Review of Modernized Water Usage & Billing Practices

The Corporation of the City of Timmins

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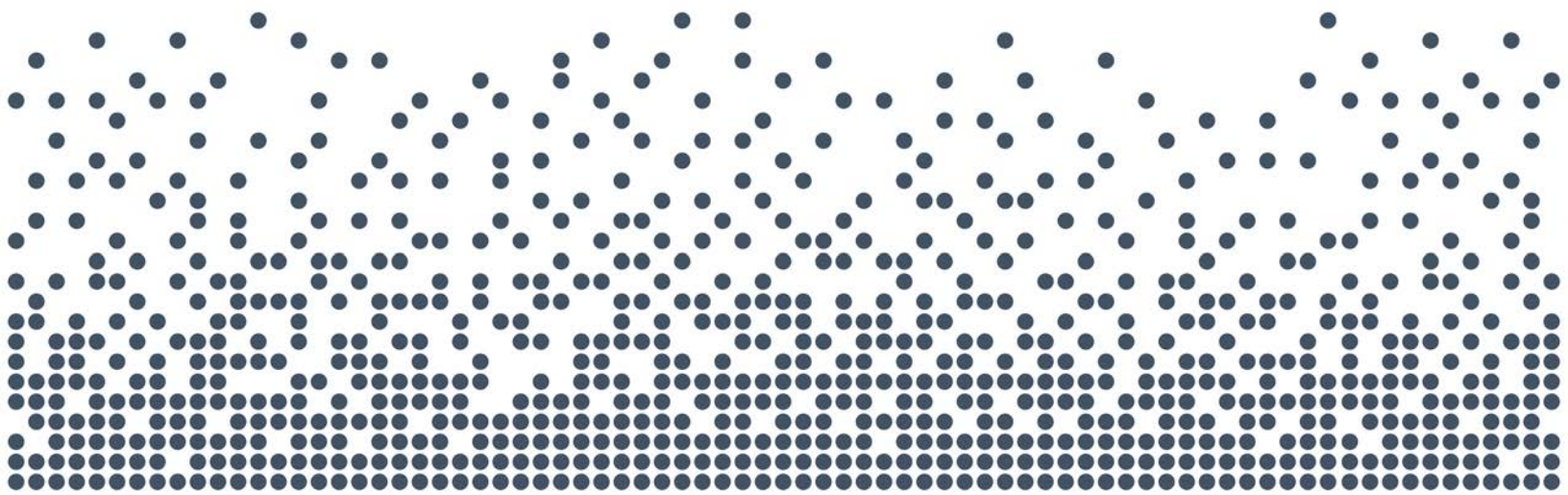
List of Acronyms and Abbreviations

A.M.I.	Advanced Metering Infrastructure
A.M.R.	Advanced Meter Reading
A.W.W.A.	American Water Works Association
cu.m	cubic metres
R.F.	radio frequency



Executive Summary

Executive Summary

Purpose of Report

The City of Timmins has retained Watson & Associates Economists Ltd. (Watson) to undertake a review of the City's current metering and billing system and provide information in support of new water metering and billing technology. Although the City has employed water meters for all non-residential properties and some residential properties, most residential customers are charged a flat rate based on room count. Given the lack of data on water volume usage, the City does not have sufficient information to direct decision making with regards to the provision of water services. Through these technology changes, the City wishes to achieve operating cost reductions, increased water conservation, and enhanced data collection to support water system management decision making.

Issues with Current Practices

The City faces numerous issues with its current practices:

- The majority of the City's customers (91%) are not metered and are charged a flat rate based on the number of rooms in a home. As a result, a high-volume user would be charged the same amount as a low-volume user within the same customer class. This inequity has led to numerous customer complaints with respect to water bills.
- In the absence of meters, flat rates do not provide an incentive for customers to reduce their water consumption. Based on literature research, customers that are metered are proven to consume less water than customers on a flat rate system. Higher overall usage increases the cost to produce municipal water which correspondingly creates higher water bills.
- For accounts which are metered (predominantly non-residential), the meters ae old and technology is out of date and inefficient. Significant operating costs are required to individually access and read each meter, input the data into the City's software, validate the data, and mail out bills.
- Given the extensive time required to read meters and bill these customers, billings are only carried out once a quarter. It is not feasible to implement metering on a City-wide basis without upgrading the existing technology and the associated processes.

- Given that the majority of customers (approximately 91%) are not metered, the City does not have robust data to understand and analyze the water system. Based on prior investigative analyses, it appears that the City is experiencing significant water loss throughout its system, however, without detailed data from water meters, it is difficult to determine where within the system the water is being lost.

Survey of Practices in Other Municipalities

A survey of municipalities in Ontario that have undertaken municipal-wide water meter installation projects was conducted to better understand current best practices.

The City of Greater Sudbury, and the City of North Bay have both recently implemented advanced metering infrastructure (A.M.I.) through radio frequency technology. Water meters are read automatically (without the use of manual labour) through radio towers located throughout the respective service areas. The readings are received in real time and uploaded to a customer portal where customers can track their own water usage on a continuous basis and subsequently pay their bills.

The Town of Renfrew implemented automated meter reading (A.M.R.) technology. Water meters are read automatically as a member of staff collects data by driving throughout the Town with a vehicle equipped with meter reading technology. Readings are picked up by the reader without the need to directly access each individual property.

Evaluation of Various Metering Technologies

Based on discussions with water meter suppliers, there are numerous water meter technology options available to municipalities. The most commonly used technologies are A.M.R. and A.M.I. through radio frequency infrastructure. The two options largely differ in the initial capital costs, the relative administrative burden and the quality of data collected. Table ES-1 summarizes the cost and administrative considerations for each option (the City's current practice is also provided for comparison purposes). Costing has been provided based on the assumption that the City would be replacing/installing meters for all 13,000 customers.

A.M.R. is the most cost effective solution for City-wide water meter installations, however, A.M.I. provides the lowest administrative burden and the highest quality data.

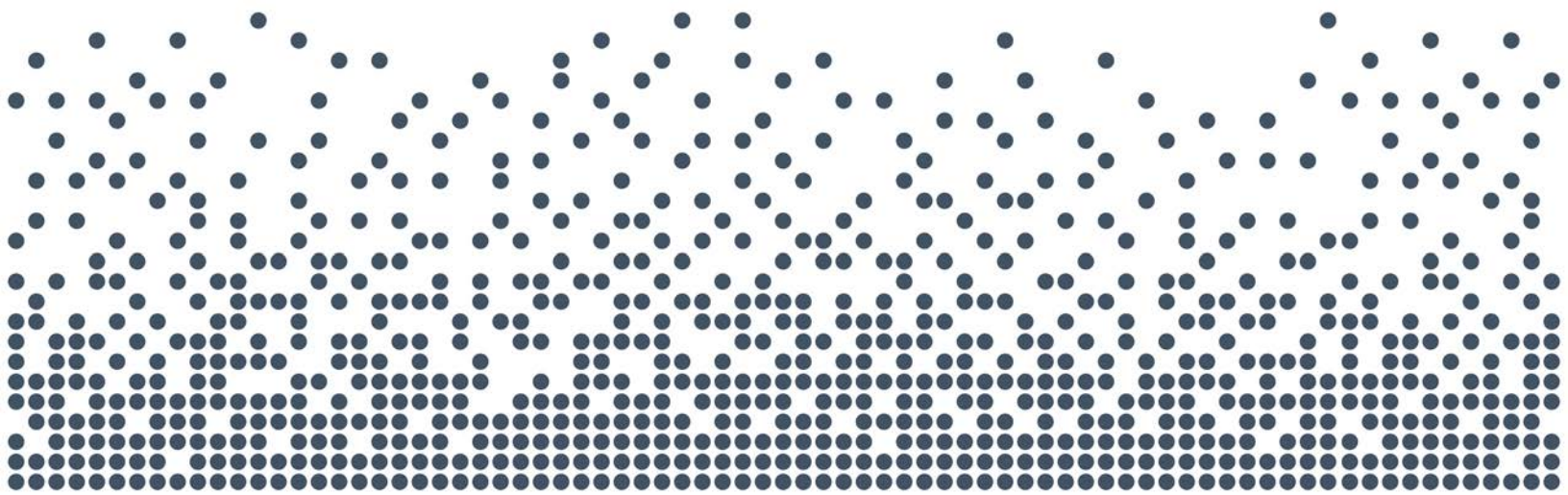
Table ES-1
City of Timmins
Summary of Metering Technology Costs and Administrative Considerations

Meter Reading Technology and Billing Type	Annual Operating Cost	Annual Capital Cost	Total Capital Cost	Administrative Burden for Data Collection	Administrative Burden for Billing	Quality of Data Provided
Status Quo – Current Billing Structure	$100,000	N/A	N/A	High	High	Low
Status Quo with Monthly Billings – Physically Mailed Bills	$363,900	N/A	N/A	High	High	Low
Status Quo with Monthly Billings – Electronic Bills	$161,000	N/A	N/A	High	High	Low
A.M.R. – Drive By, Physically Mailed Bills*	$292,000	$625,000	$8,500,000	Medium	High	Medium
A.M.R. – Drive By, Electronic Bills*	$40,000	$625,000	$8,500,000	Medium	Low	Medium
A.M.I. – Fixed Area Network, Physically Mailed Bills*	$403,300	$668,000	$9,075,000	Low	Medium	High
A.M.I. – Fixed Area Network, Electronic Bills*	$151,300	$668,000	$9,075,000	Low	Low	High

*Assuming billing is carried out monthly

Other Matters for Consideration

The City must also consider implementation hurdles in the evaluation of a City-wide water meter installation project. The main challenge will likely relate to pushback and concerns from customers related to the change. Public engagement and open communication will be very important in the successful implementation of a water meter project. Transparent communication with respect to the rationale for the change in technology and the benefits it can provide to customers will be required. Additionally, the City will need to determine whether it has the in-house personnel to manage a project of this magnitude or whether an external project management company should be contracted. Finally, the City's Water By-law should be updated to ensure the City maintains ownership of water meters in order to allow for the timely maintenance and replacement of aging meters.



Report

Chapter 1
Background and Overview of Timmins Water System

1. Background and Overview of Timmins Water System

1.1 Timmins Water System

The City of Timmins (the "City") provides drinking water to approximately 13,000 customers. The water source comes from the Mattagami River and is treated at the Timmins Water Filtration Plant, which is owned and operated by the City. The plant has the capacity to treat approximately 55,000 cu.m per day, which is then stored in two (2) clearwell storage tanks at the Water Filtration Plant, and three (3) additional reservoirs within the distribution system.

In addition to the above, there are approximately 230 kilometers of watermains, a booster pumping station, and various hydrants, valves, and service connections.

1.2 Summary of Users

As noted above, the City provides water services to approximately 13,000 customers. Of these customers, approximately 1,200 are metered customers, majority of which are non-residential customers. The remaining customers are not metered and are billed on a flat rate basis determined by the number of rooms. Additional details related to these customers and the associated rate structures are provided below.

Non-Metered (Flat Rate) Customers

Non-metered customers are predominantly residential properties across the City, and account for 11,794 (or 91%) of all water customers as of 2022. These customers are billed a flat rate based on the number of "livable" rooms in a home.

Based on discussions with City staff, "livable" rooms exclude bathrooms, laundry rooms, and furnace rooms. Properties on a flat rate billing structure are billed semi-annually in January for the January to June period, and in July for the July to December period. All residential properties are billed on a flat rate basis unless the property owner has put in a request and had a water meter installed at their own expense. Table 1-1 provides the 2022 flat rates:

Table 1-1
City of Timmins
2022 Water Rates – Flat Rates (Based on number of “livable” rooms)

2022 - Water Billing Rates	
Flat Rate per "Livable" Room (Semi-Annually)	
1	$144
2	$189
3	$235
4	$265
5	$303
6	$333
7	$370
8	$397
9	$427
10	$465
11	$495
12	$532
13	$563
14	$597
15	$627
16	$665
17	$695
18	$732
19	$763
20	$794
21	$827
22	$857
23	$894
24	$925
25	$959
26	$989
27	$1,026
28	$1,057
29	$1,087
30	$1,125

Metered Customers

Properties on a metered billing structure include all non-residential properties, and residential properties that have elected to purchase their own water meter. As of 2022, there are 1,209 metered customers (i.e. 9% of all customers) throughout the City as follows:

- 28 industrial;
- 648 commercial;
- 57 multi-residential; and
- 476 residential.

Metered customers are billed based on a minimum charge as well as a volume charge on either a cubic metre or imperial gallon basis. Metered properties are billed quarterly for the periods of January to March, April to June, July to September, and October to December. The current water rate structure for metered customers consists of:

1. A minimum quarterly charge (which includes volumes up to 16,000 gallons or 72,737 liters);
2. A constant volume rate (only applied to volumes in excess of the minimum charge); and
3. A quarterly water meter service charge.

