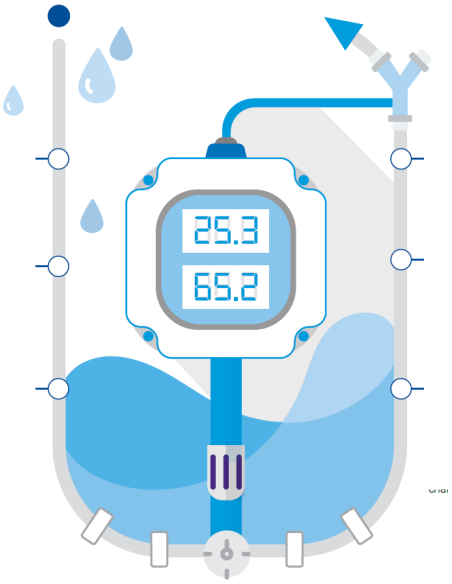
Water Meters, Conservation and Sustainability

City of Cornwall Draft Discussion Paper

Options for City Wide Implementation of Water Meters

November 2019

Water security is one of the most tangible and fastest-growing social, political and economic challenges faced today. World Economic Forum, 2014



Cornwall
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Corporate Report

Water Meters, Conservation and Long Term Asset/Rate Sustainability

For consideration

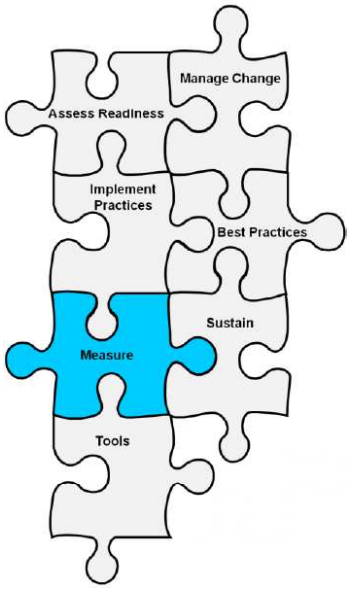
The City of Cornwall currently does not have water meters installed throughout the municipality. According to available information, Cornwall is the only provincial municipality of equal size or greater in Ontario without a citywide metering system.

Data from the latest Statistics Canada survey of drinking water plants "Residential water use declined 12% from six years earlier, from 251 litres per person per day in 2011 to 220 litres per person per day in 2017." While per capita use in Cornwall can only be estimated, the data suggests that our usage is approximately 450 litres per person per day in the residential sector.

Do water meters contribute value to the community?

"If you can't measure it, you can't improve it."
-Peter Drunker

This report describes and presents summary information of how water meters can contribute significant value to a community. This value is not obtained directly. For example, the installation of a water meter at a homeowner's property doesn't by itself save money or decrease rate increases. Although, the water meter is an essential element. The meter provides the information that lets everyone know where to look for improvements, where we create the most value and tells us when we can pat ourselves on the back, we are creating value and keeping things affordable (sustainability) while maintaining (conservation) what we have.



In other words, when we do many small things they act together to create something complicated. This report presents some of the pieces of the puzzle with water meters being a crucial piece, as it becomes the measurement tool.

Background

The City of Cornwall is the last municipality yet to adopt a consumption model, that is, pay for what you use. The primary benefit, as seen by customers, of a consumption model is equity. As payment is based on the volume or the amount of water used in a billing period. This model puts the resident and the Industrial, Commercial & Institutional (IC&I) sector in control of measuring their effort to reduce water consumption as daily/monthly water use is displayed in their billing. It is a choice based model. This will mean that some individuals would see a water bill decrease if they chose to use less water and those who chose to use more water for the things important to them, would pay more.

In addition, research on pay for what you use programs has shown to provide an economic incentive for behaviour change or modification. Water meters provide an economic poke.

A secondary benefit (close second) is the measurement tool that a water meter program provides. A city wide water meter program can measure the effectiveness of a conservation program, the effectiveness of a leak detection program, provide business case measurements for capital improvement programs and can provide data for prevention programs.

