RESIDENTIAL WATER METERING AND PRICING STRUCTURES FOR THE DISTRICT OF MISSION

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EXECUTIVE SUMMARY

The District of Mission is considering implementation of universal water metering. Residential water metering and well-designed volumetric-based rate structures provide a means to encourage conservation.

This report reviews the economic literature on residential water and wastewater metering and pricing. It also includes results of a jurisdictional scan and identifies pricing structures used by other municipalities across the country, highlighting some of the main issues municipalities consider when setting rates or implementing new metering programs.

This work will inform the District's decision to implement residential water metering and consumption-based pricing and will provide the tools for it to assess the results of various rate options. This report is subject to various limitations and the District of Mission should seek legal advice before implementing changes to its water rate structure or other recommendations in this report.

Background

B.C.'s Living Water Smart Water plan sets ambitious targets for water efficiency and conservation and indicates that improvements such as implementation of water metering will help reduce water use (Government of British Columbia, 2011).

Consumers with meters and volume-based pricing use significantly less water on average than those who pay flat fees (Environment Canada, 2011, p. 7). Only one-third of residential clients in B.C. were metered in 2006, compared to the national average of 63%. However, in recent years, several municipalities in the province have begun residential water metering.

According to the 2010 Abbotsford Mission Water and Sewer Services Water Master Plan Update, new water sources will be needed to meet projected water demand by 2031 (AECOM Canada Ltd., 2010, p. i). Abbotsford has universal metering in place and began charging residential users a three-tier increasing block summer rate, with higher rates at set usage thresholds, in July 2011 (City of Abbotsford, n.d.b). Its per capita residential water consumption is estimated to be less than two-thirds of that in Mission (Abbotsford Mission Water & Sewer Services, 2010).

Recent reports have recommended that Mission expand water metering from the Industrial, Commercial, Institutional (ICI) sector to all residences (Maas & Porter-Bopp, 2009, p. 30). The District is considering implementation of a universal water metering program, but has expressed concerns about revenue stability.

Literature review

The economic literature indicates that municipalities should charge for what they provide and that consumers should pay for what they get (Bird and Tsiopoulos, 1997, p. 50). Properly designed user fees are a key tool to ensure economic efficiency as they provide a price signal that encourages consumers to consume the optimum amount. Without such a price signal, consumption will exceed efficient levels, resulting in over-investment in capacity (Kitchen, 2000, p. 14). User fees can be politically 'sticky' and hard to change, so it is important to try to make rates as efficient as possible from the start (Bird and Tsiopoulos, 1997, p. 84).

Marginal cost pricing is viewed as the best way to ensure economic efficiency (Altmann, 2007, p. 23; Brandes, Renzetti, & Stinchcombe, 2010, p. 17; Howe, 2005, p. 44; Olmstead, Hanemann, & Stavins, 2007, p. 2). However, marginal cost pricing is infrequently used in practice due to practical difficulties (OECD, 2010, p. 27; Swain, Lazar, & Pine, 2005, p. 61) and most Canadian jurisdictions use a form of average cost pricing instead (Brandes et al., 2010, p. 17). A recommended compromise on pure marginal cost pricing is the use of two-part rates that allow municipalities to recover fixed costs through a fixed component, while variable costs are covered through a volumetric charge, set to approximate marginal costs (Bird & Tsiopoulos, 1997, p. 57).

Equity considerations are also frequently cited as an important consideration in water rate design. According to the benefits received, or user pay approach, fairness requires that people pay for what they receive; no more, no less (Bird, 1976, p. 11). This approach is relevant for municipal services, since redistribution issues should not be a priority at the local level (Kitchen, 1984, p. 268)—efficient pricing should be the top priority (Bird and Slack, 1983, p. 81). This does not mean that concerns about ability-to-pay should be ignored. However, such concerns should be addressed using a subsidy outside the rate structure (Kitchen, 1984, pp. 268-9) to ensure that the efficiency and equity of the user fee, in terms of benefits received, are not compromised.