Table 1-2 below provides the 2022 water billing rates:

Table 1-2
City of Timmins
2022 Water Rates – Volume Rates

2022 Water Billing (Metered) Rates per Quarter	
Metered Rates (Based on Gallons)	
Quarterly minimum charge for volumes between 0 to 16,000 gallons	$120.00
Volume charge per 1,000 gallons for volumes greater than 16,000 gallons	$7.49
Metered Rates (Based on Liters)	
Quarterly minimum charge for volumes between 0 to 72,737 liters	$120.00
Volume charge per ML for volumes greater than 72,737 liters	$1.65

In addition to the above rates, each metered customer is charged a quarterly service charge of $14.

1.3 Overview of Report

With the City's existing flat rate structure for the majority of customers, a high-volume user is billed the same amount as a customer in the same class who uses very little water. A water meter can be utilized to charge an equitable price for the amount of water a customer consumes. In turn, customers have an incentive to minimize water use and promote water conservation. In addition, with water meters installed on a City-wide basis, the City may achieve cost reductions, increase water conservation, and enhance their data collection to support management decision making.

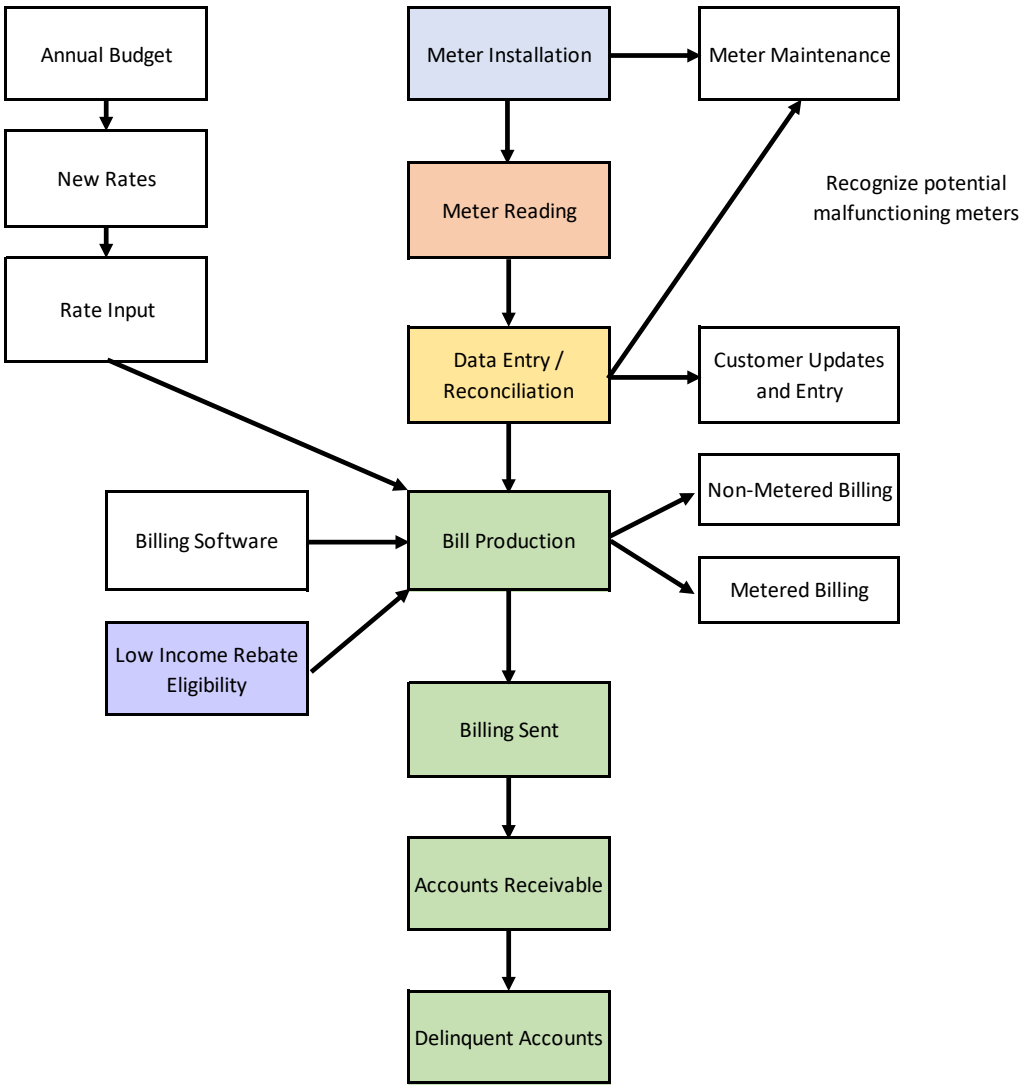
The City of Timmins retained Watson & Associates Economists Ltd. (Watson) to undertake a review of the City's current system and provide information in support of new water metering and billing technology. The following report will first provide an overview of the City's current meter installation and water billing process along with an examination of current issues the City is facing. This is followed by a survey of other municipalities in Ontario that have undertaken meter installation projects on a large-scale basis. A summary of best practices based on this survey and literature research from various associations is also provided within this report. Based on best practices and current market availability, a variety of metering technologies were analyzed with respect to the pros and cons and high-level costing of each option. An evaluation of these technologies and the potential cost to the City is provided, along with a high-level discussion on the implementation of meter installation and other matters that need to be considered in undertaking a meter installation project.

Chapter 2
Current Practices and Process Mapping of Water Billing

2. Current Practices and Process Mapping of Water Billing

As part of this study, Watson undertook a review of the City's current practices in order to gain an understanding of current issues and areas for improvement within the process. As mentioned earlier, the City has a mix of metered and non-metered customer accounts and has a desire to move all accounts to a metered system. The process for existing accounts is mapped out from meter installation (where applicable) to data entry to billing and is shown in Figure 2-1. A detailed discussion on each component of the process is provided in the subsequent sections.

Figure 2-1
City of Timmins
Process Map of Meter Installations and Water Billing



2.1 Meter Installation

2.1.1 Non-Residential Customers

The City's water meter by-law (By-law 1974-253), as amended, requires water meters to be installed in all commercial, industrial, and institutional buildings which are

connected to the municipal water supply. The cost of the water meter along with installation costs are to be borne by the customer. A licensed contractor, approved by the City, is required to install a new water meter to minimize improper/faulty installations.

2.1.2 Residential Customers

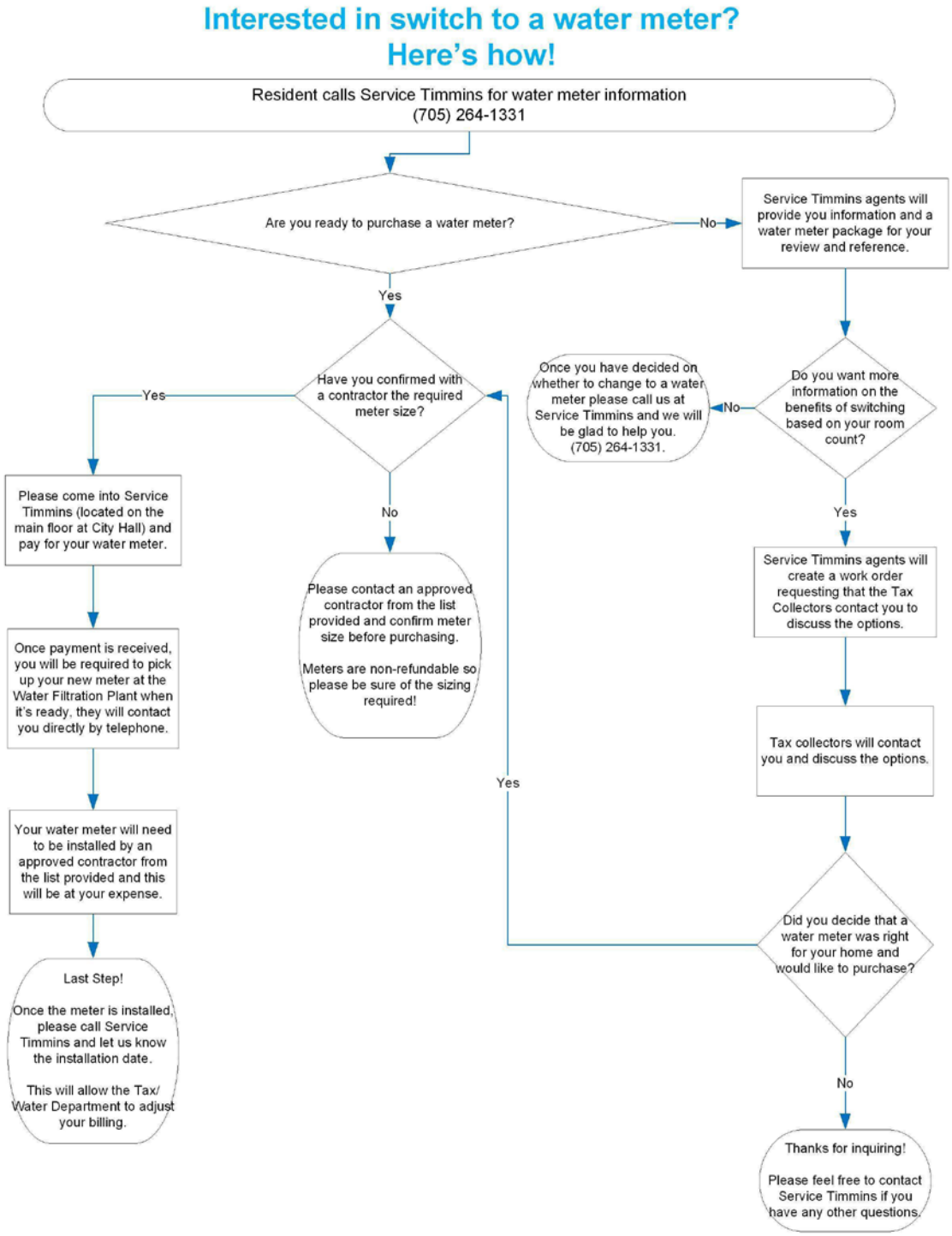
Residential accounts are not required to have a water meter under the City's By-law, however, property owners may voluntarily elect to purchase a meter and have one installed at their own expense. Wamco Waterworks (Wamco) is the City's current water meter supplier. The City purchases water meters from Wamco and re-sells these to customers wishing to install a meter. The price per meter (in 2023 dollars) is shown in Table 2-1.

Table 2-1
City of Timmins
Residents' Price per Meter for City Customers

Size	Price per Meter (2023$)
5/8"	$185
3/4"	$230
1"	$400
1 1/2"	$620
2"	$900
3"	$3,800

The City's water meter by-law states that water meters must be installed by a licensed contractor, approved by the City of Timmins. A list of approved contractors can be found on the City website. Figure 2-2 illustrates the process residents follow when considering installing a water meter to their property.

Figure 2-2
City of Timmins
Current Process to Install a Residential Meter (excerpted from City's brochure)



The City's inventory of existing water meters is a mix of imperial and metric meters, some dating back over 40 years. Based on discussions with staff, the City would prefer to move towards only installing metric water meters, in order to minimize the administrative burden of reading meters utilizing different measures. It is noted that older meter technology requires that the meters be recalibrated at least every 10 years. Based on discussions with staff, no recalibrations have taken place and hence, it is most likely that a majority of these meters are not performing properly.

2.2 Meter Reading

Meters across the City are read every quarter. The City currently has direct read meters (manual readings through visual odometer inspection), and remote pulser read meters (manual readings from outside the house). The current process for meter reading is as follows:

- Meter readings begin on the week of the 15th of each quarter and must be completed in 4 weeks (i.e., March/April, June/July, September/October, December/January);
- The City meter reader uses a master schedule of meter books for consistency of reading (17 books in total);
- The meter reader first picks up the meter reading books at City Hall and then prepares the vehicle, gathers keys for locked locations, and brings door knocker sheets;
- The meter reader begins the reading process by first visiting all schools in the area in order to avoid issues with respect to holidays or summer break school closures;
- For properties requiring appointments, the meter reader either calls the owners or property managers upon arrival to gain access to the building (e.g. shopping malls, colleges, and apartment buildings);
- For all other properties the meter reader arrives at the address and either enters the building or goes to the remote located on the outside of the building (note: most water meters are in basements or main floors, but the City has a handful of properties with water meters on the second floor). The meter reader has a meter card for each property that gives direction to where the meter or remote is located;

- Once the meter is located, the meter reader manually writes the reading in the corresponding meter card;
- If the meter reader is unable to gain access to the property, a door knocker is left on the door with instructions for the customer to text or call to schedule the meter reading at a later time;
- Once the meter readings are complete for the day, the meter reader returns to the Water Treatment Facility and the tax collector enters each reading into the billing software;
- If the readings are unusually high, the meter reader will return to the address to double check the reading. If verified, the meter reader informs the collections department and/or the owner of the property of the high reading;
- For properties which were unable to be read and a door knocker was left, the meter cards are photocopied and left for staff to fill in as the readings are called or texted in by property owners; and
- Finally, the meter books are returned to City Hall once the meter reading procedure is complete for the quarter.

