IWA WATER LOSS CONFERENCE 2012

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Title of Presentation: Assessing UFW and Variable Water Rate Impacts, Use And Loss Metrics in a Declining Water Consumption Environment

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Water utilities in North America have recently experienced significant downturns in water consumption arising, in large measure, from the economic slowdown and the effectiveness of water efficiency strategies implemented over the last few of years. The information presented in this study of water production, use and loss trends in Ontario Canada, is likely characteristic of many other countries that have experienced a similar recent economic downturn affecting water use. Other influencing factors include behavioural changes arising from water conservation initiatives, and reduced water losses resulting from asset replacement or active leak control loss reductions.

Issues with Unaccounted-for Water Loss (UFW)

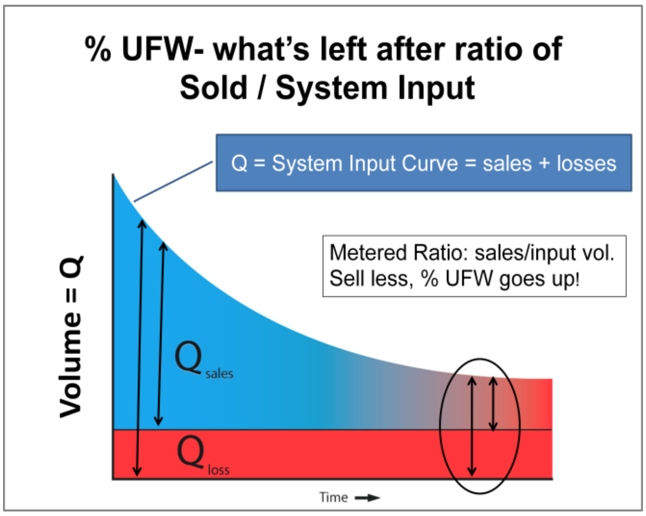
IWA has advocated the use of infrastructure leakage index (ILI) as the preferred performance benchmark comparator between utilities for water losses. The historical use of percentage UFW loss has been discouraged as a best practice, but is still used by many utilities throughout the world to evaluate water loss.

The issue of using UFW as a performance metric is the general application of percentages estimates to reduce these unaccounted-for figures that include a variety of general rules of thumb to write off water use or losses. UFW has no generally accepted standard definition. Consequently, utilities typically apply a wide variety of estimates to account for water use and losses. As a result, little confidence can be achieved from using percentage UFW as a comparator of system performance between utilities that typically will not use the same parameters, percentages to assess water use and loss in the evaluation period.

Unaccounted-for water may be generally defined as the remaining percentage ratio from the sold volume of water to customers, divided by a system input (water produced). In other words, the remaining component of the metered ratio, expressed as a percentage. The significant issue with this metric is the more water that a utility sells will have the consequence of reducing the UFW percentage. Correspondingly, if water sales decrease with the same amount of system input, the percentage of UFW goes up. The relationship of system input and water consumption may have little to do with the actual volume of water that is lost.

Chart 1 provides an illustration of this concept. The declining system input and sales, moving from left to right over time across Chart 1 will have the effect of reducing the ratio of water sales to production. If one assumes a reasonably consistent level of the volume of water lost, UFW percentages, in fact, go up while consumption goes down. This may have little bearing on the actual losses in the system. The illustrative example in Chart 1 is reflected in the various utility trending examples shown in Figures 1 to 10, where the general decline in water production and consumption is manifested with an increase in UFW trends over the same period of time. As well, other examples are provided that show where increased water production and consumption sales have a somewhat downward influence, or trend in UFW calculation results.

Chart 1



UFW – Accounting Cheat Sheet for Those so Inclined

The purpose of Chart 2 is to highlight where some utilities have taken extreme liberties to reduce UFW for the purposes of demonstrating to their board or public that they don't really have a leakage problem. If there is no demonstrated problem, then there will no urgency to implement different practices and make investments in resources, training, infrastructure or reporting practices to governing boards or agencies. Chart 2 is a consolidation of the overly generous accounting "cheat sheet" that has been assembled from reviewing water write-off statistics that have been applied by utilities around the world. It provides a visual interpretation of "stretching the accounting" of water use and loss to the point where some utilities have written down upwards of 20% of their water loss to the application of these overly generous rules of thumb for non-revenue water accounting before reporting UFW results.