Price elasticity research can help determine how water consumption will respond to changes in the price of water. Research shows that the price elasticity of demand for water is negative, with many estimates in the range of -0.41 (Dalhuisen, Florax, de Groot, & Nijkamp, 2003, p. 295), indicating that a 10% price increase would lead to a 4.1% drop in consumption. Price elasticity estimates increase in the long run, indicating that households respond slowly to changes in price (Hoffmann, Worthington, & Higgs, 2006, pp. 354-6). Research also shows that low-income earners respond more to price increases than those with higher incomes (Howe, 2005, p. 49; Olmstead & Stavins, 2008, pp. 8-9) and that outdoor water use is more elastic than indoor use (Harris, Tate, & Renzetti, 2002, p. 68). The research also notes the fact that many households are not very aware of water rates: simply including rate information on water bills can increase elasticity estimates by up to 30% (Olmstead & Stavins, 2008, p. 9).

Traditionally, municipalities have taken a supply-oriented approach, increasing water supply and infrastructure, to deal with issues surrounding population growth and water scarcity. However, in the context of decreasing availability of water, environmental constraints, and the level of investment needed to expand water systems, demand management approaches, such as water use restrictions, water metering, and education and outreach, have become more common (de Loe, Moraru, Kreutzwiser, Schaefer, & Mills, 2001, p. 66). Metering is recognized as a best management practice by several organizations including the Canadian Council of Ministers of the Environment (Canadian Council of Ministers of the Environment, 1994), Federation of Canadian Municipalities (Federation of Canadian Municipalities, 2006, p. 37) and others.

Water metering and consumption-based rates provide an effective means of encouraging consumers to reduce water use (Inman & Jeffrey, 2005, p. 137; Olmstead & Stavins, 2008, p. 18). Rate design is a complex process and requires attention to different and sometimes conflicting objectives including cost recovery, economic efficiency, equity and simplicity (Marsden Jacob Associates, 2004, p. 2; Montginoul, 2007, p. 861; Worthington & Hoffman, 2008, p. 857). Environmental sustainability also frequently figures in rate design objectives (Harris et al., 2002, p. 9).

Various pricing structures can be used, each of which has different impacts on the above objectives:

- Flat rates allow an unlimited amount of water use and are ineffective at encouraging conservation (Brandes et al., 2010, p. 19).
- Volumetric rates (e.g. uniform, increasing or decreasing block) are a user-pay approach where charges are based on the amount of water used, as determined through metering. Revenue instability is a potential issue with these types of rates because of the unpredictability of consumer usage (Brandes et al., 2010, p. 23).
- Two-part rates include a fixed service, connection, or meter fee, as well as a volumetric charge (e.g. uniform, increasing, or decreasing block). Two-part rates are considered to be the best approach to dealing with the some of the problems associated with volumetric rates (Marsden Jacob Associates, 2004, p. 6; Monteiro, 2005, p. 14).

Use of flat and declining block rates results in water use and capacity investments that are higher than otherwise needed (Bird & Tsiopoulos, 1997, p. 51). These rates favour high-volume water users whose consumption is in effect subsidized by lower-volume users and are seen as regressive since higher-volume consumers tend to be wealthier (Harris et al., 2002, p. 133).

Two-part rates are considered to be optimal provided that the volumetric charge reflects marginal cost (Bird & Tsiopoulos, 1997, p. 57). One benefit of uniform volumetric charges is that they are simple to explain (Brandes et al., 2010, p. 21). Increasing block volumetric components, which set higher prices above defined usage thresholds, are used as a way to encourage water conservation since they provide a stronger price signal to conserve water (Inman & Jeffrey, 2005, p. 131). However, these rate structures have been criticized as unfair to large households (Arbués, García-Valiñas, & Martínez-Espiñeira, 2003, p. 82; Barberán & Arbués, 2009, p. 2109; Brandes et al., 2010, p. 21; Edwards, 2006, p. S60; OECD, 2010, p. 87). Seasonal rates involve higher charges during periods of water scarcity and can enhance efficiency as they provide an increased financial incentive to reduce peak water use (Harris et al., 2002, p. 63; Monteiro, 2005, p. 13).

Jurisdictional scan

The jurisdictional scan identified and reviewed the websites of 300 municipalities across the country that currently meter or that were in the process of implementing residential water metering. It is important to note that legislation authorizing water fees may vary across the country; therefore, no presumption should be made about the legality of different fees in British Columbia, without first reviewing the applicable legislation.

Two-part rates that included a fixed and a uniform component were the most commonly used rate structure, used by 58% of municipalities, while those that included an increasing block component made up 16% of rate structures (Table 1). Decreasing block components were less common—they were used by 8% of municipalities, although most set the second block above the normal level of domestic consumption. Although 16% of municipalities used a volumetric only rate structure, almost half incorporated a minimum charge. Relatively few municipalities made use of alternative rate options such as seasonal rates or targeted low-income or senior citizens rate reductions.