Based on the above process, there are various costs associated with meter reading. The direct read and remote pulser read meters require manual labour to collect meter readings. The meter reader must visit every individual location with a water meter across the City (i.e. 1,209 properties). The City of Timmins has a geographic area of 3,210 sq.km., making it one of the largest cities in Canada, land wise. Given the vast area, and the time it takes the meter reader to gain access to every property to manually record the meter reading, the process takes a total of 4 weeks to complete one full round of reads. This process is repeated 4 times a year, requiring 16 weeks of staff time on an annual basis. Additionally, a second meter reader is required to accompany the main meter reader for safety reasons one day per quarter. In addition to the personnel costs for meter reading, there are also equipment costs for the vehicle being used to transport the meter reader. Table 2-2 provides the cost for meter reading per year.

Table 2-2
City of Timmins
Annual Meter Reading Cost

Cost Item	Annual Cost
Labour and Equipment Costs	$35,200
Total Cost	**$35,200**

2.3 Data Entry/Reconciliation

Once the water meter reader(s) complete their reads, the books are returned to the tax collection team. Staff double check the consumption values, inspect for anomalies, and calculate estimated bills where necessary. The City uses a financial Enterprise Resource Planning (E.R.P.) system called Vadim-iCity to input data. Vadim is a software that the City uses to help automate and manage core business processes such as utility billings. The City does not currently run any data validation reports from Vadim, however, staff are currently being trained on how to run these reports. In the interim, visual data validation and sampling is completed to correct anomalies, after which the Clerk finalizes the readings in Vadim. Table 2-3 breaks down the cost for data entry and reconciliation on an annual basis:

Table 2-3
City of Timmins
Annual Data Entry/Reconciliation Cost

Cost Item	Annual Cost
Labour Cost for Reviewing Meter Books	$8,600
Labour Cost of Data Entry	$3,200
Total Cost	**$11,800**

2.4 Billing

The City sends out physical bills to customers every billing cycle. Flat rate bills are sent to customers twice a year, and metered bills are sent four times a year (see Section 1.2 for current rates). Every quarter, the City tax collector calculates the metered bills, and analyzes them to ensure the system is calculating correctly (i.e. ensuring that meters based on metric versus imperial gallons are appropriately distinguished and that service

charges are being calculated correctly). This process takes approximately one full day per quarter. The bills are then printed to PDF format and emailed to a contracted printing company for printing and distribution, a process which takes half a day. The annual billing costs are provided below in Table 2-4:

Table 2-4
City of Timmins
Annual Billing Cost

Cost Item	Annual Cost
Cost of Postage and Printing	$37,900
Cost for Billing Calculations	$1,400
Cost for File Prep and Sending to Printers	$700
Cost for Utility Billing Module	$13,000
Total Cost	**$53,000**

2.4.1 Delinquent Accounts

If customers default on their water bill payment, the City sends mail notices, followed by registered letters stating the deadline for payment before the water is shut off to the property. If payment is still not received, a by-law officer is then sent to the property to speak with the owner. If there is still no response or payment, the water is shut off to the property. If water is required to be shut off, a customer is charged $75 to have the meter read, and another $85 for the water shut off.

2.4.2 Bleeder Systems

The City has identified a number of residential properties which bleed their systems due to shallow water service lines and/or the property located at the end of a service line where the water flow is weak. As a result, these properties must always have their water running in the colder months from December to May to prevent freezing of pipes. The City sends annual notices to the bleeder homes as a reminder for the winter months coming. The bleeder properties which have water meters are billed based on their water consumption in the billing quarter in the summer months (July to September).

2.4.3 Low Income Rebate Program

As part of the City's efforts to provide financial relief to low income residents, a rebate program has been provided. Residents can apply for the Low Income Utility Assistance Credit to receive a reduction on the water bill. City staff review these applications and adjust the bills that qualify for this rebate. An annual credit of $150 is provided for metered accounts and for the standard 5 room unit and prorated accordingly to the other unit room counts for flat rate accounts.

2.5 Overall Costing for Current Billing Process

Table 2-5 gives the combined costs of meter reading, data entry and reconciliation, and billing per year given the City's current processes.

Table 2-5
City of Timmins
Annual Water Meter Costs

Cost Item	Annual Cost
Meter Reading	$35,200
Data Entry/Reconciliation	$11,800
Billing	$53,000
Total	**$100,000**

2.6 Current Issues

Based on discussions with staff and an analysis of the City's existing practices, a number of issues and inefficiencies have been identified for each stage of the meter installation and billing process:

2.6.1 Meter Installation

- Current meters across the City are a mix between metric and imperial gallons. This increases the administrative burden on staff to account for two different measures and ensure meter reads are entered and accounted for correctly.
- Many of the existing water meters throughout the City are well beyond their useful lives, which often leads to inaccurate meter readings and customer

complaints. Based on the City's current water by-law, once installed, water meters are owned by the property owner rather than the City. This means that the City cannot replace old meters until the customer elects to do so, leading to a large number of inaccurate meter reads, lower revenue recovery, and overall inaccurate data collection.

2.6.2 Meter Reading

- Given the current market offerings and metering technologies available, the City's current meter reading process is outdated and inefficient for the following reasons:
    - The City's current process of manual meter reading and recording in a meter book is prone to human error and misreads.
    - Relative to the meter technologies currently available, the City's current reading process results in high labour costs given the extensive manual work required to access each individual property. If the City were to move towards metering all 13,000 customers, the existing practice would not be feasible on a City-wide basis.
    - The meter reader experiences problems with locked doors and meters installed in poor places (reader must sometimes crawl in cramped spaces and read with a flashlight and mirror).
    - The meter reader is occasionally accompanied by an additional City staff member for safety concerns, further increasing labour costs.
    - If an anomaly is detected in the meter recording, the meter reader is required to go back to the location to confirm the reading, further adding to the inefficiencies of the current practice.

2.6.3 Data Entry/Reconciliation

- When reconciling data and checking for errors, visual data sampling is utilized, which may lead to error or bias.
- The City is often faced with issues when there is a change in property ownership. Often, the City is not advised of the change in ownership until the day of the change, and sometimes even after the change. This requires the meter reader to access the property and read the meter immediately, which proves challenging given the meter reader has other roles and responsibilities.

2.6.4 Billing

- High costs are associated with printing and mailing out physical bills to each customer.
- As discussed further in the next section, billing flat rate accounts based on the number of "livable" rooms is perceived as inequitable as a high-volume user would be charged the same as a low-volume user with the same number of "livable" rooms. As a result, the City receives numerous complaints from residents based on perceived inequities in their water bill. In addition, the City has very little information on the number of rooms in older homes, making it difficult to classify and bill these properties.
- The bleeder homes in the City's system are billed in the winter months based on their water consumption in the summer months. Typically, residential customers utilize more water in the summer months given the pattern of watering lawns, gardens, pools, etc. This means these customers may be paying an inequitable rate in the winter months when they are using less water than they would have in the summer.

2.7 Inequities in Flat-Rate Billing

Flat rate billing is perceived as an inequity in the City given customers with the same number of "livable" rooms often have drastically different levels of water consumption. Property owners' lifestyles vary quite drastically and can result in customers paying the same amount for significantly different volumes. In addition, the number of rooms in a household does not necessarily correlate with the amount of water being consumed within that home. For example, a single individual using minimal water may be charged the same as a family of four with significantly higher usage. Another issue with using a flat rate based on a per room basis is that newer homes are more likely to be constructed as an open concept design resulting in less rooms per unit compared to older homes in the City.

The City also does not have a current practice in verifying the number of rooms in each household for existing homes and must rely on outdated historical information. This information is only available for new homes based on information provided by the City's building department.

2.8 Summary

Based on the above, installing water meters on a City-wide basis would address:

- Inefficiencies in the current meter reading and billing process; and
- Inequities in charging a flat rate based on the number of “livable” rooms in a home.

In addition, the City should update their water by-law to maintain ownership of the water meters to allow for timely replacement of outdated and inaccurate meters.

Chapter 3
Survey of Comparable Municipalities in Ontario

3. Survey of Comparable Municipalities in Ontario

3.1 Survey of Municipalities

A review of water metering practices was undertaken for other municipalities across Ontario. In general, most municipalities are implementing either automated meter reading (A.M.R.) or advanced metering infrastructure (A.M.I) technology. A.M.R. is a system which municipalities use to automatically collect water consumption data from water meters. A visual remote on the outside of the building is wired to the water meter inside the building, and a City staff member collects readings by tapping each remote with a collection probe, or by driving by with a data receiver in close proximity to the device. A.M.I. is a communications technology which municipalities use to collect consumption data from water meters without the use of meter reading personnel. The system automatically sends the data to the City through a fixed network of infrastructure.

As part of this review the following municipalities were interviewed and surveyed:

- The City of Greater Sudbury is a comparable northern Ontario municipality and is in the process of a City-wide water meter replacement program with updated technology;
- The City of North Bay was reviewed as it is another northern Ontario municipality with a similar population as Timmins. North Bay also undertook a water meter installation program for the first time in 2015; and
- The Town of Renfrew was surveyed given its A.M.R. installation program.

A general description of the water meter installation programs for each municipality is provided in the subsequent sections, followed by a detailed summary table comparing the three programs.

3.1.1 The City of Greater Sudbury

Beginning in 2020, the City of Greater Sudbury began a City-wide water meter replacement program. The City's previous water meters were remote pulse read meters which were manually read from the outside of individual properties by City Staff every two months. The new program will move the City from this manual process into a fully automated meter read through radiofrequency A.M.I. technology. The City was

able to utilize existing Greater Sudbury Utilities radio towers with excess bandwidth, but also built 6 new towers to increase the radio coverage range throughout the City. The City also developed a new customer portal where customers can check their usage in real time. The portal also has a system which flags a customer's account if continual use is detected, which typically indicates a leak. Customers are also able to set personalized alarms/notifications if their flow exceeds a certain amount in any particular billing period.

Since the meter replacement program was completed, the City has experienced a number of benefits with the new A.M.I. technology which includes labour cost savings on meter readings and enhanced customer service through the new digital portal. In addition, the City was also able to repair aging infrastructure including curb stops, add tamper detection to the new meters, and fix any previously illegally tampered systems.

The main challenges the City faced during the replacement program were the increase in costs due to COVID-19 and supply chain disruptions (microchip shortage increased radio costs) in addition to the large number of customers refusing installers to enter their home (this was heightened as a result of COVID-19).

3.1.2 The City of North Bay

Prior to 2015, the City of North Bay did not have any water meters in place. In 2015, the City implemented a full City-wide water meter installation program which included approximately 16,000 customers. Similar to Greater Sudbury, North Bay also installed A.M.I. infrastructure through radio frequency water meters. To implement this technology, the City required 8 collector towers to provide coverage across the City's entire land area.

Prior to implementing metering technology, the City billed residents on a flat rate based on the number of water fixtures in the household. With the new meters, the City bills customers through a combination of a monthly base rate based on meter size and a constant volume rate per cubic metre of water consumed. When the meters were first installed the City initially recovered 60% of costs through the base rate, and 40% of costs through the volume rate. The current rate structure provides for 50% of cost recovery through the flat rate, and 50% through the volume rate, however, Council intends to move to 40% flat rate/60% volume rate cost recovery. The phased

introduction of the variable rate was done to promote equity while giving customers time to adjust to the new rate structure.

The City has experienced a number of benefits through this program. This includes operational savings and improved customer satisfaction. Customers are able to access their daily water usage through the customer portal, but unlike the City of Greater Sudbury, the portal does not flag customer accounts for high or continual usage. For liability reasons, this is the responsibility of the customer to recognize on their own. Further, the introduction of the volume-based rate provided a behavioural change incentive to reduce water consumption. This has resulted in a lower demand on the Water Treatment Plant given the overall reduced levels of water consumption.

The biggest challenge that the City of North Bay faced with their water meter installation program was public perception and misinformation. City staff noted that change management from a public perspective was an extensive and time-consuming process. The City held numerous information sessions, town-halls, and distributed information packages on a regular basis to inform customers and ease any concerns. Another area in which the City experienced challenges was the change from flat rate billing to monthly metered billing. The transition increased the administrative burden for City staff with respect to the water bills. Between preparing the monthly bills and managing property ownership changes, staff find there is very little time to find efficiencies and improve the process before the next billing cycle begins.

3.1.3 The Town of Renfrew

The Town of Renfrew implemented a universal water meter program in 2010. Prior to the program, the Town had meters installed for commercial customers but not residential properties. All residential accounts were billed on a flat rate every three months, while commercial accounts were billed through a combination of a base charge based on the size of the water meter, and a constant variable rate based on water consumption. Through this program, the Town implemented A.M.R. with remote drive-by readings. By implementing this technology, meter reads across the entire Town can be completed in one hour by driving around the Town to collect data through the reading equipment. Meter readings are done every month, however, billing is done every second month.