Chart 2

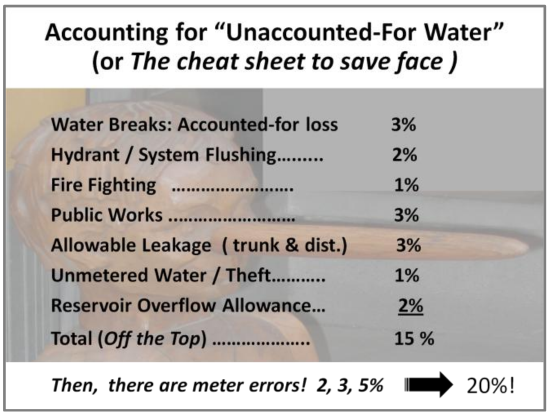
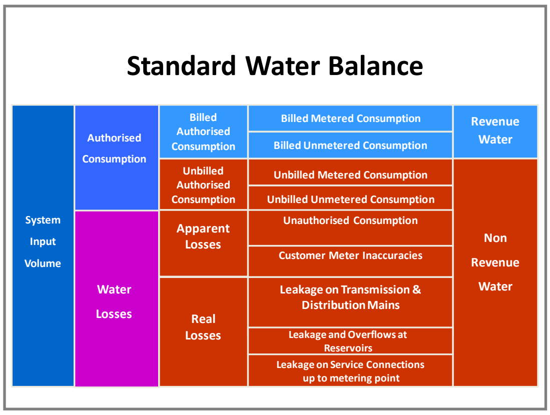


Chart 3



The author does not support this application of percentage water write-offs for these various categories. The IWA provides a standard water balance (illustrated in Chart 3) that captures all of the elements of billed and unbilled water accounting and the assessments of real and apparent water losses, using international standard definitions in the process.

Unfortunately, utilities continue to use UFW and apply generous write-offs that produce unaccounted-for figures to suit their purpose. There is little credibility that can be achieved from utilities that utilize such write-offs for UFW.

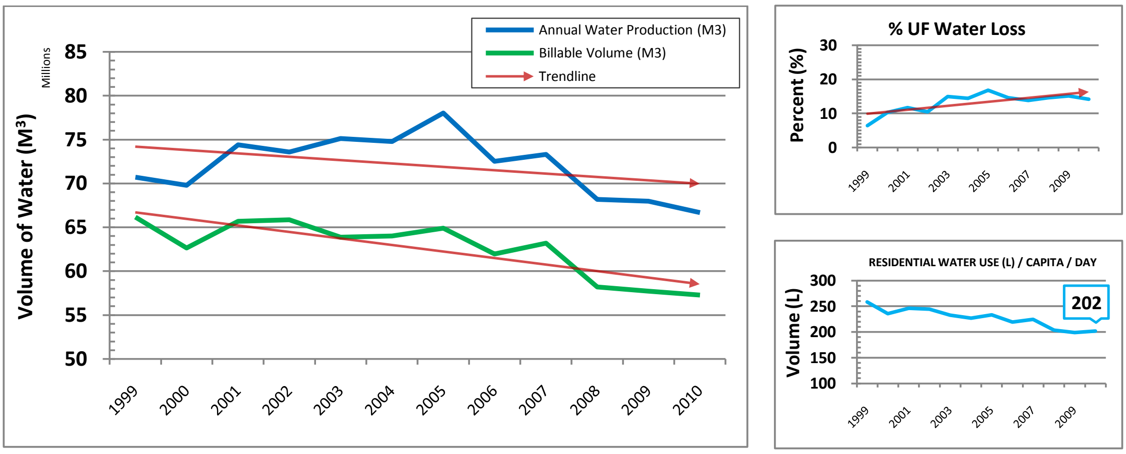
The most significant barrier to address water losses is the realization that a water loss or leakage conditions exist. In the absence of a standard water balance and evaluation of the volume of water that is lost, utilities will likely not undertake a new priority initiative or investment to address real or apparent losses in their system. The standard water balance is the first step in providing a scientific and rational basis to evaluate the water that is produced, consumed and measured to determine the extent of real or apparent losses in the water system. The importance of using standard terminology and the standard water balance are the necessary first principles to be taken by a utility in determining the next strategic steps to maximize revenue and reduce real and apparent priorities.

Study Data Sets

The data set comprises ten of the largest wholesale and retail water providers in the Province of Ontario, supplying water to over seven million residents. This recent 10-year data set (where available) of system input trends will illustrate the general downward trend in water production, billable water use and associated trends in per capita water conservation impacts during the same time period. The charts also illustrate the UFW loss calculation that demonstrates the relationship between reduced water production and consumption and, generally, a corresponding rise in the UFW values.