Water meters provide information

The water use information in it's various forms within the Urban Water Cycle is the first step in water management and is key to helping both the municipality and users understand how much water is being used and where.

Key questions for water usage include:

- Where is the water going?
- How much water is lost between withdrawal from the St. Lawrence and delivery to the customers? (both residential and IC&I)
- How much revenue is lost? Or how much water is lost through leaks?

Water Audits: Leak Detection and Revenue Loss Minimization

Without municipal wide use of water meters it is difficult to measure the water loss to the environment through leaks or other forms of loss. Water that is not delivered to a customer is an expense to the system and a waste. Reducing loss saves operating costs of the water treatment, distribution systems and the wastewater treatment plant. System water losses average 13 per cent across Canada, ranging from 7.5 per cent to 21 per cent. The MECP recommends a goal of 10% or less average water loss.

Halifax Water, as an example, through methodically tracking flows and leaks through standardized water audits, has reduced the amount of water the system requires with annual savings of $600,000, partly due to the need to pump less water and use fewer chemicals in water treatment.

By limiting unnecessary or wasteful source water withdrawals, water authorities gain financial benefits through improved revenue recovery, less wear and tear on infrastructure, fewer service disruptions, and improved system integrity.

Water Meters and Conservation

In general, water meters are thought of as a method to decrease demand. Although, the benefits are more nuanced.

Beyond the obvious benefits of decreasing demand, water meters can help a municipality:

- Track progress in municipal water conservation monthly, seasonally and/or annually;
- Identify high water users and areas of water loss, often "low-hanging fruit" solutions where monetary resources can be directed;
- Estimate water use by sector and employ “narrowcasting” techniques;
- Showcase your progress by comparing numbers with other similarly-sized communities or a national average;
- Provide essential management information to system operators in both water and other utilities (e.g. energy) for improved efficiencies; and
- Use the collected data for better long-term Urban Water Cycle planning through forecasting future water use and where best to invest through cost/benefit studies.

The following link from the Grand River Conservation Authority, provides practices that municipalities can implement to reduce the demand for water.

(https://www.grandriver.ca/en/our-watershed/Demand-management-primers.aspx)

Conservation and it’s Effects on Behaviour

Water Pricing Report:

2009 Statistics found that households on a flat rate system use 52% more water (361 litres per person per day) than households paying per volume of water used (238 liters per person per day). Although, this is somewhat misleading, as the water meter only provides information. The behaviour change occurs when the volume information is coupled with a public outreach and incentive program that explains for example that the highest water usage in a home is the use of toilets. So a rebate for a toilet change gives the incentive to change the toilet and the customer can see the reduction in water usage reflected in their billings. The “pay for usage” is the incentive to look for opportunities to purchase water reducing items. Meters are the essential first step providing the need/want to reduce volume and either reduce costs or offset a rate increase (home or business).

Conservation and its Effect on Rates

Volume-based rates give customers some cost control as people can change how much water they use (habit and behaviour changes) and/or buy more efficient water appliances (e.g. washing machines and dishwashers) and fixtures (e.g. toilets, showerheads and taps). Volume-based rates also encourage water conservation to everyone's benefit.

There is a common misperception that water conservation is the main cause for annual water and wastewater rate increases. While it is true that the City would receive less volume-based revenue as customers use less water, conservation saves a community far more money than it costs, both at the utility (municipal) level and the individual (customer) level. For the municipality, major capital projects are delayed or eliminated and conservation saves operating costs at the Water Purification Plant (WPP) and Waste Water Treatment Plant (WWTP) with the two largest being chemical and energy savings which lowers rate increases.

For example, the City of Guelph reports their investment over the last 10 years of $10.2 million in water conservation and efficiency programs and resources has resulted in over 30 million in savings over that same period. That is, $30 million in savings for the water rate payers, their customers, both residential and IC&I. The savings come in many forms:

- from deferred infrastructure projects which are the annual capital projects such as:
  - New watermains in new developments, replacement watermains in older neighbourhoods, new pumping stations to get the water to new developments, new pumps in the water purification plant to get the treated drinking water to the new developments.