When assessing the various options as part of this water meter installation program, the Town evaluated A.M.I. radio frequency meters, but did not find it feasible due to the topography of the Town (dips and valleys require a larger number of radio towers to cover the entire land area in comparison to a relatively flat municipality). The current billing structure is a combination of a flat rate based on the size of the water meter, and a constant variable rate based on water consumption.

Through this program, the Town was able to promote behavioural change by educating the end user on water consumption and the impact increased volumes have on the water bill. These behavioural changes in turn reduced water usage and encouraged conservation. The Town marketed the new program to residents as an opportunity to take ownership of their own water consumption wherein the less water they use, the less they are required to pay. The Town's system does not send the customer flags for continual water use or high usage, however, the system creates leak reports for Town staff to review and inform the residents if a leak is suspected. Staff also mentioned a major benefit of meter installation has been the increased data collection which has supported enhanced customer service in addition to management decision making. Similar to Greater Sudbury, the program also gave the Town the opportunity to upgrade and repair curb stops, in addition to mapping out their locations.

Through this program, the Town experienced hesitation to install meters from customers. To overcome this challenge numerous public meetings were held, and information newsletters/brochures were distributed. For residents strongly refusing a water meter, the Town billed them triple the amount of a home in the same demographic to encourage meter installation.

3.1.4 Summary of Metering Practices Survey

A summary of the municipal survey and the associated metering practices is provided in Table 3-1 below:

Table 3-1
City of Timmins
Municipal Water Metering Best Practices

Category	The City of Greater Sudbury	The City of North Bay	The Town of Renfrew
Number of accounts:	48,600	16,000	3,200
Current type of water meters used:	A.M.I. (Radio-Frequency)	A.M.I. (Radio-Frequency)	A.M.R. (Automatic Remote Read)
Previous type of water meters used:	Remote Pulse Read	N/A	N/A
Frequency of meter reads:	Real time (hourly)	Real time (hourly)	Monthly
Do all properties have a dual check valve or backflow preventor?	No	No	No
Does the municipality have any bleeder systems in place? How are these billed?	Yes - for freeze control The City measures a baseline flow amount and then credits the customer account for the difference.	Yes - approximately 160 properties due to shallow water mains Water agreements are entered into between the properties and the City.	No
Does the municipality have a leak alert service which informs customers their water usage is higher than normal and there may be a suspected leak?	Yes - system feature which flags and alerts continual use	No - responsibility of the customer to check their portal themselves	No - Town staff perform checks based on reports
Billing software used:	Greater Sudbury Utilities billing software	The City created their own software	Supplier software
Software capabilities:	Customer portal	Customer portal	Creates a report for high water users
Frequency of billings:	Monthly	Monthly	Every 2 months

Category	The City of Greater Sudbury	The City of North Bay	The Town of Renfrew
Electronic or physical billings:	Customers can pay online, but physical mailings are still being sent out	Customers who have signed up for the customer portal have online bills, but those not signed up receive physical mailings	Customers can pay online, but physical mailings are still being sent out
Billing rate structure:	Monthly base charge based on meter size and constant volume rate charged on a per cubic metre of water consumed	Monthly base charge based on meter size and constant volume rate charged on a per cubic metre of water consumed.	Bi-monthly base charge based on meter size and constant volume rate per cubic metre of water consumed.
Project Budget:	$17,000,000 (2021 $)	$7,200,000 (2015 $)	$1,000,000 (2010 $)
Cost per water meter:	$350 (2021 $)	$450 (2015 $)	$313 (2010 $)
Installation Process:	A firm was hired by the City to manage meter installs. This firm hired and trained 22 local Sudbury employees to complete meter installs for the duration of the project.	The supplier was responsible for meter installs. The supplier brought a small number of corporate staff and hired and trained local employees to complete meter installs for the duration of the project.	The supplier was responsible for meter installs. The supplier brought a small number of corporate staff and hired and trained local employees to complete meter installs for the duration of the project.
Refusals to Installation:	9% of households gave soft refusals 2-3% gave hard refusals Refusals are charged $50 per month to have their current meter manually read. Going forward the City will present Council with alternative options such as increasing the charge or water shut-off options.	5% of users refused initial installation Refusals were billed three times the average customer bill the first month, followed by four times the average bill the next month, etc.	Refusals were billed triple the amount of the average home in the same demographic.

Category	The City of Greater Sudbury	The City of North Bay	The Town of Renfrew
Other Useful Practices:	The City informed customers that they would not be charged for tampering of their existing water meter. The purpose of this was to minimize the amount of refusals for the new meter installation program.	The City applied for environmental grants in conservation to help cover a portion of the capital costs of the universal water metering program.	The Town uses an ID system to account for water meters and property owners (e.g. the first home owner account ID was 12345-a, then after the sale of the property and a new owner moved in, the account ID would be 12345-b, etc.). This assisted in tracking changes of ownership.

3.2 Literature Research

A review of the National Guide to Sustainable Municipal Infrastructure – Establishing a Metering Plan to Account for Water Use and Loss was conducted to better understand industry best practices regarding water metering. This report was developed based on standards from the American Water Works Association, the American Water Works Association Research Foundation, the International Water Association, and the Canadian Water and Wastewater Association.

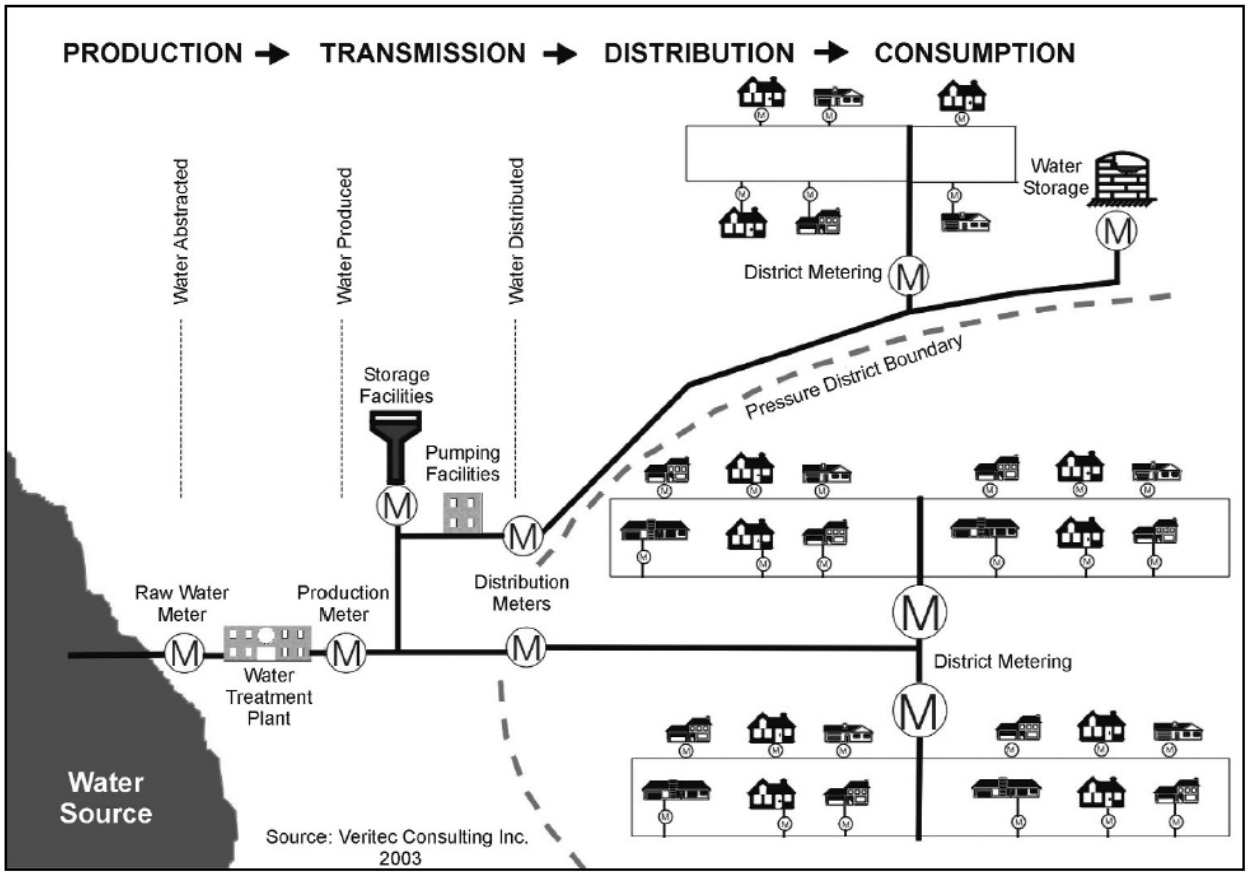
This report identified the four drivers for universal metering in municipalities to be: equity, water efficiency and environmental stewardship, economic management benefits, and system management. User pay systems, like ones used for other commodities such as electricity, natural gas, and fuel should be adopted by the water industry for full cost recovery management, end-user accountability, and wise-water use. According to Environment Canada, flat rate customers in Canada use 457 litres of water per capita per day compared to volume based customers who use only 269 litres per capita per day. As a result, universal metering has proven to reduce overall residential and non-residential water consumption by 15 to 30 percent.

3.2.1 Water Loss Detection

Through discussions with City staff, the City has been experiencing significant amounts of water loss, however, in the absence of robust metering data, it is unclear where water is being lost. As a result, the City is not able to repair/resolve these issues and faces significant revenue losses from this unaccounted for water.

Detailed metered information from across the City would provide a more accurate evaluation of system performance. Based on the survey of best practices, municipalities/utility boards should complete a water audit to account for water usage and loss in the distribution system. Figure 3-1 provides the foundation for establishing a metering plan for a water audit. With a metering plan similar to the figure below, the City would be able determine where water is lost and provide repairs/address issues in those specific areas.

Figure 3-1
City of Timmins
Metering Plan (Excerpt)



Note: the letter “M” in the above figure provides direction on where to position meters to gain a better understanding of areas of water loss. It is important to meter the treated water leaving the water treatment plant to understand total water production relative to the total amount of billable water. A significant discrepancy would indicate water loss somewhere in the municipality’s system.

3.3 Summary of Best Practices

Based on the surveys of the City of Greater Sudbury, the City of North Bay, the Town of Renfrew, and the review of the National Guide to Sustainable Municipal Infrastructure, the most common metering practices currently utilized are A.M.R. and A.M.I. Significant infrastructure investment is required for A.M.I., however, there is an operating cost savings given the reduction in staff time for meter reading. There is also a significant increase in the amount of data provided through this technology through constant meter reads. A.M.R. is a very common practice which is less capital intensive than A.M.I., however there are still some additional labour costs required for meter reading. According to the National Guide to Sustainable Municipal Infrastructure, many municipalities have found that the A.M.R. option has been the most cost effective solution for most water utilities.

Chapter 4
Survey of Available Metering Technologies

4. Survey of Available Metering Technologies

There are a number of water metering technologies available on the market with varying functionalities and costing. When evaluating metering technologies there are many variables to consider including costs, the type of meter reading, functionality, materials, lifespan, warranty, etc. The main types of meters to be considered as part of this study process include the following:

- **Direct Read:** manual reading through visual inspection on the odometer inside the building (current City practice for metered properties);
- **Remote Pulser Read:** manually read the odometer from the outside of the building;
- **Automatic Remote Read (A.M.R.):** meter is read at an outside remote device and recorded automatically using a hand-held interface (probe touched to the remote device to read and store into a computer, or in proximity without touch/connection (e.g. drive-by in a vehicle);
- **Radio Frequency Read (A.M.I.):** meter is connected to a transponder unit transmitting the reading via a radio frequency (R.F.) signal. The transmitter is activated automatically by an outside receiver/transmitter. There are 3 ways to read this:
    - The walk by approach where a reader walks down the street and collects the R.F. signals;
    - The drive by approach where a reader drives through the City collecting R.F. signals in a properly equipped vehicle; and
    - The fixed area network which involves installing an infrastructure system to collect meter reading signals and transmit to a central location (fully automated). This type of infrastructure allows for constant meter reads.

Remote pulse read meters, automatic remote read meters, and radio frequency meters require two major components: the water meter inside the building, and the remote communications unit mounted on the outside of the building.

4.1 Advantages and Disadvantages of Metering Technologies

The following table provides a listing of the relative advantages and disadvantages of the various available technologies. Other than capital costs, there are a number of other variables that need to be considered when evaluating the various options (e.g. potential operating cost reductions, administrative burden, potential for process errors, etc.)