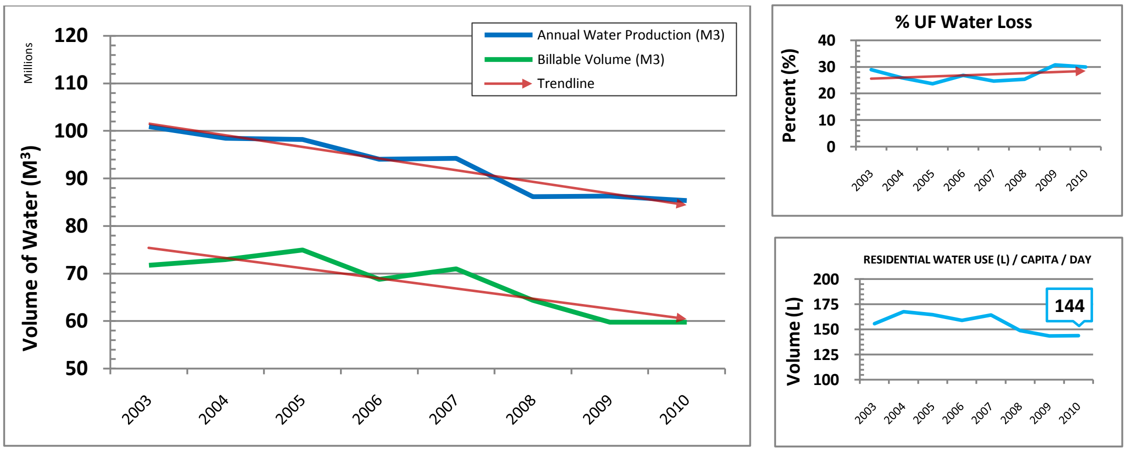
Water production, billable water and residential per capital use is displayed in the following trend charts. In addition, each data set also includes population trends over the assessment period, the existing population, 2010 per capita water use and system input data on a per capita basis. A calculated percentage UFW chart is also plotted over the same timelines for rate formulation and use trends.

The charts also indicate that customer growth has been accommodated or mitigated through reduced volumetric demand via residential and ICI sectors. In municipalities with higher growth trends, declining water consumption has buffered the overall increase in production.



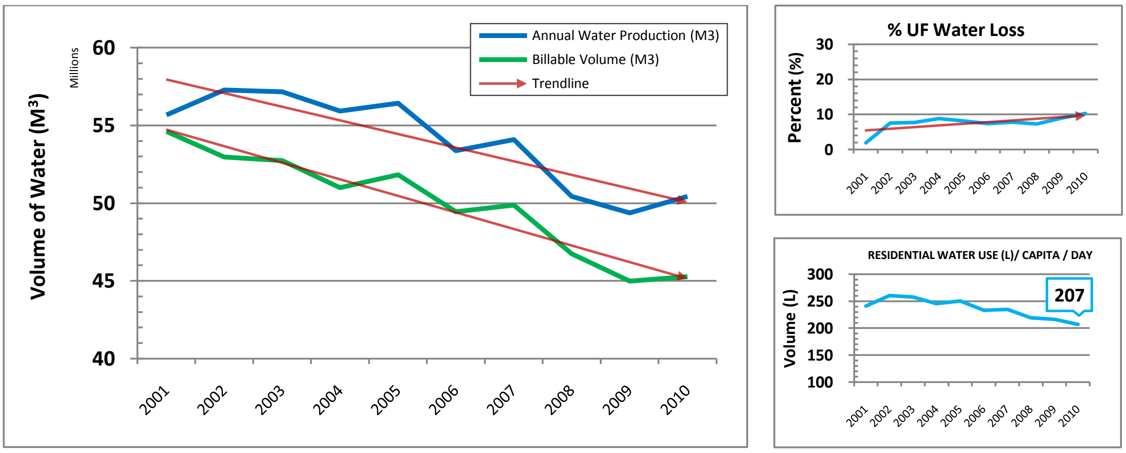
2010 population & ▲over period:	**578,421; 29.6%**	Residential water use(L) / capita / day in 2010:	**202**
Daily production(L) / capita in 2010:	**316**	Density of connections / km:	**68**