Residential metering has been in use for decades in several provinces and several municipalities have begun updating their equipment to reduce malfunctioning meters and facilitate meter reading, through use of radio-frequency meters.

Table 1. Type of water rate used for metered customers, by province

Province	BC	AB	SK	MB	ON	QC	NB	NS	PEI	CANADA
Rate type	Number of municipalities									
Fixed fee only	6									6
Uniform rate only	3	3			13	1	1	1		22
Uniform rate with a minimum bill	1	7			9		1			18
Uniform rate with seasonal increasing block for residential; decreasing block for ICI / farms	1									1
Increasing block rate only	1	1			1	1				4
Increasing block rate with a minimum bill	1	2			1					4
Two-part (fixed fee + uniform rate)			1							1
Two-part (fixed fee without water allocation + uniform rate)	15	43	10	13	63	3	3	7	1	158
Two-part (fixed fee without water allocation + uniform rate with a minimum bill)	2				2					4
Two-part (fixed fee with water allocation + uniform rate)	3		1			2				6
Voluntary two-part (fixed fee with water allocation + uniform rate) OR flat rate	1									1
Two-part (fixed fee without water allocation + increasing block rate)	8	8	1		11	1	1	1		30
Two-part (fixed fee without water allocation + increasing block rate with a minimum bill)					1					1
Two-part (fixed fee with water allocation + increasing block rate)	7		1			1				9
Two-part (fixed fee without water allocation + increasing block for residential; decreasing block for ICI / farms					7					7
Two-part (fixed fee without water allocation + decreasing block rate)	1	1	1	6	12		2	3		26
Two-part (fixed fee without water allocation + decreasing block rate with a minimum bill)	1									1
CANADA	51	65	15	19	120	9	8	12	1	300

See Appendix B for complete details for municipalities included in this table.

A review of municipalities' rate study reports, financial and strategic plans identified a wide range of considerations that influence rate setting, including cost recovery, affordability, debt financing, conservation, equity and others.

Issues related to full cost recovery were emphasized—where municipalities have not recovered full costs for water, large rate hikes or debt financing are required to pay for system improvements and many water systems have reached the point where major investment can no longer be deferred (City of Hamilton, 2010, p. 11; City of London, 2011a, p. 2).

Municipalities also consider equity principles when setting rates, with most referencing the user-pay equity standard that customers should pay the cost of the service they receive. A few municipalities considered intergenerational equity issues (Vancouver, 2011, p. 9), while others focused on affordability or ability to pay. Conservation is another factor considered in rate setting. Most jurisdictions in Ontario have experienced some problems covering costs due to faster than expected reductions in water consumption as a result of conservation efforts. Seasonal variations and climate patterns can also cause revenue instability. Two-part rates can help address revenue fluctuations and provide a measure of certainty for municipalities. The relative balance between fixed and volumetric charges will depend on the values and preferences of the jurisdiction, with the fixed component supporting revenue predictability and stability and the volumetric

component supporting conservation and affordability, since consumers have more control over their bill (City of St. Catherine's, 2011, p. 13; Urban Systems, 2009, p. 5).

Where conservation and seasonal peak demand are the main issues, municipalities may consider use of an increasing block volumetric component. However, setting block thresholds is a challenge: set too high, there is little incentive for conservation since most consumption will fall within the first block; set too low and affordability and equity concerns prevail. A few jurisdictions addressed seasonal peak demand using a uniform seasonal premium, tiered summer rate or seasonal surcharge to consumption over a given threshold (City of Abbotsford, n.d.b; City of Vancouver, 2012b; District of Tofino, 2009; Municipality of Middlesex Centre, 2011).

The scan identified 31 municipalities that have recently implemented metering. Some of the issues that need to be considered include costs and benefits of metering, the choice between universal and non-universal programs, meter and meter reading equipment and installation options and communication. Cost-benefit studies showed that projected costs of universal metering frequently outweighed identified savings, except where implementation allowed long-term deferral or avoidance of capital costs and grant assistance was received. However, results from municipalities that implemented universal metering indicate that significant water use reductions occurred. Water flow reductions ranged from 21% to 34% in some municipalities (City of Port Alberni, n.d.; District of Peachland Water Department, 2011; Village of Lumby, 2011b) while average household usage decreased 30% in Kelowna and Vernon experienced per capita reductions of 19% (City of Kelowna, 2009; as cited in TRUE Consulting, 2009, p. 21).