Table 4-1
City of Timmins
Advantages and Disadvantages of Various Metering Technologies

Metering Technology	Advantages	Disadvantages
Direct Read	• Low cost per meter • Low installation cost	• Highly time consuming to individually read each meter • Less frequent reads given the time it takes to undertake meter reads • Higher labour costs • Meter reader needs access to meters inside buildings which can be difficult for a number of properties • Higher chance of meter reading errors
Remote Pulser Read	• Access to meter is not required	• Higher per meter and installation cost than direct reads • Increased maintenance of remote reader required • Time consuming • Direct access to meter remote required for reading (outside of building)

Metering Technology	Advantages	Disadvantages
		• Meter reader may face obstacles accessing the remote reader (i.e., fences, pets, snow, gardens, etc.) • Higher chance of meter reading errors • Requires periodic verification between remote and actual water meter odometer
Automatic Remote Read (A.M.R.)	<u>Touch Connection through Probe</u> • Less labour is required (increased time efficiency due to automation) • No human error in meter reading • Increased data collection due to potential for increase in frequency of reads <u>Hands-Free (Proximity)</u> • Meters can be read when in close proximity, not requiring any access to the meter or the remote reader • Less labour is required (increased time efficiency due to automation) resulting in lower operating costs • No human error in meter reading • Increased data collection due to potential for increase in frequency of reads Note: most A.M.R. metering technology has R.F. capabilities if the municipality chooses to invest in radio tower infrastructure at some	<u>Touch Connection through Probe</u> • Higher per meter and installation cost than prior two options • Higher maintenance cost than prior two options • Additional costs for remote readers/ remote reading software • Access to remote reader is required <u>Hands-Free (Proximity)</u> • Higher per meter and installation cost than touch connection through probe • Higher maintenance cost than touch connection through probe

Metering Technology	Advantages	Disadvantages
	point in the future (i.e. lower incremental costs to move to more advanced technology)	
Radio Frequency Read (A.M.I.)	<u>Walk-By Reads</u> • Lower labour costs than other metering technologies • No human error in meter reading • Increased data collection due to potential for increase in frequency of reads • Access to meter is not required <u>Drive-By Reads</u> • Lower labour costs • No human error in meter reading • Increased data collection due to potential for increase in frequency of reads • Access to meter is not required <u>Fixed Area Network</u> • Lowest labour cost • Fully automated • No human error in meter reading • Increased data collection • Access to meter is not required	<u>Walk-By Reads</u> • Higher meter and installation costs • Requires batteries which have a shorter lifecycle than the water meters • May require the addition of a data analyst given the increased amount of data collected <u>Drive-By Reads</u> • Higher meter and installation costs • Meters require batteries which have a shorter lifecycle than the water meters (i.e. need to replace these before meter is replaced) • May require the need for an additional full time equivalent/data analyst given the significant increase in data collected and the time required to analyze such data <u>Fixed Area Network</u> • Higher meter and installation costs • Large capital investment for radio tower infrastructure • Meters require batteries which have a shorter lifecycle than the water meters

Metering Technology	Advantages	Disadvantages
	• Opportunity to use existing towers in the City or lease towers	• May require the need for an additional full time equivalent/data analyst given the significant increase in data collected and the time required to analyze such data

4.2 Costing of Alternative Metering Technologies

Based on discussions with other municipalities and water meter suppliers, **high level costing estimates** for the various meter reading technologies is provided in Table 4-2 below. Cost estimates are based on installing meters for all 13,000 customers across the City of Timmins. Annualized capital costs have been provided with the assumption that the City would debenture the initial capital costs over 20 years at a rate of 4%. Annual operating costs provided in the table below are specific to the water meter function (e.g. annual licensing fees, cellular costs, etc.). All other City operating costs (e.g. billing, meter reading, etc.) are identified in Section 5.

Table 4-2
City of Timmins
Meter Reading Technology Costs

Metering Options	Description	Costs ($)
Touch Read Meters	Capital Cost: Supply and installation of water meters and remote readers. Operating Cost: Supplier support and software.	Total capital cost: $7,000,000 Annualized capital cost: $515,000 Annual operating cost to directly support the water meters: $5,000
Automatic Remote Read Meters (A.M.R.)	Capital Cost: Supply and installation of water meters and remote readers. Operating Cost: Supplier support and software.	Total capital cost: $8,000,000 to $9,000,000 Annualized capital cost: $625,000 Annual operating cost to directly support the water meters: $12,000 (largely related to software costs)
Radio Frequency Read Meters and Infrastructure (A.M.I.)	Capital Cost: Supply and installation of water meters, remote readers, and fixed area network infrastructure. This high level estimate for the City of Timmins considers the need to construct two (2) towers. The remaining towers that would be required are assumed to be existing.	Total capital cost: $8,700,000 to $9,500,000 Annualized capital cost: $668,000 Annual operating cost to directly support the water meters: $123,000 to $150,000 (largely related to cellular costs)

Metering Options	Description	Costs ($)
	Operating Cost: Supplier support, software, cellular cost, and customer portal.	

Note: cost estimates are high-level and meant for illustrative purposes. If the City chooses to proceed with City-wide water metering, a detailed costing analysis should be undertaken through a procurement/tender process.

The costs in Table 4-2 consider the water meter infrastructure, the remote communications units mounted on the outside of buildings, and installation costs. Other costs that have been considered include additional equipment, and other external costs such as project management.

Chapter 5
Evaluation of Water Metering Options for Timmins

5. Evaluation of Water Metering Options for Timmins

The following sections provide a brief description of the most viable options for the City based on current market offerings. The City's current practice is also provided for comparison purposes. Annualized costs are provided for each option. This section concludes with an evaluation of the financial and non-financial considerations for each option.

5.1 Status Quo – Direct Read, Physically Mailed Bills

The City's current water meter procedure uses direct read water meters for approximately 9% of all water customers. Metered accounts are billed quarterly based on usage, and non-metered accounts are billed a flat rate semi-annually. All billings are sent through physical mailings. Based on the costing analysis undertaken in Section 2, annual operating costs for the current practice is approximately $100,000.

The A.M.R. and A.M.I. options analyzed in subsequent sections have assumed that the City would move to monthly billings. In order to provide for a more direct comparison between all options, the annual operating costs to provide monthly billings (either physically mailed bills or electronic bills) under the current practice have been provided. It is assumed that both the metered and flat rate customers would be billed monthly under this scenario.

Table 5-1
City of Timmins
Annual Water Meter Costs – Status Quo

Cost Item	Annual Operating Cost – Quarterly Metered Bills and Semi-Annually Base Rate Bills	Annual Operating Cost – Physically Mailed Monthly Bills	Annual Operating Cost – Electronic Monthly Bills
Meter Reading Costs	$35,200	$105,600	$105,600
Data Entry/Reconciliation Costs	$11,800	$35,500	$35,500
Billing Costs	$53,000	$222,800	$20,000
Total Annual Costs	**$100,000**	**$363,900**	**$161,000**

5.2 A.M.R. – Drive by

This water meter alternative considers the installation of automatic remote read meters for all 13,000 customer accounts. Meter reading is conducted by a City staff member driving throughout the City to collect meter reads from a distance. Billing is assumed to occur monthly under this scenario, as meter reading can be conducted in under a day by one staff member. Operating costs associated with the meter function are based on costs identified in Section 4.2. Capital costs have been annualized by assuming a 20-year debenture at a rate of 4%.

Table 5-2
City of Timmins
Annual Water Meter Costs – A.M.R. Drive by

Cost Component	Physically Mailed Bills	Electronic Bills
Meter Reading Costs	$3,800	$3,800
Data Analysis and Reconciliation Costs	$4,200	$4,200
Billing Costs*	$272,000	$20,000
Operating Costs Associated with Meters (refer to section 4.2)	$12,000	$12,000
Annualized Capital Cost	$625,000	$625,000
Total Annualized Costs	**$917,000**	**$665,000**

*Assuming monthly billings

A.M.R. technology would provide the City with a much more advanced system than the current practice. It would be feasible to undertake metering on a City-wide basis as a meter reader is not required to access each individual meter. Meter readings can be undertaken and completed in a matter of hours, making it possible to bill customers on a monthly basis. Depending on the City's specific operations, the meter reader could be affixed onto garbage trucks that regularly travel throughout the entire City, further lowering labour costs associated with meter reading. In addition, the City would have access to a robust data set, which can be analyzed to detect leaks, determine system tampering, and monitor usage patterns.

5.3 A.M.I. – Fixed Area Network

This water meter alternative considers the City of Timmins installing radio frequency read meters to all 13,000 accounts. Additionally, two (2) fixed area network radio

infrastructure towers are assumed to be installed in the City. Meter reading is done without the use of City personnel, and billing is assumed to be monthly. Annualized capital costs are assumed to be debentured over 20 years at a rate of 4%.

Table 5-3
City of Timmins
Annual Water Meter Costs – A.M.I. Fixed Area Network

Cost Component	Physically Mailed Bills	Electronic Bills
Meter Reading Costs	$0	$0
Data Analysis and Reconciliation Costs	$8,300	$8,300
Billing Costs*	$272,000	$20,000
Operating Costs Associated with Meter (refer to Section 4.2)	$123,000	$123,000
Annualized Capital Cost	$668,000	$668,000
Total Annualized Costs	**$1,071,300**	**$819,300**

*Assuming monthly billings

In addition to the above cost considerations, there would be no human error or issues in accessing the meters as meter reading would be fully automated. In addition, the quality of data provided is the highest with this technology as real-time data can be provided to both the City as well as the end user.

5.4 Summary

Based on the two meter options above (A.M.R. and A.M.I.), Table 5-4 provides a summary of both quantitative and qualitative considerations including annual operating costs, annual capital costs, administrative burden, and the quality of data provided. Assuming the status quo is not a viable option as the City moves forward, A.M.R. is the cheapest alternative in terms of capital and operating costs.

It must be noted that A.M.I. provides the lower administrative burden as there is no requirement for staff to collect meter data. A.M.I. also provides the highest quality data. Customers would have access to real time usage information, providing a better sense of control and transparency to the user. A.M.R. on the other hand would typically provide usage data only a monthly basis.

In terms of the type of bills, physical bills entail a much higher operating costs, however the City may receive complaints and pushback from residents on the change in process if there was a switch to online billing. However, given that other utilities have implemented this form of billing, acceptance may be a short term “growing pain”. The advantage to the users is smaller, more manageable bills along with quicker notice of any leaks within the building.

Table 5-4
City of Timmins
Summary of Water Meter Alternatives

Meter Reading Technology and Billing Type	Annual Operating Cost	Annual Capital Cost	Total Capital Cost	Administrative Burden for Data Collection	Administrative Burden for Billing	Quality of Data Provided
Status Quo – Current Billing Structure	$100,000	N/A	N/A	High	High	Low
Status Quo with Monthly Billings – Physically Mailed Bills	$363,900	N/A	N/A	High	High	Low
Status Quo with Monthly Billings – Electronic Bills	$161,000	N/A	N/A	High	High	Low
A.M.R. – Drive By, Physically Mailed Bills*	$292,000	$625,000	$8,500,000	Medium	High	Medium
A.M.R. – Drive By, Electronic Bills*	$40,000	$625,000	$8,500,000	Medium	Low	Medium
A.M.I. – Fixed Area Network, Physically Mailed Bills*	$403,300	$668,000	$9,075,000	Low	Medium	High
A.M.I. – Fixed Area Network, Electronic Bills*	$151,300	$668,000	$9,075,000	Low	Low	High

*Assuming monthly billings
Note: Operating costs include meter reading, data analysis and reconciliation, billing, infrastructure support, and costs directly associated to meter function.

Chapter 6
Other Matters for Consideration

6. Other Matters for Consideration

In addition to the evaluation considered in the prior section, the following provides an overview of a number of other matters that should be considered when assessing whether the City should implement a City-wide metering program.

6.1 Implementation Considerations

6.1.1 Public Communication

The successful implementation of a City-wide water metering project is very important for customer acceptance. City staff at Greater Sudbury, North Bay, and Renfrew noted that one of the biggest obstacles of the project was customer acceptance. The implementation process varied for each municipality, however they all followed a similar approach. The first point of contact to customers came directly from the municipality.

North Bay mailed customers an information page informing them that the supplier would be in touch shortly to educate customers and book installations. Many City Hall information sessions were held, and informative videos were also posted on the City's website.

The City of Greater Sudbury also made the first contact with City customers through an informative brochure. Next, a virtual open house was held by the City. Following the virtual open house, the firm they hired to oversee the process took care of every other point of contact with customers. These contacts included door knocking, brochures, and other notices.

Staff at the Town of Renfrew also held numerous public information sessions and distributed informational brochures.

Greater Sudbury created a schedule for meter installation based on the 12 wards in the City. They also had a call centre, and an online booking portal for customer convenience. See Appendix B for more information on this process.