Figure 1: Water Production/Consumption and UFW Trends – Durham Region, ON



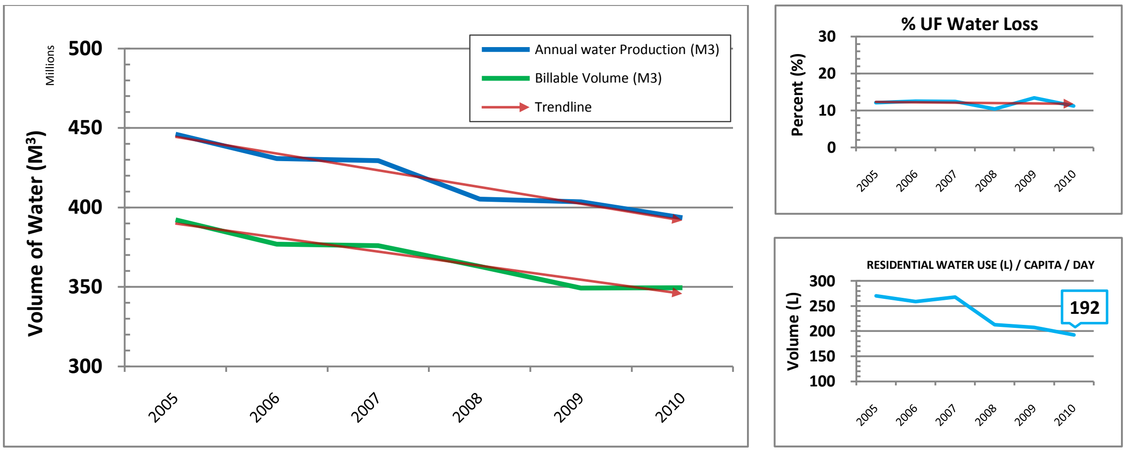
2010 population & ▲over period:	**528,502; 7.86%**	Residential water use(L) / capita / day in 2010:	**144**
Daily production(L) / capita in 2010:	**442**	Density of connections / km:	**71**

Figure 2: Water Production/Consumption and UFW Trends – Hamilton, ON



2010 population & ▲over period:	**363,080; 7.89%**	Residential water use(L) / capita / day in 2010:	**207**
Daily production(L) / capita in 2010:	**381**	Density of connections / km:	**71**

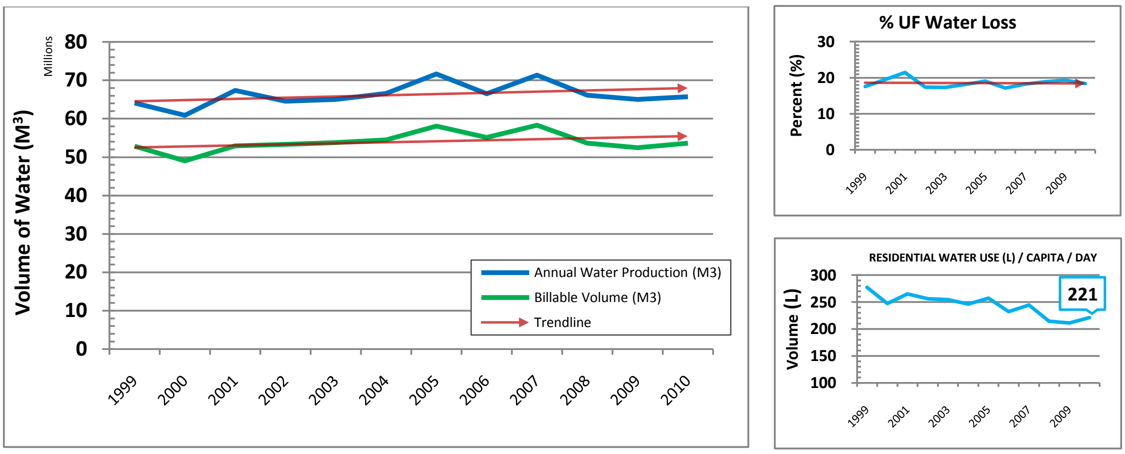
Figure 3: Water Production/Consumption and UFW Trends – London (City), ON



2010 population & ▲over period:	**2.59 M; 3.97%**	Residential water use(L) / capita / day in 2010:	**192**
Daily production(L) / capita in 2010:	**415**	Density of connections / km:	**85**