Municipalities that wish to move towards universal metering incrementally often begin with voluntary water metering programs. High participation was evident where rate structures allowed significant savings over flat rates, for example in Surrey and Richmond (City of Surrey, 2010; Mui, 2011). As revenue declines from metered customers, flat water rates need to be adjusted upwards.

A range of metering equipment and installation options are available. Mobile and fixed network meter reading can reduce operational costs, but cost significantly more to install (City of Kamloops Public Works and Utilities Department, 2007, p. 13). Installation of meters in the home reduces costs, while pit installation at the property line reduces access problems and encourages consumers to fix outdoor leaks (Earth Tech (Canada) Inc., 2007a, p. 6).

Communication is an important part of successful water conservation programs and new water rates and bills need to be clear and understandable. Shadow billing, which shows consumers the costs they would face under the new rate, is frequently used before consumption-based billing begins. Implementing water metering and volumetric billing can be controversial, particularly if it will result in increased bills. Where customers refuse on-property meter installation, municipalities sometimes opt to install meters at the property line and charge customers accordingly. Other municipalities instead significantly increase the fixed water charges for these customers.

Discussion

According to the 2010 Abbotsford / Mission Water Master Plan, average day water demand will exceed capacity between now and 2031, while maximum day demand was forecast to exceed capacity by as early as 2011 (AECOM Canada Ltd., 2010, pp. i-ii). Metering and consumption-

based rates are considered to be some of the most effective tools to reduce water use, with many estimates of the reduction ranging from 20% to 30% (TRUE Consulting, 2009, p. 23).

Findings show strong support for user fees designed to maximize efficiency and support the user pay principle. The importance of full cost recovery was also emphasized. Consumption-based rates are preferred since they support a fair distribution of costs to consumers based on user pay and since they can provide price signals that will encourage conservation; this is particularly important for Mission and Abbotsford, given the need to reduce average and maximum day water use. Metering is, of course, required for consumption-based billing.

Several authorities, including the Canadian Water and Wastewater Association (CWWA) (as cited in Brandes et al., 2010) and the Ontario Water Works Association (OWWA) (2005, p. 8) identify use of two-part rates incorporating fixed and volumetric components as a best practice. The majority (86%) of municipalities in Canada that were included in the jurisdictional scan have adopted some type of two-part rate variation.

Public debate regarding setting fixed charges indicate that low fixed charges encourage conservation, while high fixed charges favour revenue stability. The Federation of Canadian Municipalities' Infraguide recommends using a low fixed charge to achieve conservation goals (2006, p. 35). Three quarters of the municipalities reviewed set their fixed or minimum charge below 50% of the total average water charge; however, municipalities in B.C. were more likely to use high fixed or minimum charges.

Mission currently uses a minimum quarterly consumption charge of $106, a level that is unlikely to encourage water conservation and that sees its metered customers paying 98% of the flat unmetered rate. Should the District move forward with metering, it should consider options to reduce the fixed charge.

Uniform volumetric rates are the most commonly used volumetric component and are the easiest to communicate. While these rates do not provide an increased price signal to conserve, they treat all water users equally (Brandes et al., 2010, p. 19; Edwards, 2006, p. 62). Increasing block rates may be appropriate where conservation is a concern (1997, p. 152). However, these rates pose equity concerns for large families and those in multi-residential dwellings, and may require special approaches such as threshold adjustments based on household size. Seasonal rates are not widely used in Canada, but are an additional tool to improve water use efficiency where peak demand is a problem. While Abbotsford's new summer tiered rate system has attracted some criticism (Baker, 2012), other seasonal rate options are possible, for example the 25% seasonal surcharge applied to all metered water use in Vancouver (City of Vancouver, 2012b).

Implementing water meters can unlock a great deal of potential for Mission in terms of understanding local water consumption trends. Should Mission move forward with water metering, some key messages to be communicated as part new water meter program implementation include:

- Metering will reduce water use and help defer or avoid expansions to the water system.
- Metering is fair since water users are billed based on their consumption. Low-volume water users will no longer subsidize high-volume users.
- With metered water rates, those who use less water can save money compared to the fixed rates.