It is recommended that City staff develop a very detailed public communications strategy prior to project commencement. Similar to the best practices observed, the City should develop an online customer portal to allow for easy online booking, access to information and a point of contact between customers and the City. Greater

Sudbury's online customer portal can be used as a template to develop something similar for the City of Timmins. Based on discussions, water meter supplier companies also have the capabilities to set up these online portals for customer bookings. In-person open house sessions should also be held to address concerns and questions from residents as well.

In addition to the above, where certain customers are refusing meter installations, the City could charge the user three times the average customer's bill. Based on discussions with other municipalities, this has proven to be a successful practice to incentivize customers to allow installation and can result in a meter installation success rate of 90-95%.

6.1.2 Project Management

Project management is crucial to ensure a project of this scale is successful. The City of Greater Sudbury hired a project management services company ($1.6 million) for their universal water metering project. Based on discussions with other municipalities as well as meter suppliers, it appears that hiring an external company to oversee the project and manage the installation has been found to be the most successful way to implement a municipal-wide meter installation. The City of Timmins would need to determine whether it has the in-house capabilities to manage this project or whether it would be more effective to contract an external company to run and manage this project.

It is recommended that this project be phased in over 3-4 years, given the extensive nature of installing and/or replacing meters for 13,000 customers. This will allow the City to better manage the project and initially test out the installation in smaller areas before moving onto the remainder of the City.

6.1.3 Considerations after Meter Installation

If the City proceeds with system-wide meter installations, the process map for billings and departmental responsibilities will need to be revised. This will vary based on the type of technology chosen, but at a high-level, moving towards a more advanced technology will drastically reduce staff time associated with meter reading and data entry. This staff time can be reallocated towards the analysis of the increased data production. For example, with increased meter reads, the City would be able to run reports on water loss, overall consumption patterns, monitoring trends in behaviours

and whether changes to rate structures have resulted in desired outcomes, etc. Staff time that was previously spent reading meters and reconciling the data can now be utilized to analyze data and run these reports to enhance management decision making.

The City will need to consider whether their existing software is capable of running these reports or investments will need to be made to upgrade the technology. Many of the meter providers also provide software to assist in data collection and run useful reports. The City may wish to purchase these annual subscriptions to make the best use of the increased data.

Increasing the frequency of meter reads will not only increase the amount of data collected for the City's use, but it will also better inform customers of their water usage. In addition, moving from flat rate billing to variable rate billing will give customers a sense of control of their water bills and promote water conservation in the City.

Finally, increased data collection will inform the customer that they may have a leak or a broken fixture. The City's current process of reading meters every quarter would see a leak go unnoticed for months in comparison to daily readings or even monthly readings. The City will need to determine whether the customer portal offers automatic leak detection flags, if a member of City staff is responsible for reviewing reports to detect leaks and notify customers, or if it is the responsibility of the customer to recognize such leaks through the portal on their own. This decision will impact the operating costs of the project. To limit liability and staff costs, the City could consider requiring a customer to flag and report unusually high water usage to the City.

6.2 Cash Flow

Moving to A.M.R. or A.M.I. metering technologies will allow for more frequent billings given the ability to conduct more frequent meter reads. Given that the City currently charges the majority of customers on a semi-annual basis, moving towards a monthly or bi-monthly billing frequency would enhance the City's cash flow.

6.3 Potential Rate Structures

If the City were to move towards metering all customers, a variety of alternative rate structures can be adopted. The adoption of any one particular rate structure is a

function of a variety of administrative, social, demographic and financial factors. Rate structures can be utilized to promote economic development, conservation behaviours etc. The factors that are assessed and the importance of each factor will vary based on the municipality. Appendix A provides additional details on the various rate structures and the assessment of each.

6.4 Updates to Water By-law

The City's current water by-law is significantly out of date. It is recommended that the City seek to update the by-law and revise a number of components including:

- Require all properties within the City (i.e. residential and non-residential) to have a water meter in place;
- Ensuring the City maintains ownership of meters. This will allow the City to replace or repair old meters when needed instead of having to wait for the customer to install a new one. Replacing old meters when they are past their useful lives will provide more accurate meter reads and as a result, better overall revenue recovery;
- Provide direction on how customers with bleeders will be charged in winter months. If metering is in place, the City could potentially charge these customers based on usage in a similar home with a similar demographic;
- The City will be responsible for the cost of the meter as well as installation costs;
- Update the by-law to include the requirement to install backflow preventors for large non-residential customers; and
- Update costs related to extra readings, billings, water shut off, quarterly shut offs, etc. and indicate that these costs will be reviewed and updated on an annual basis.

Chapter 7
Concluding Remarks

7. Concluding Remarks

Based on the information received from other Ontario municipalities and the literature research, A.M.R. and A.M.I. universal metering are the most common practices utilized by municipalities. There are several cost considerations for each type of meter reading technology including meter type, installation, and reading costs. The change from the City's current practice of direct read metering to A.M.I. would allow for extremely accurate and frequent meter readings, but the infrastructure cost is substantial, thus efficiencies may not be experienced for many years. In addition, A.M.I. and constant meter reads provides for an exponential increase in the amount of data collected. For a municipality like Timmins, where there is no existing metering data for the majority of customers, the sheer increase in data would be very difficult to manage/analyze and may not prove to be useful at this initial stage.

Moving from direct read metering to A.M.R. also allows for accurate and frequent meter reads with much less labour but will also be a significant upfront cost given the municipality will need to purchase water meters and remote sensors. According to the National Guide to Sustainable Municipal Infrastructure – Establishing a Metering Plan to Account for Water Use and Loss, A.M.R. has been the most cost-effective solution for most water utilities. In addition, based on discussions with meter suppliers, moving from A.M.R. to A.M.I. does not require a complete replacement of existing meters and technologies as the readers can be used for either technology. As a result, if the City initially wishes to install A.M.R. technology, it can then choose to move to A.M.I. at a later date when it feels it is ready to handle the additional data produced, while only incurring the incremental costs as opposed to the full costs of the project.

Given the issues the City has been facing with respect to inequities in billing, lack of data collection and inefficiencies in the meter reading and billing process, the current practices are out of date and need to be updated to improve the current practice. Moving towards more sophisticated technology will help to address many of the City's issues as follows:

- System-wide water metering will assist the City in understanding and addressing where major water loss is occurring. This unaccounted water is a significant operating cost for the City and metering data will assist in minimizing this cost.
- The current flat rate structure is inequitable given the lack of correlation between the number of rooms in a home and water consumption. Moving to a metered

system will allow the City to change its rate structure and charge customers based on the amount of usage.

- Replacing existing meters and retaining ownership of all meters (through an update of the water by-law) will allow the City to maintain and replace faulty equipment on a timely basis. Replacing all meters and converting meters that measure on a per gallon basis to a per cubic metre basis will also reduce the administrative burden on the City.
- With the ability to charge customers based on usage, the City will be able to promote conservation efforts as users will be required to pay a higher bill with higher volumes.
- Data from metering on a City-wide basis will support management decision making with respect to policy changes.

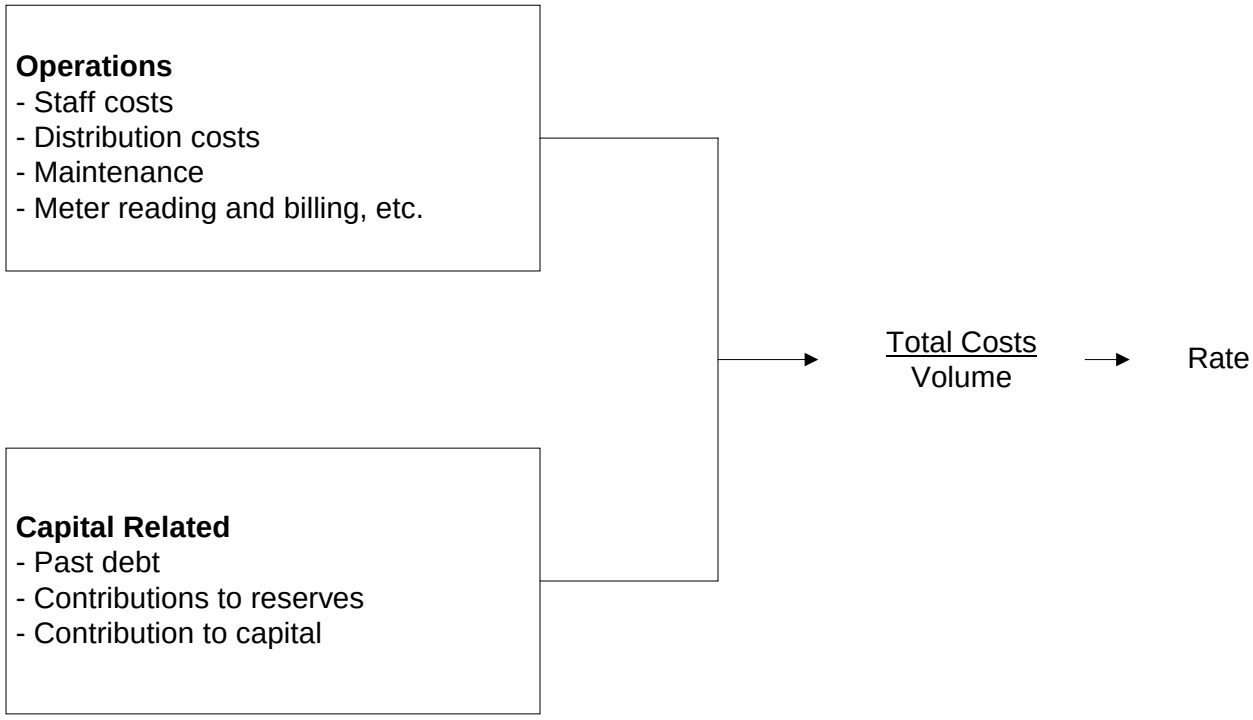
Appendix A
Pricing Structures

Appendix A: Rate Structures

Introduction

Rates, in their simplest form, can be defined as total costs to maintain the utility function divided by the total expected volume to be generated for the period. Total costs are usually a combination of operating costs (e.g. staff costs, distribution costs, maintenance, administration, etc.) and capital-related costs (e.g. past debt to finance capital projects, transfers to reserves to finance future expenditures, etc.). The schematic below provides a simplified illustration of the rate calculation for water.

"Annual Costs"



These operating and capital expenditures will vary over time. Examples of factors that will affect the expenditures over time are provided below.

Operations

- Inflation;

- Increased maintenance as system ages; and
- Changes to provincial legislation.

Capital Related

- New capital will be built as areas expand;
- Replacement capital needed as system ages; and
- Financing of capital costs are a function of policy regarding reserves and direct financing from rates (pay as you go), debt and user pay methods (development charges, *Municipal Act*).

Alternative Pricing Structures

Throughout Ontario, and as well, Canada, the use of pricing mechanisms varies between municipalities. The use of a particular form of pricing depends upon numerous factors, including Council preference, administrative structure, surplus/deficit system capacities, economic/demographic conditions, to name a few.

Municipalities within Ontario have two basic forms of collecting revenues for water purposes, those being through incorporation of the costs within the tax rate charged on property assessment and/or through the establishment of a specific water rate billed to the customer. Within the rate methods, there are five basic rate structures employed along with other variations:

- Flat Rate (non-metered customers);
- Constant Rate;
- Declining Block Rate;
- Increasing (or Inverted) Block Rate;
- Hump Back Block Rate; and
- Base Charges.

The definitions and general application of the various methods are as follows:

Property Assessment: This method incorporates the total costs of providing water into the general requisition or the assessment base of the municipality. This form of collection is a "wealth tax," as payment increases directly with the value of property owned and bears no necessary relationship to actual consumption. This form is easy to

administer as the costs to be recovered are incorporated in the calculation for all general services, normally collected through property taxes.

Flat Rate: This rate is a constant charge applicable to all customers served. The charge is calculated by dividing the total number of user households and other entities (e.g. businesses) into the costs to be recovered. This method does not recognize differences in actual consumption but provides for a uniform spreading of costs across all users. Some municipalities define users into different classes of similar consumption patterns, that is, a commercial user, residential user and industrial user, and charge a flat rate by class. Each user is then billed on a periodic basis. No meters are required to facilitate this method, but an accurate estimate of the number of users is required. This method ensures set revenue for the collection period but is not sensitive to consumption, hence may cause a shortfall or surplus of revenues collected.

Constant Rate: This rate is a volume-based rate, in which the consumer pays the same price per unit consumed, regardless of the volume. The price per unit is calculated by dividing the total cost of the service by the total volume used by total consumers. The bill to the consumer climbs uniformly as the consumption increases. This form of rate requires the use of meters to record the volume consumed by each user. This method closely aligns the revenue recovery with consumption. Revenue collected varies directly with the consumption volume.