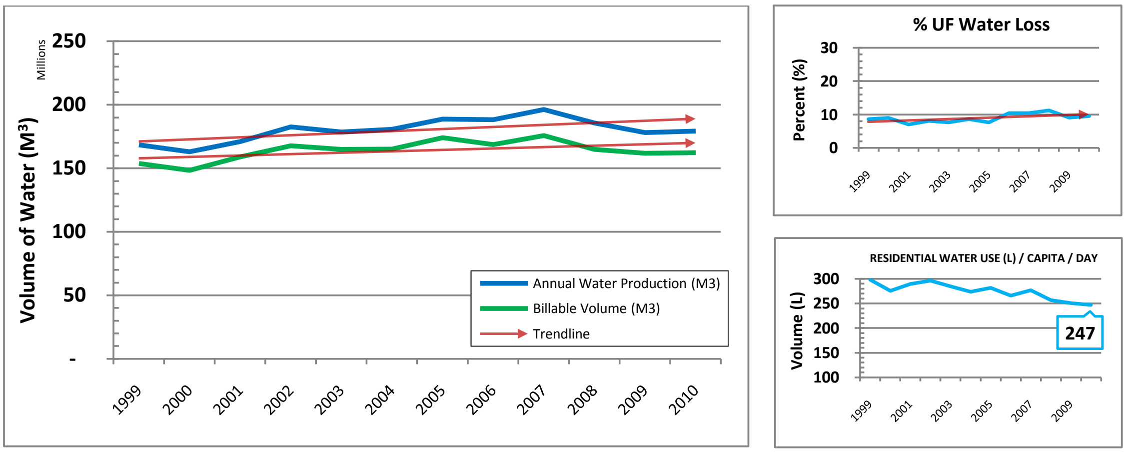
Figure 4: Water Production/Consumption and UFW Trends – Toronto, ON

Data set Figure 5 - 6 indicates those high or growth utilities that have a modest increase in water production and billable water trends.



2010 population & ▲over period:	**465,469; 33.44%**	Residential water use(L) / capita / day in 2010:	**221**
Daily production(L) / capita in 2010:	**387**	Density of connections / km:	**69**

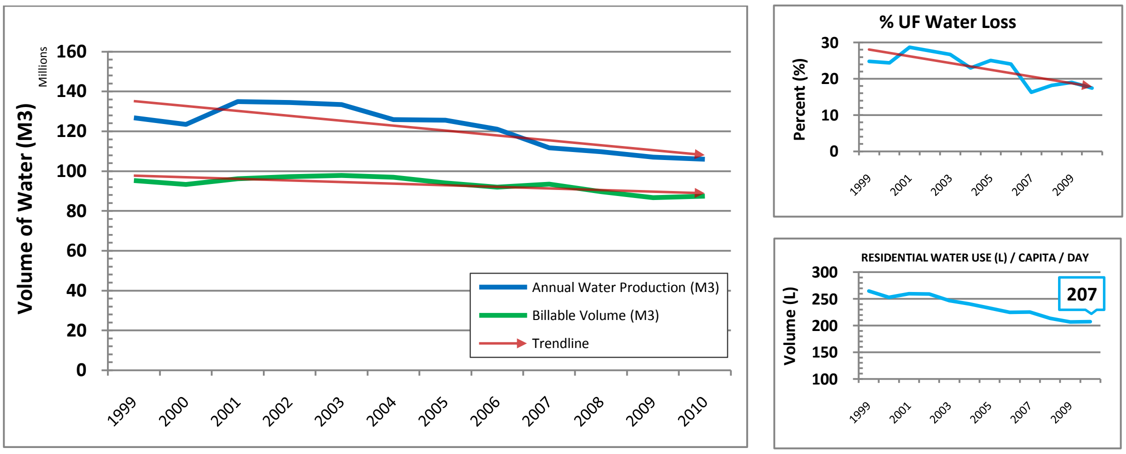
Figure 5: Water Production/Consumption and UFW Trends – Halton Region, ON



2010 population & ▲over period:	**1.24 M; 32.82%**	Residential water use(L) / capita / day in 2010:	**247**
Daily production(L) / capita in 2010:	**396**	Density of connections / km:	**71**