Mission may also wish to consider taking a voluntary metering approach. However, the key to ensuring participation is to design rates so that volunteers are able to save money. Since most volunteers will likely be low-volume water users, this will require increases to the fixed rate.

Options

The recommendations aim to reduce water use, while maintaining revenues at a level sufficient to recover costs. The two-part rate structure, a CWWA best practice, can approximate marginal cost pricing, which is critical for economic efficiency, while maintaining financial stability Emphasizing the volumetric component over the fixed component sends a stronger price signal to reduce water use and more closely approximates marginal cost pricing, although it can cause revenue instability.

The benefits-received notion of equity is important, but rate setting exercises should also consider ability to pay. However, affordability should be addressed outside the rate structure using mechanisms such as rebate programs for low-income residents. This will avoid unwanted price distortions.

Water rates directed at discretionary water use, such as outdoor water use in summer, should be prioritized as these uses are most responsive to price and most responsible for peak demand. A rate calculator has been developed and is included in Appendix B to explore the impact of various price settings and other user-input parameters on revenue.

Recommended options include:

- A two-part rate with a uniform volumetric component with seasonal rate applied as a percent increase to all summer consumption.
- A two-part rate with a two-step increasing block component, with the first block set at a level that reflects consumption for basic needs.

Consumption-based rates can be developed to achieve both conservation and financial objectives. Scenarios modeling the above two options, including the potential impacts on different customers are included.

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INTRODUCTION

The District of Mission is considering implementing universal water metering. Water metering programs including voluntary, semi-mandatory, and universal programs are becoming more common in British Columbia. New meter and meter reading technologies are available, some of which provide real-time information on water use throughout the day (Environment Canada, 2011, p. 6).

A recent study conducted for Abbotsford Mission Water and Sewer Service recommended that Mission implement universal metering and volume-based pricing as part of a suite of demand management efforts (Maas & Porter-Bopp, 2009, p. 45). The District anticipates that installing meters would allow a better understanding of residential water consumption patterns and the use of consumption-based billing, which would better encourage water conservation (M. Younie, Personal communication, April 2, 2012). However, rate design must also consider other factors such as cost recovery and equity.

This report reviews the economic literature on residential water metering and pricing. It focuses on identifying problems resulting from a given pricing structure or approach. It also identifies pricing structures used by other municipalities in Canada and highlights some of the main issues municipalities consider when setting rates or implementing new metering programs, including positive and negative impacts in terms of financial stability, conservation, affordability for low-income households and more.

Findings are used to develop consumption-based pricing options for consideration by the District. A water rate calculator is included that will allow the District to analyze the impacts of different rate structures and parameters on revenue.

Residential water metering and volumetric-based rate structures provide a means to reduce consumption, which is the District's main objective. However, the District has expressed concern about the potential for revenue instability to adversely impact cost recovery. The objective of this report is to provide information on residential metering and consumption-based pricing options, including recommendations, that will allow the District of Mission to:

- reduce water use
- while maintaining revenues at a level sufficient to recover costs.

The District has indicated that although reducing consumption, conditional on revenue stability, is the key objective, considerations of how rates impact equity and affordability are also important. This paper provides information specific to these concerns.

This work will inform the District's decision to implement residential water metering and consumption-based pricing and will provide tools for assessing various consumption-based rate options. Consumption-based rates can be part of a carefully tailored pricing structure that reflects the full cost of water and distributes those costs among users based on water use.

LIMITATIONS

This report does not consider legal issues pertaining to the authority of municipalities to impose fees for water services. There are limitations on how municipalities can legally generate revenue. These limitations are not only outlined in applicable legislation, but are also established by the

courts. This report does not consider how such limitations affect the District of Mission's authority to charge for water services, particularly with respect to the rate structures outlined in this report.

As noted by the District of Mission, the applicable legislation for setting fees is the Community Charter (2003). Specifically, section 194 of the Community Charter authorizes municipalities in B.C. to set fees by bylaw and that the fees can be based on "any factor specified in the bylaw and, in addition to the authority under section 12(1) [variation authority], establish different rates or levels of fees in relation to different factors" (Community Charter, SBC, 2003). In addition, courts have stipulated that such user fees must have specific characteristics, including that: (1) the fee must be demonstrably linked, at least somewhat in proportion, to the actual costs of provision of the good or service; and, (2) revenues from such fees may only be directed towards covering those costs. This means that user fees cannot be structured so as to either generate a surplus on a regular basis or to be used for other purposes. Courts have, however, recognized significant latitude for municipalities in determining what full costs should include, and they "will not insist that fees correspond precisely to the cost of the relevant service. As long as a reasonable connection is shown, that will suffice" (Eurig Estate (Re), [1998] 2 S.C.R. 565).