Declining Block Rates: This rate structure charges a successively lower price for set volumes, as consumption increases through a series of "blocks." That is to say that within set volume ranges, or blocks, the charge per unit is set at one rate. Within the next volume range, the charge per unit decreases to a lower rate, and so on. Typically, the first, or first and second blocks cover residential and light commercial uses. Subsequent blocks normally are used for heavier commercial and industrial uses. This rate structure requires the use of meters to record the volume consumed by each type of user. This method requires the collection and analysis of consumption patterns by user classification to establish rates at a level which does not over or under collect revenue from rate payers.

Increasing or Inverted Block Rates: The increasing block rate works essentially the same way as the declining block rate, except that the price of water in successive blocks increases rather than declines. Under this method the consumer's bill rises faster with higher volumes used. This rate structure also requires the use of meters to

record the volume consumed by each user. This method requires, as with the declining block structure, the collection and analysis of consumption patterns by user classification to establish rates at a level which does not over or under collect from rate payers.

The Hump Back Rate: The hump back rate is a combination of an increasing block rate and the declining block rate. Under this method the consumer's bill rises with higher volumes used up to a certain level and then begins to fall for volumes in excess of levels set for the increasing block rate.

Assessment of Alternative Pricing Structures

The adoption by a municipality or utility of any one particular pricing structure is normally a function of a variety of administrative, social, demographic and financial factors. The number of factors, and the weighting each particular factor receives, can vary between municipalities. The following is a review of some of the more prevalent factors.

Cost Recovery

Cost recovery is a prime factor in establishing a particular pricing structure. Costs can be loosely defined into different categories: operations, maintenance, capital, financing and administration. These costs often vary between municipalities and even within a municipality, based on consumption patterns, infrastructure age, economic growth, etc.

The pricing alternatives defined earlier can all achieve the cost recovery goal, but some do so more precisely than others. Fixed pricing structures, such as Property Assessment and Flat Rate, are established on the value of property or on the number of units present in the municipality, but do not adjust in accordance with consumption. Thus, if actual consumption for the year is greater than projected, the municipality incurs a higher cost of production, but the revenue base remains static (since it was determined at the beginning of the year), thus potentially providing a funding shortfall. Conversely, if the consumption level declines below projections, fixed pricing structures will produce more revenue than actual costs incurred.

The other pricing methods (declining block, constant rate, increasing block) are consumption-based and generally will generate revenues in proportion to actual consumption.

Administration

Administration is defined herein as the staffing, equipment and supplies required to support the undertaking of a particular pricing strategy. This factor not only addresses the physical tangible requirements to support the collection of the revenues, but also the intangible requirements, such as policy development.

The easiest pricing structure to support is the Property Assessment structure. As municipalities undertake the process of calculating property tax bills and the collection process for their general services, the incorporation of the water costs into this calculation would have virtually no impact on the administrative process and structure.

The Flat Rate pricing structure is relatively easy to administer as well. It is normally calculated to collect a set amount, either on a monthly, quarterly, semi-annual or annual basis, and is billed directly to the customer. The impact on administration centres mostly on the accounts receivable or billing area of the municipality, but normally requires minor additional staff or operating costs to undertake.

The three remaining methods, those being Increasing Block Rate, Constant Rate and Declining Block Rate, have a more dramatic effect on administration. These methods are dependent upon actual consumption and hence involve a major structure in place to administer. First, meters must be installed in all existing units in the municipality, and units to be subsequently built must be required to include these meters. Second, meter readings must be undertaken periodically. Hence staff must be available for this purpose or a service contract must be negotiated. Third, the billings process must be expanded to accommodate this process. Billing must be done per a defined period, requiring staff to produce the bills. Lastly, either through increased staffing or by service contract, an annual maintenance program must be set up to ensure meters are working effectively in recording consumed volumes.

The benefit derived from the installation of meters is that information on consumption patterns becomes available. This information provides benefit to administration in calculating rates which will ensure revenue recovery. Additionally, when planning what services are to be constructed in future years, the municipality or utility has documented

consumption patterns distinctive to its own situation, which can be used to project sizing of growth-related works.

Equity

Equity is always a consideration in the establishment of pricing structures but its definition can vary depending on a municipality's circumstances and based on the subjective interpretation of those involved. For example: is the price charged to a particular class of rate payer consistent with those of a similar class in surrounding municipalities; through the pricing structure does one class of rate payer pay more than another class; should one pay based on ability to pay, or on the basis that a unit of water costs the same to supply no matter who consumes it; etc.? There are many interpretations. Equity therefore must be viewed broadly in light of many factors as part of achieving what is best for the municipality as a whole.

Conservation

In today's society, conservation of natural resources is increasingly being more highly valued. Controversy continuously focuses on the preservation of non-renewable resources and on the proper management of renewable resources. Conservation is also a concept which applies to a municipality facing physical limitations in the amount of water which can be supplied to an area. As well, financial constraints can encourage conservation in a municipality where the cost of providing each additional unit is increasing.

Pricing structures such as property assessment and flat rate do not, in themselves, encourage conservation. In fact, depending on the price which is charged, they may even encourage resource "squandering," either because consumers, without the price discipline, consume water at will, or the customer wants to get his money's worth and hence adopts more liberal consumption patterns. The fundamental reason for this is that the price paid for the service bears no direct relationship to the volume consumed and hence is viewed as a "tax," instead of being viewed as the price of a purchased commodity.

The Declining Block Rate provides a decreasing incentive towards conservation. By creating awareness of volumes consumed, the consumer can reduce his total costs by restricting consumption; however, the incentive lessens as more water is consumed, because the marginal cost per unit declines as the consumer enters the next block

pricing range. Similarly, those whose consumption level is at the top end of a block have less incentive to reduce consumption.

The Constant Rate structure presents the customer with a linear relationship between consumption and the cost thereof. As the consumer pays a fixed cost per unit, his bill will vary directly with the amount consumed. This method presents tangible incentive for consumers to conserve water. As metering provides direct feedback as to usage patterns and the consumer has direct control over the total amount paid for the commodity, the consumer is encouraged to use only those volumes that are reasonably required.

The Inverted Block method presents the most effective pricing method for encouraging conservation. Through this method, the price per unit consumed increases as total volumes consumed grow. The consumer becomes aware of consumption through metering with the charges increasing dramatically with usage. Hence, there normally is awareness that exercising control over usage can produce significant savings. This method not only encourages conservation methods, but may also penalize legitimate high-volume users if not properly structured.

Figure A-1 provides a schematic representation of the various rate structures (note property tax as a basis for revenue recovery has not been presented for comparison, as the proportion of taxes paid varies in direct proportion to the market value of the property). The graphs on the left-hand side of the figure present the cost per unit for each additional amount of water consumed. The right-hand side of the figure presents the impact on the customer's bill as the volume of water increases. Following the schematic is a table summarizing each rate structure.

Figure A-1

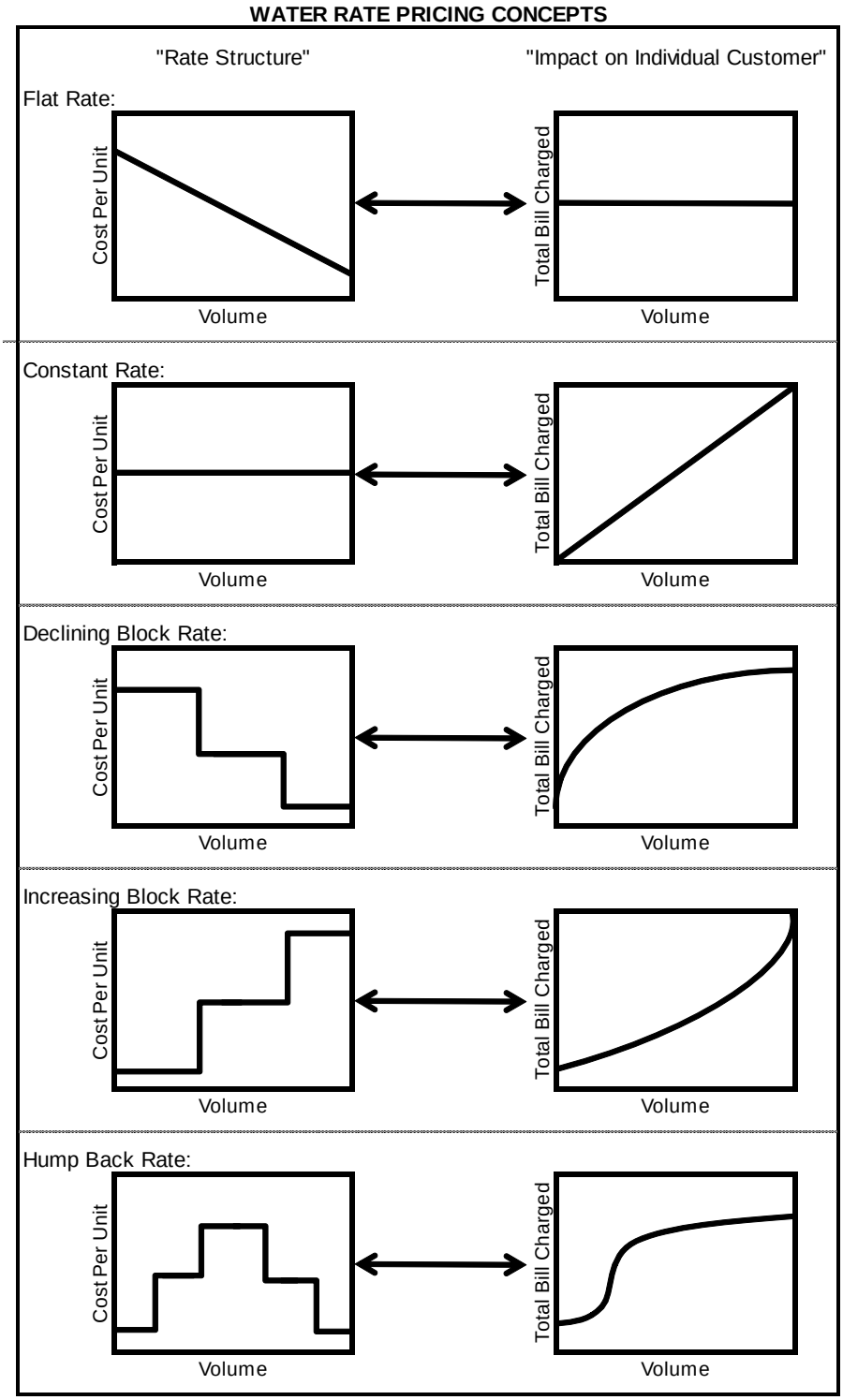

WATER RATE PRICING CONCEPTS
"Rate Structure"
"Impact on Individual Customer"
Flat Rate:
Cost Per Unit
Volume
Total Bill Charged
Volume
Constant Rate:
Cost Per Unit
Volume
Total Bill Charged
Volume
Declining Block Rate:
Cost Per Unit
Volume
Total Bill Charged
Volume
Increasing Block Rate:
Cost Per Unit
Volume
Total Bill Charged
Volume
Hump Back Rate:
Cost Per Unit
Volume
Total Bill Charged
Volume

Figure A-2
Summary of Various Rate Structures and their Impact on Customer Bills as Volume Usage Increases

Rate Structure	Cost Per Unit As Volume Increases	Impact On Customer Bill As Volume Increases
Flat Rate	Cost per unit decreases as more volume consumed	Bill remains the same no matter how much volume is consumed
Constant Rate	Cost per unit remains the same	Bill increases in direct proportion to consumption
Declining Block	Cost per unit decreases as threshold targets are achieved	Bill increases at a slower rate as volumes increase
Increasing Block	Cost per unit increases as threshold targets are achieved	Bill increases at a faster rate as volumes increase
Hump Back Rate	Combination of an increasing block at the lower consumption volumes and then converts to a declining block for the high consumption	Bill increases at a faster rate at the lower consumption amounts and then slows as volumes increase

Rate Structures in Ontario

In a past survey of over 170 municipalities (approximately half of the municipalities who provide water and/or sewer), all forms of rate structures are in use by Ontario municipalities. The most common rate structure is the constant rate (for metered municipalities). Most municipalities (approximately 92%) who have volume rate structures also impose a base monthly charge.

Historically, the development of a base charge often reflected either the recovery of meter reading/billing/collection costs, plus administration or those costs plus certain fixed costs (such as capital contributions or reserve contributions). More recently, many municipalities have started to establish base charges based on ensuring a secure

portion of the revenue stream which does not vary with volume consumption. Selection of the quantum of the base charge is a matter of policy selected by individual municipalities.

Appendix B
Sample Implementation Information from the City of Greater Sudbury

Appendix B: Sample Implementation Information from the City of Greater Sudbury

The following provides an example of how the City of Greater Sudbury communicated with its customers when installing new meters.

Customers received a booklet from KTI Limited with their password and login information for the online portal. From there, customers were directed to a login interface. The City website provided customers with a brief project description, frequently asked questions, information on the benefits of new water meters, a YouTube video recording of the virtual open house, information on how to book an appointment, and contact information.