The water consumption savings through conservation efforts allows us to provide the water to the new projects with existing equipment.

- ✓ from operating costs
  - Reduced electricity costs for not having to pump additional water at the WPP and generated wastewater at the WWTP.
    - for example, being able to turn off a pump because it's not needed due to the reduced consumption.
  - Reduced chemical costs that would have been needed for treating the extra water and generated wastewater.

Rebates and Consumption Programs to reduce Water Usage

Residents play a role in the Urban Water Cycle - from reducing residential water use, reducing residential wastewater use to harvesting rainwater and helping manage stormwater. The research tells us that rebate, incentive, water audits and other forms of public outreach and engagement are needed to get the water consumption reductions after the economic poke. This behavioural nudge

or poke creates a cognitive awareness where positive reinforcement (incentives) and indirect suggestions (public outreach) are used as ways to influence the behavior and decision-making. In other words, people look for something to do once they've seen the information that comes with the installation of water meters and consumption billing.

- Community outreach is a fundamental first step for increasing awareness and gaining public support for water demand management.
- Develop a conservation incentive program whereby City residents can apply for rebates when they purchase a rain barrel that helps save water, energy, and money by using rain water for outdoor applications.
- Develop a conservation incentive program whereby City residents can apply for rebates when they purchase low flow toilets, low flow shower heads and facets and when they purchase high efficiency washing machines.

See Appendix A for some examples of rebate and incentive programs.

In a following section, a technology opportunity is described should the City decide to create a city wide drinking water metering system.

Opportunity Cost of a Water Meter and Conservation Program

Without a municipality wide metering program it is difficult to know what the water losses might be within the municipality. Typically measuring the water losses through water audits and using that information leads to:

- Lower maintenance and operating costs;
- Increased revenue;
- Positively impact wastewater treatment capacity;
- Deferral of expensive capital projects for water treatment and wastewater treatment demand;
- Improved repair planning schedules;
- Lower risk of property damage by improving underground safety (reduced likelihood of sink holes for example); and
- Increase public trust in the water utility through fewer water outages resulting from water main repair.

If our municipality chose to deploy the Advanced Metering Infrastructure (AMI) described later to perform daily and monthly water audits, this data generated by AMI would assist with the leak detection program and move the preventative maintenance program to more of a predictive maintenance system. As well, the AMI system allows for easy measurement of the effectiveness of the program and allows for quick adjustments to the program.

Based on estimates that have been realized when communities in Ontario and Canada have installed water meters and begun the programs of conservation and improved asset management, the savings that could be expected from the investment is explained in the following paragraphs.

In Cornwall, operational savings (chemical and electrical) from the Water Purification and Wastewater Treatment plants is estimated to be approximately $300,000 per year if the municipality could reduce from the current estimate of 400 liters per person per day to the 250 liters per person per day average as recorded in metered Ontario cities.

Based on estimates reported in Ontario and the American Water Works Association (AWWA), there could be an additional $70,000 per year in operational savings. This saving could be realized from the reduction in leaks if meter information were used for water audits and the data utilized in the leak detection. Un-metered systems with a leak detection program typically have on average a 15% water loss through leaks, while metered systems are on average 10%.

Reduced flow from water conservation will result in reduced wear and tear on equipment, however this is somewhat difficult to estimate as this is a life cycle cost of equipment with a long asset life. The cost of repair crews time for an unscheduled repair, inconvenience cost to residents or businesses if the water outage is significant could be estimated in the order of tens of thousands of dollars. The average cost of one water main repair in Cornwall is $7,000.

