principle employed is that water entering the area is accurately measured and water consumed is accurately measured.

The difference between these two quantities (UAW) is assumed to be lost through system losses and possible theft.
This UAW figure would then be compared with system maintenance within the period in question and would result in further interventions such as specialised leak detection inclusive of water theft.

The implementation of this strategy is currently taking place within the City with respect to the installation of the required infrastructure. It, however, still requires the improvement of actual meter reading, the coincidence of meter reading with the reading of DMA meters and the formalizing of staffing complements to interpret and investigate outcomes of findings.

In the absence of the full implementation of such a strategy, the following methods have revealed theft sites:

(i) Meter readers finding reversed meters and meter by-passes.
(ii) Members of the public (generally aggrieved staff or household members reporting incidents of theft).
(iii) Water Inspectors and maintenance staff noticing unmetered water usage on construction sites.

## 6. CASES

Some of the more prominent cases brought to the writer's attention are as follows:

### 6.1. Theft of water by a farmer

A water main running along a road verge and surrounded by bush was illegally tapped and a 50 mm leading was taken off the water main. Water used in this instance was for agricultural practises. The matter taken down legal channels and a settlement was arrived at (it was estimated that approximately R2 million of water could have been stolen).

### 6.2. Meter by-passing in high income area

A meter reader doing his rounds noticed this and the by-pass was reported to Council's audit division and the by-pass was removed. The house had recently changed ownership.

### 6.3. Theft sites revealed in a large housing estate

During the systematic mains replacement in a large low income housing estate, incidents of potable water were noticed coming from abandoned mains. What transpired was that reverse flows from the new main to the abandoned main through illegal and unmetered water connections occurred. Knowledge of these connections were understandably denied by the current tenants.