Figure B-1 provides a screenshot of the KTI customer booking login where customers were directed once they received their login information at the beginning of the project.

Figure B-1
City of Greater Sudbury
Login Interface

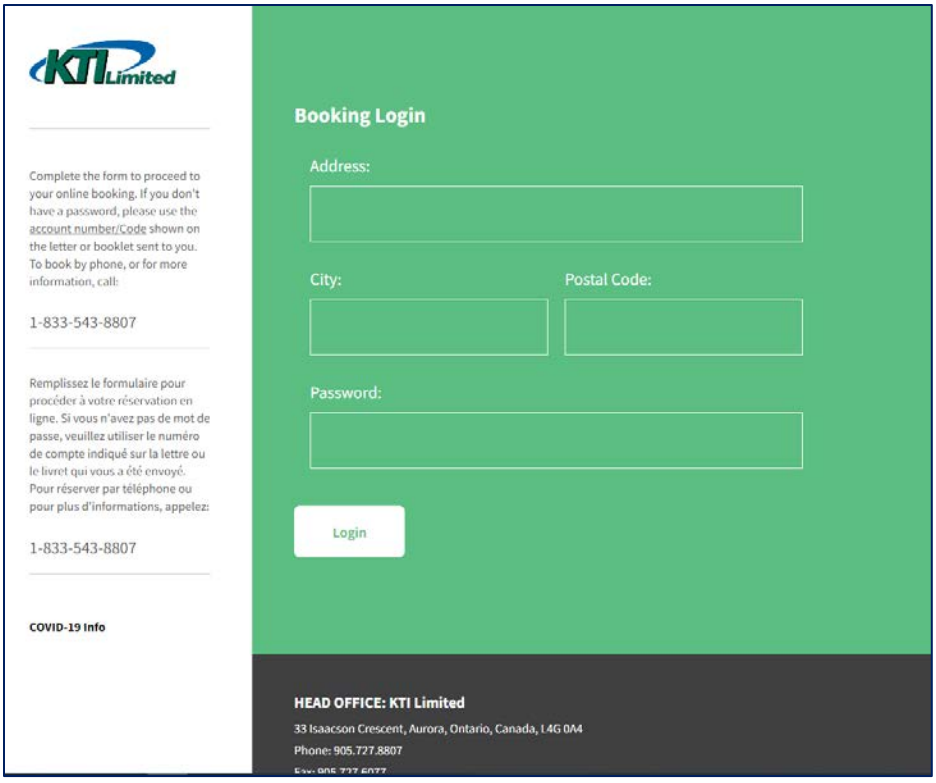
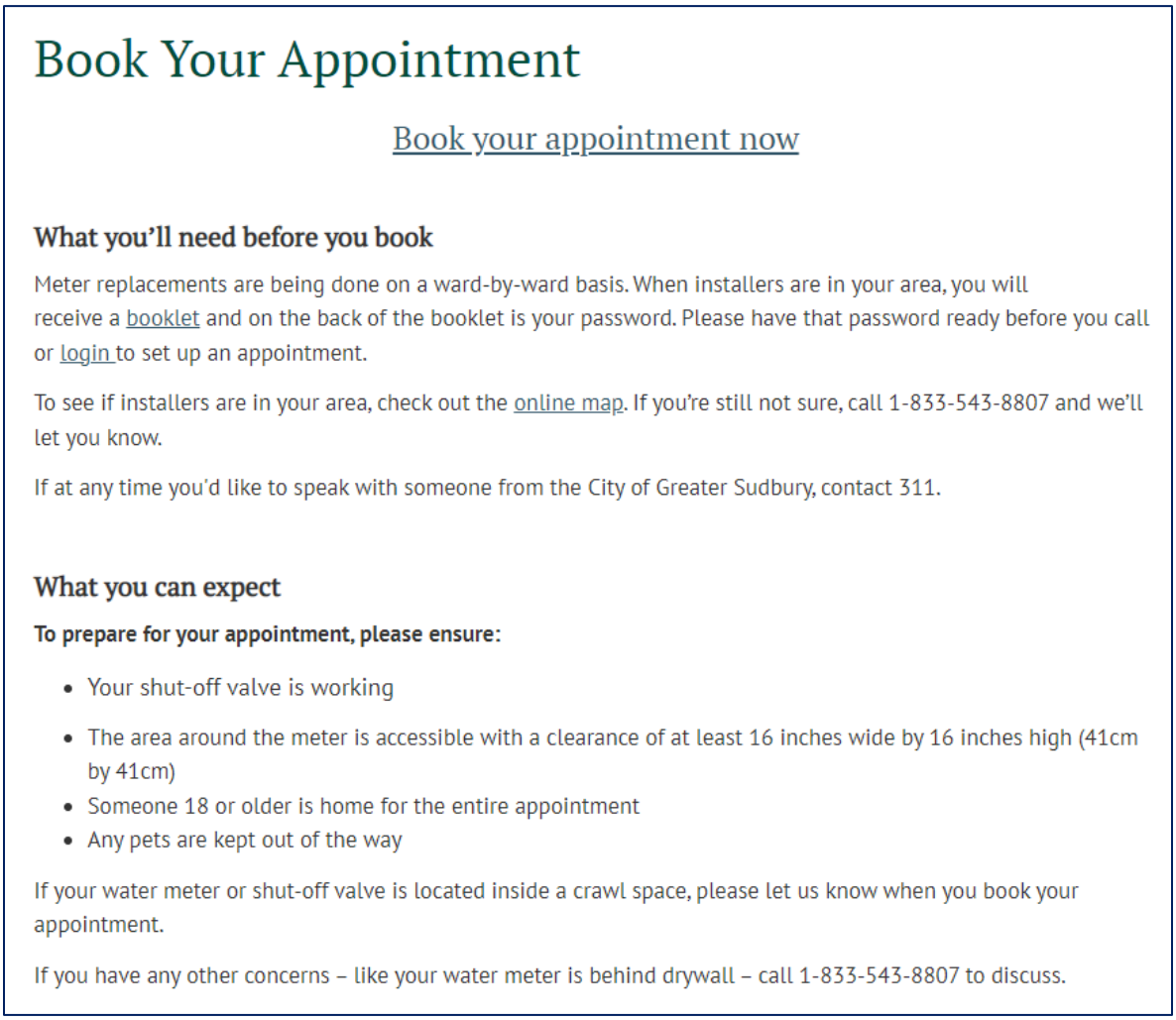


Figure B-2 provides a screenshot of the City website water meter installation booking page. This page provided customers with detailed information of the project, including how to book an appointment, how to prepare for an appointment, and what to expect during the appointment.

Figure B-2
City of Greater Sudbury
City Website – Water Meter Installation Booking Page



Book Your Appointment

Book your appointment now

What you'll need before you book

Meter replacements are being done on a ward-by-ward basis. When installers are in your area, you will receive a booklet and on the back of the booklet is your password. Please have that password ready before you call or login to set up an appointment.

To see if installers are in your area, check out the online map. If you're still not sure, call 1-833-543-8807 and we'll let you know.

If at any time you'd like to speak with someone from the City of Greater Sudbury, contact 311.

What you can expect

To prepare for your appointment, please ensure:

- Your shut-off valve is working
- The area around the meter is accessible with a clearance of at least 16 inches wide by 16 inches high (41cm by 41cm)
- Someone 18 or older is home for the entire appointment
- Any pets are kept out of the way

If your water meter or shut-off valve is located inside a crawl space, please let us know when you book your appointment.

If you have any other concerns – like your water meter is behind drywall – call 1-833-543-8807 to discuss.

During Your Appointment:

- A water meter technician from KTI will arrive at your property. The technician will be in uniform and will have a provincially issued water meter installer certificate
- The technician will ask you a few questions before they enter, to make sure no one in your home is feeling ill.
- The technician will turn off your water before the work begins.
- The technician will install the new meter and attach a transmitter to the outside of your home, running a wire to connect the transmitter to the meter.
- When the work is done, the technician will turn the water back on.
- A typical meter replacement takes between 30 and 90 minutes.

John Smith
Water meter installer
Compteur d'eau installer
#00091567

KTI Limited 3-1-1 Service Sudbury

Figure B-3 outlines the action plan for the installation of water meters across the City. The City was broken out into its existing wards and dates were pre-determined for installations in each ward. Customers were then instructed to book appointments on dates based on which ward they fell into.

Figure B-3
City of Greater Sudbury
City Website – Water Meter Installation Project Phases

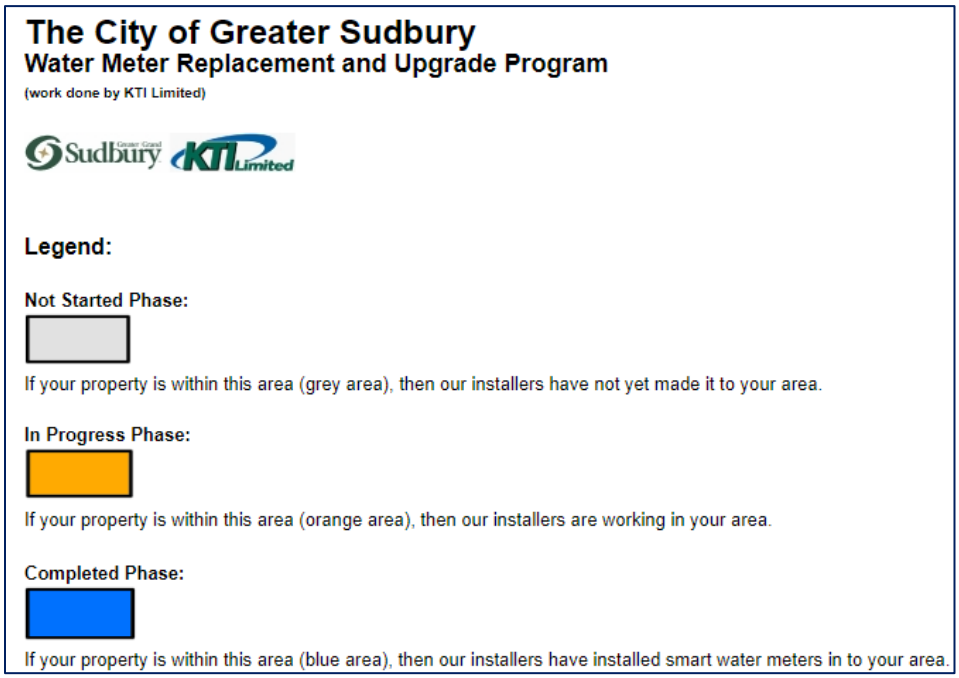
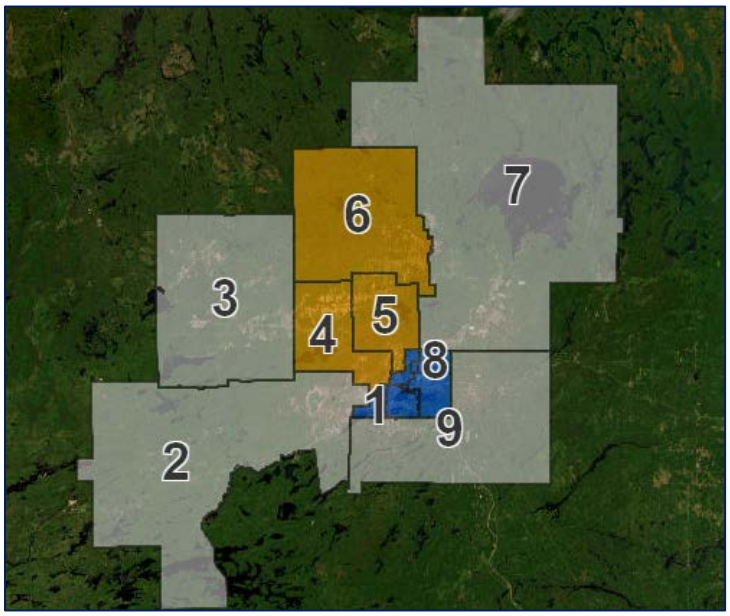


Figure B-3 (Cont'd)



Ward	Estimated Meter Install Start Date	Estimated Meter Install Completion Date	Status
Ward 1	November 2021	May 2022	Contractually Complete
Ward 2	Q1 2023	Q2 2023	Not Started
Ward 3	December 2021	Q2 2023	In Progress
Ward 4	July 2022	Q4 2022	In Progress
Ward 5	July 2022	Q4 2022	In Progress
Ward 6	August 2022	Q1 2023	In Progress
Ward 7	Q3 2023	Q4 2023	Not Started
Ward 8	February 2022	August 2022	Contractually Complete
Ward 9	Q2 2023	Q3 2023	Not Started
Ward 10	September 2020	October 2021	Contractually Complete
Ward 11	December 2021	July 2022	Contractually Complete
Ward 12	June 2021	February 2022	Contractually Complete