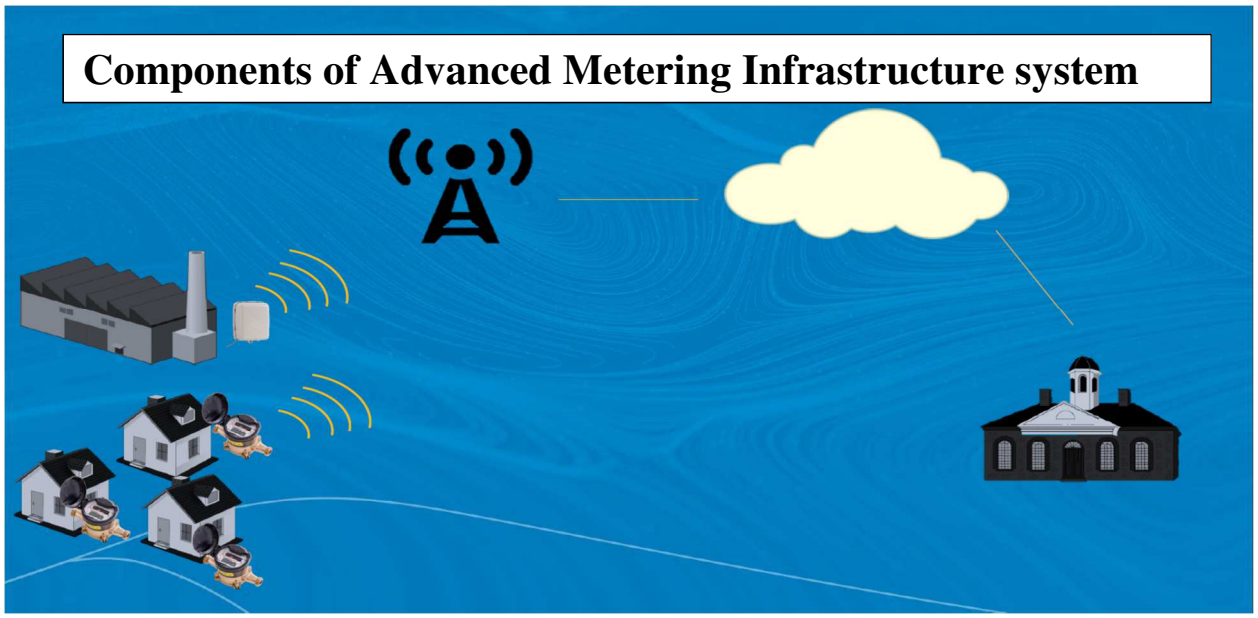
In summary, an investment in a water meter and conservation program would return significant savings over the 10 year forecast period. With the significant economic development potential of being “Open for Business” without the need for a significant capital project to increase treatment capacity. And as noted above, Guelph and every major municipality has realized savings greater than the investment.

2019 Technology Opportunities

It is likely interesting to consider that waiting until now to contemplate implementation of a water meter program allows the City to leap frog into technologies that are very efficient. For example, the technology described below which has only recently become available, collects the water meter data and transmits it to the billing software without the need for a technician to drive around the city and then upload the data.

The water meters now on the market allow for drive by or wireless communication options. The water meters currently installed in the City have first generation radio transmitters that require the Water Meter Technician to drive by at a low speed of less than 20 km/h. New meters allow for readings to be taken at normal vehicle speed (50 km/h) or transmitted to a wireless tower (like a cellphone tower) and transmitted directly to a computer.

Advanced Metering Infrastructure (AMI)



The system consists of a small, low-power radio frequency transmitter connected to your water meter that sends readings to a network of receivers throughout the system. These receivers provide all relevant billing information and eliminate the need for Water Meter Technicians to go door to door on a regular basis to manually take a meter reading. The Advanced Metering Infrastructure (AMI) system provides automatic meter reading as well as more accurate and responsive water consumption information to assist the municipality and customers in managing water use.

How it works

A small meter interface unit is integrated onto the water meter that combines radio and high resolution encoded register, replacing the old touch pad. It is connected to the water meter register located on your water meter and transmits a low-power radio frequency signal to a data collector which relays the information to the municipality's host software and then into Water Accounting software in taxation dept.