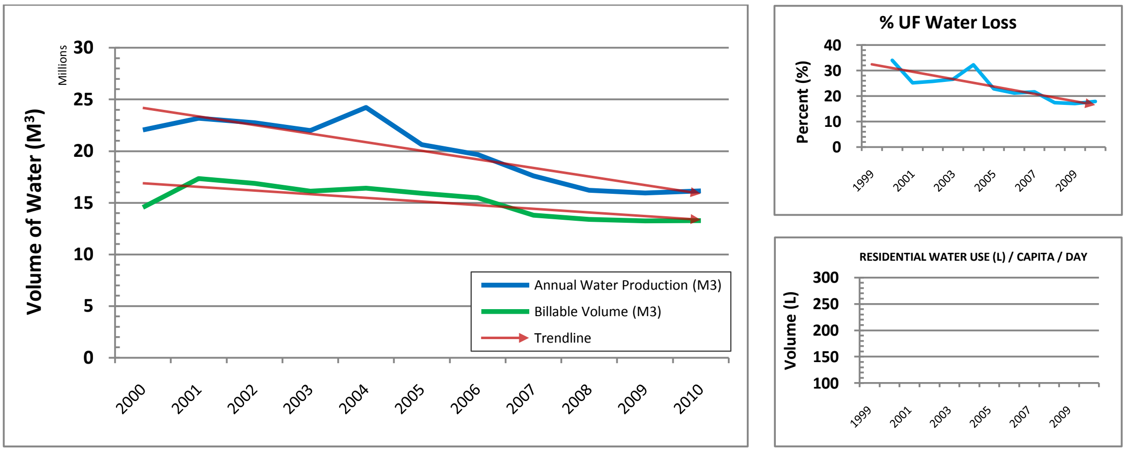
Figure 6: Water Production/Consumption and UFW Trends – Region of Peel, ON

Data set Figure 7 illustrates a situation in Ottawa where declining production and billable water is shown, as well as reductions in real water loss evident in the converging production and billing trend lines.



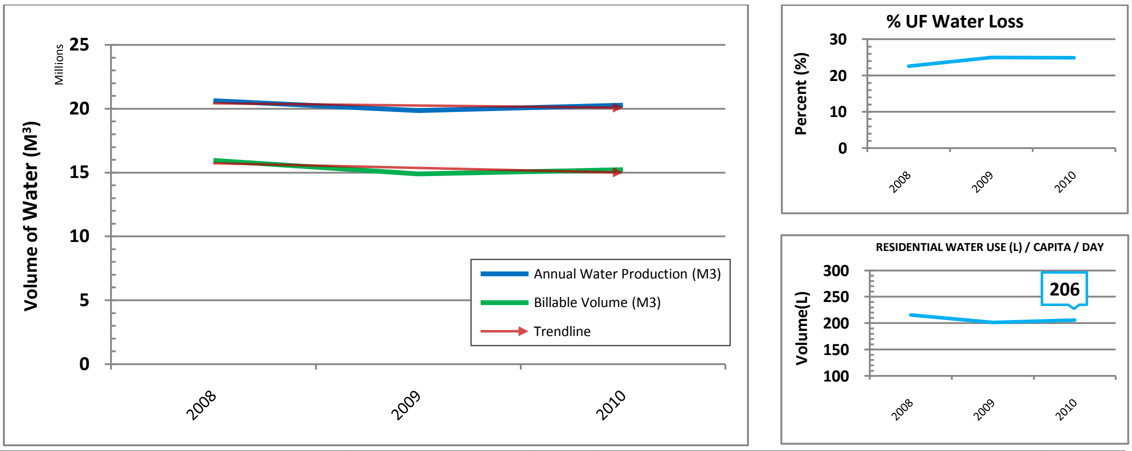
2010 population & ▲over period:	**832,649; 18.37%**	Residential water use(L) / capita / day in 2010:	**207**
Daily production(L) / capita in 2010:	**349**	Density of connections / km:	**62**

Figure 7: Water Production/Consumption and UFW Trends – Ottawa, ON



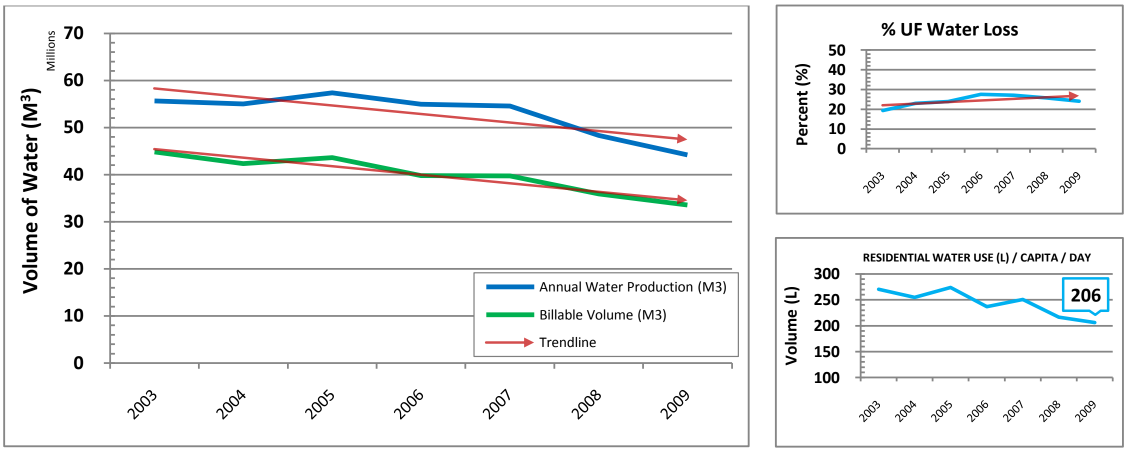
2010 population:	102,000	Residential water use (L) / capita / day in 2010:	n/a
Daily production (L) / capita in 2010:	434	Density of connections / km:	51