There is no personal data transmitted, only the meter read and the transmitter number. Once received by the municipality's host data management system computer, the data is paired with the billing account information and processed to create the utility bill.

What are the benefits of the AMI system?

There are two main advantages of AMI. One, Water Meter Technicians are focused on repair instead of meter readings and the AMI allows for a greater frequency of meter readings. Second,

the AMI system provides a web based account for users to login and see consumption and a place where notifications can be set up.

Upgrading to the AMI system will:

- Allow your meter to be read remotely.
- Improve customer service by providing timely data should reading/billing issues arise.
- The new smart meters will utilize an AMI system to provide remote meter reading, data analysis and alerts for possible leak or flow problems. This real-time data will help ensure bill accuracy, and allows municipal staff and residents the ability to detect potential issues and avoid unnecessary water costs. These wireless water meters allow homeowners to manage water consumption, mitigating high or unintended water usage.

By combining telemetry data and modeling information water utilities can gain a more complete and accurate picture of their systems hydraulic and water quality operation and performance capabilities.

Business Case

Where are we?

Residential properties use a flat rate structure based on the number of fixtures. Although, there are a number of volunteer residential water meters, these meters are read annually or as requested by the resident. In addition, the readings are only provided to the volunteer resident if requested.

The IC&I sector uses both a flat rate system and a consumption model. IC&I's have their consumption read twice per year. 900 IC&I accounts are on flat rate and only 311 are on consumption billing.

When considering options it is often useful to look at the process used for the business case. The status quo is summarized below. The following sections in the report presents information on how water meters would help create programs to reduce the risk elements for the business case. The report concludes with a recommendation to develop an implementation master plan.

The business case for a water meter master plan would compare the following options:

Option 1: Status Quo

This option maintains the current business practices of the water and wastewater systems.

The benefits of the status quo follow:

1. The rate structure is established.

2. The billing system is established.

3. Billings in the flat rate account are predictable and increase each year based on inflation and Long Term Asset Management deprecation calculations

Risk to the status quo follow:

1. MECP 2018-2019 Inspection Report recommendation "measures should be considered to promote water conservation. This could include studies of current practices to determine how much water would be saved by implementing conservation measures." The body of this report contains a small summary of the current best practices for water conservation programs.

2. The City's Drinking Water Quality Management System (DWQMS) is regulated by the MECP. A new update of the DWQMS (entitled DWQMS 2.0) puts greater emphasis on the external and internal audit process. To be able to audit a conservation program a measurement needs to be developed and implemented. How do you audit a conservation program without a measurement? The body of this report describes the current best practice for water meters which includes technology that allows for easy data collection from the water meters and a city wide program would allow the conservation to be measure for effectiveness and adjusted (through the DWQMS continual improvement process) to obtain real measureable conservation.

3. The current meters in service in Cornwall need to be upgraded. It would be more efficient and cost effective to upgrade these meters at the same time as a municipality wide program.

4. Water loss due to leaks is unknown.

5. Combined Sewer Overflows (CSO) were 101,674 m^3 in 2019. A reduction in water consumption would mean less water to the combined sewers which directly reduces the overflows and would free up pumping capacity at the WWTP which could be used to reduce CSO overflows.

Option 2: Status Quo with Conservation Plan

This option maintains the current business practices of the water and wastewater systems. The benefit being the rate structure is established.

The recommendation would be to introduce a rebate and incentive based on, for reference only, the Guelph model. These series of actions for toilet replacement, shower head replacement, water efficient appliances and conducting water audits. As part of the 2018 MECP water services inspection, the Ministry noted that Cornwall did not have a conservation program so this recommendation would address that deficiency/request/observation.

Option 3: Install water meters in all IC&I facilities and add Conservation Plan.

This option would create measurement and a volume based incentive for the major users of water within the municipality. This option creates a method for equity billing. This would improve tracking of water and use a revenue based model that would be available for Economic Development. This option would recommend as well the use of wireless towers for gathering of data. A benefit of the IC&I group would be a website tracking of water volume for the business and notification via email for an increase in water use that might indicate a leak in their system. The system would make tracking of any internal water conservation program of a particular IC&I easy and effective.

Option 4: Install water meters City wide and add Conservation plan with a leak detection system.

This option would create a volume based system for the community and create equity among users from a volume approach. All users would have the option of a web based method to monitor usage. As this option includes wireless transmission of data, the information would allow users to monitor the effectiveness of any water conservation program. For example, if a resident installed low flush toilets and low flow shower heads, they could login online and track how water use is trending down. In the IC&I sector, installation of new equipment could be tracked for water savings. This software includes a notification that can be sent to your email to notify you that water usage has spiked. For example, if the toilet valve doesn't shut off over night a resident would see an email in the morning saying maybe "Check for leaks". This notification in addition is sent to the Water Meter Technician who follow up to see if the resident or IC&I customer is aware of the leak notification. In that way, there are no surprises come billing time and customer service is enhanced. In addition, this usage information has a property address and Water Distribution can use address information to dispatch leak detection crews for faster and more focused leak detection.

Implementation of Water Meters

Where are we?

Currently, the City of Cornwall has in place:

- 16,600 residential water accounts with flat rate billing.
- 1,880 residential water meters with flat rate billing (installed but used only for volume information by municipal staff).
- 311 IC&I water meters with volume billing.
- 900 IC&I water meters with flat rate billing (installed but used only for volume information by municipal staff).

What is needed?

- 18,500 residential water meters in single and multi-residential locations
- Upgrade 1,034 IC&I meters

Costs

Installed cost for a water meter is estimated at $650. Although, this figure could change depending on the procurement and installation plans.

For single residential and multi-residential units, the capital cost of installation would be approximately $12,000,000. Installations would be completed over 2-3 years.

The upgrade of meters within the IC&I sector would cost approximately $500,000.

Recommendation

There is a variety of approaches that the City could consider for a comprehensive metering plan. The recommendation is that the Environmental Services Department develop a Water Conservation and Servicing Master Plan for presentation to Council.

The master plan would include but not limited to:

- A public outreach program:
    - with an education component that provides a framework and vision for the water and wastewater servicing needs within the urban areas and recommend through stakeholder engagement what incentive programs would be best developed for the City's variety of customers (residential and IC&I).
- Community outreach is a fundamental first step for increasing awareness and gaining public support for water demand management. Community outreach also plays a fundamental role in enhancing the planning and implementation success for most Water Demand Management (WDM) initiatives. In other words, community outreach is a cross-cutting and ongoing WDM initiative. The community outreach would become part of the annual conservation program..
    - Provide extensive consultation with the public and stakeholders.
    - Develop a volume based rate structure.
    - Determine a financing model.
    - Develop a timeline.
    - Develop an implementation plan.
    - Business Plans.
    - Installation Plan
    - Procurement methodology ie. Request for Proposals, tender development.
    - Conservation Incentive and Rebate Plan.

    .

Appendix A: City of Guelph Conservation an example of Best Practice program

Blue Built Home program (City of Guelph)

To get a Blue Built Home certification, a homeowner must complete one of the following actions:

- Install a greywater reuse system
- Install an all-season rainwater harvesting system
- Complete a minimum of three qualifying water–saving options including installing an Energy Star® washing machine, Energy Star® dishwasher, WaterSense® showerheads, or sub-water meter.

    - Toilets with 1.0 gallons per flush or less will be rebated $100.
    - An additional $50 incentive will be provided for water customers that use septic systems and apply for a toilet rebate.
    - Smart irrigation timers will be rebated at $75.
    - Rainwater harvesting cisterns will be rebated at $0.50/gallon of storage.
    - A passive rainwater harvesting system rebate will be available at $3/square foot of the drainage footprint. (Please see www.prescottwater.com for further details.)
    - Turf removal will increase from $0.25/square foot of turf removed to $0.50/square foot of turf removed.
    - Washing machines will be rebated at $200 please see the website for qualifying washing machines and take a photo of your old machine.