Figure 8: Water Production / Consumption and UFW Trends - Thunder Bay, ON



2010 population:	133,640	Residential water use (L) / capita / day in 2010:	206
Daily production (L) / capita in 2010:	416	Density of connections / km:	64

Figure 9: Water Production / Consumption and UFW Trends – Sudbury, ON



2009 population & ▲over period:	218,623; 4.50%	Residential water use (L) / capita / day in 2009:	206
Daily production (L) / capita in 2009:	554	Density of connections / km:	n/a

Figure 10: Water Production / Consumption and UFW Trends – Windsor, ON

Data Use Summary – Getting the Right Numbers

Referring to the Tables' data, system input tracking and consumption trends, declining billable water has an inverse influence on UFW results. That is, less water sold had an upward pressure on UFW results and, where billable water sales increased, there was a downward influence on UFW.

In compiling the information, a summary of the system input volume and residential use has been consolidated in Chart 4, which displays the system input on a per capita basis and in litres per capita per day. The system input data sets the context in terms of providing a source water perspective. In Ontario, the Ministry of the Environment has been reviewing proposed targets for water use and conservation results. Although no specific targets have been established, it is envisioned that a residential use objective will be set in the order of 150-175 litres per capita per day. The average residential daily use across the nine regions is also calculated at 204 litres per capita per day. The water consumption trend in Figures 1-10 illustrates a remarkable reduction in per capita use over the past 10 years. These results and trending data indicate that the Provincial target for water efficiency will be achieved in the near future. The system input and average residential use on a per capita per day basis can be used illustrate the overall source withdraw (input volume) in contrast to the per capita use.

Chart 4

Ontario Survey Summary	System Input /Capita (10 Regions)	Average Residential Use / Capita (9 Regions)
Litres / Connection / Day	1394	N/A
Litres / Capita / Day	409	204

Average Connection Density (9 Regions)	68 connection/km	Average System Pressure	47 metres

But, do we have the metrics right? The regulatory authority, whether at the local, state, provincial or national level, should have clear policy objectives, which include the appropriate metrics that demonstrate or support those objectives. Metrics that reflect source water source abstraction, and water conservation use metrics that reflect behavioural change results in residential, commercial and industrial (ICI) sectors should be relevant with the policy and regulatory objectives within the authority's jurisdiction.

System input data, residential and ICI, or other customer consumption classifications, could also be tracked on a basis of litres per connection per day (l/conn./day). The application of litres per connection per day for residential properties would be valuable in setting the context of water use on a per connection basis. This metric can also be related to the IWA Water Losses Task Force minimum level of leakage in any operating system in terms of litres per connection per day. This has been described as the unavoidable annual real loss (UARL), which includes both background and minimum leakage run time losses, using the standard formula UARL.

A revised suite of metrics that relate to water production, consumption and losses on the basis of litres per connection per day may provide easy to understand comparators for how much water is put into the system, the volume of water consumed and the minimum level and actual level of losses on a litre per connection per day basis. The assembly of this suite of metrics provides a holistic perspective that can assist in an overall source water withdrawal metric, a water conservation and residential consumption behaviour metric, water leakage metrics and real water loss performance objectives (that inherently promote pressure reduction) for utilities considering a broader and integrated performance metric regime based upon a litres per connection per day.

Water Rates in a Declining consumption environment

Water rate structures typically have fixed and variable (volume metric rate) components of the water bill. The apportionment of the revenue requirements to the fixed (base charge) or the consumption (variable) component are set by the water utility.

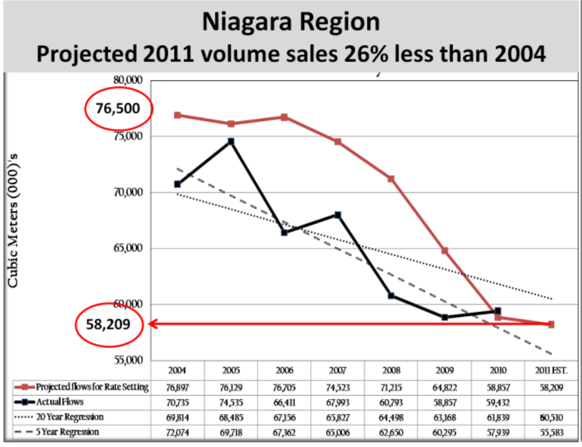
The declining trend in water consumption has resulted in a number of consequences, particularly with utilities that utilize a high weighting (50% or greater) towards the variable water rate in their consumer billing methodologies. In utilities that have embraced water conservation initiatives from as early as the 1990's, a high apportionment of the revenue requirement has been derived from the variable water rate component of the bill. In the Niagara Region, as a water wholesaler to 11 towns and cities, a 75% variable water rate was set, along with a 25% fixed component as the rate methodology to wholesale water to local area municipalities. The declining water consumption trend has resulted in a reduction in the revenue generated. This occurred as a consequence of the management board's direction to set the volume sales above the recent consumption levels despite a declining trend in residential consumption and ICI use from the Region's manufacturing base decline.

Public opposition to rate increases and the prevailing political climate of austerity influenced the management board to keep rates low, by approving optimistic metered sales that were not achieved. From a political perspective, this pressure to overestimate the volume sales, which results in a lower volumetric charge, may be easy for municipal boards or councils to approve. However, they have a significant impact on the potential for revenue shortfalls from overly optimistic volumetric sales to the customer base. This trend has continued for several years, resulting in an accumulated revenue shortfall to sustain utility operations.

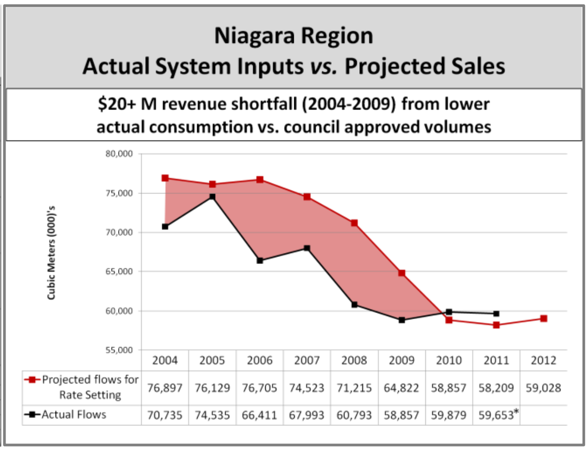
Graphs 1 and 2 illustrate the seven-year trends of projected and actual volumetric sales that were used to establish the volumetric consumption metered rate. Graph 1 illustrates a 26% reduction in the projected volume sales, from 2004 to 2011. The actual sales to area municipalities was also significantly lower during this timeframe. Actual sales were reduced by 16%, from 2004 to 2010.

Graph 2 demonstrates the revenue shortfalls that resulted from higher projected volumetric sales compared to the actual consumption and sales of water over that same timeline. Over $20 million of revenue shortfall occurred as a result of projecting higher volumetric sales, which corresponded to a lower volumetric rate during this timeline. If realistic projections of volumetric sales had been used, the utility would not have experienced such an accumulated deficit in revenue between 2004-2010.

Graph 1



Graph 2



Achieving the right balance of fixed and variable apportionment of the annual revenue requirement can mitigate the risk of revenue losses in a declining consumption environment. Accurate projections of water sales, based upon current trends in residential and ICI sector use patterns will support sales projection forecasts for required budget annual revenue. Utilities with a high apportionment of the revenue requirement to the variable charge should consider limiting the risk of reduced sales by increasing the fixed proportion in their billing methodology. This is particularly the case, if there is resistance to the approval of lower volumetric sales and a corresponding increase to the volumetric consumption water rate. Failure to balance the projected volume sales and secure the required volumetric rate through a low fixed rate apportionment methodology is a recipe for revenue deficit.

Conclusions

Recent water use trends in Canada reflect an overall reduction in per capita water consumption. UFW percentage is a poor performance indicator and is influenced by the trend of increasing or decreasing consumption volumes. In systems with a corresponding reduction in overall water system input, the UFW trend will tend to rise. In other systems, rising sales will tend to exert downward pressure on UFW percentages. The overall declining consumption trend has consequences for utilities that have a high variable water rate structure, where predicting sales volumes may be influenced by local politics and a customer base challenged by an economic environment of austerity. Recent and robust water use trend information and a scan of customer classification consumptions will provide valuable information to set the balance between rate methodology and projected volumetric sales and pricing to meet the strategic, operational and financial requirements of the utility.