It is equally important to highlight that the scope of authority for generating revenue can vary from one jurisdiction to the next. For example, Ontario passed legislation specific to the City of Toronto that established powers that other jurisdictions may not have (City of Toronto, 2007). This means that some of the rate structures used by other municipalities, as identified through the jurisdictional scan, may be permitted under distinct legal authorities that are not applicable to the District of Mission. Another, related consideration is that some rate structures used in these other jurisdictions may have been chosen because the jurisdiction is limited in its authority to implement other more desirable rate structures.

The District should also note that the Water Act (1996), the provincial legislation governing water use, is under review and may be soon be superseded by a new Water Sustainability Act (Province of British Columbia, 2010). Although it is impossible to fully anticipate how this Act might impact water pricing, the currently policy direction indicates that it will include: (1) improvements in water use efficiency (Province of British Columbia, 2010, p. 11); (2) that "economic instruments will be enabled as incentives" (p. 11); and, (3) that "fee-based measures—e.g., increasing block pricing to incent water conservation, scarcity pricing" (p. 11)—may be considered. If these aspects are implemented, the District may be authorized to set regulatory water charges, as opposed to water user fees, which would likely permit greater scope for pricing designed not only to cover costs, but also to change water use behaviours.

As a result of all of these limitations, the District of Mission should seek legal advice before implementing any changes to its water rate structure or other recommendations in this report. Also, should the District implement changes to water pricing before legislative change, the District should carefully consider and document its rationale for rate setting and maintain such information in case it becomes necessary to demonstrate that rates conform to the required characteristics of user fees; this information would be essential in the event that the District's rates were ever challenged in court.

BACKGROUND—RESIDENTIAL WATER USE, METERING AND PRICING

British Columbia

In 2006, average daily residential water use in British Columbia was 448 litres per capita, more than a third higher than the national average of 327 litres per capita (Environment Canada, 2010, p. 6). Water conservation efforts are becoming more widespread due to growing awareness that available water supplies are limited and under pressure from population growth, other competing uses and ecological requirements. As well, increasing water supply entails significant costs associated with building new water infrastructure (Booker, Howitt, Michelsen, & Young, 2012, p. 171).

B.C.'s Living Water Smart plan sets ambitious targets for water efficiency and conservation—half of new municipal water demand by 2020 "will be met by conservation" (Government of British Columbia, 2011). The province indicates that water efficiency improvements including implementation of water metering will help reduce water use.

According to Environment Canada, consumers with meters and volume-based pricing use significantly less water on average than those who pay flat fees (Environment Canada, 2011, p. 7). In some provinces, the residential sector is essentially fully metered. However, only one-third of residential clients in B.C. were metered in 2006, compared to 63% nationally. In recent years, several municipalities in the province have studied or begun implementation of residential water metering.

Public awareness about metering and conservation rates is growing in B.C. as water metering programs become more common. As well, growing awareness may be due to communication about BC Hydro's new stepped rate structure, developed in 2008 (BC Hydro, 2012), and its current efforts to install smart meters across the province. The smart meter program has encountered some vocal opposition, with some customers concerned about possible health impacts of radio-frequency meters (St. Clair, 2012).

District of Mission

The District of Mission and the City of Abbotsford are joint owners of the water and sewage systems serving the two municipalities (City of Abbotsford and District of Mission, 2005, p. 7). The municipalities have designated authority to the Abbotsford Mission Water and Sewer Commission to administer and operate these systems. Initially the allocation of costs was based on assessed property values in each municipality (M. Younie, Personal communication, April 2, 2012). However, since 2005 Mission's share of operating and capital expenditures has been calculated based on its percentage share of water and sewer use (City of Abbotsford and District of Mission, 2005, p. 9) as measured through bulk meters (M. Younie, Personal communication, April 2, 2012) and is currently set at 26% (District of Mission, 2011a).

Abbotsford is the larger of the two municipalities, accounting for 78% of the population in 2006 and 61% of the total land area (Statistics Canada, 2007). Median household income for both municipalities exceeded the provincial average of $52,709 in 2005, although it was slightly higher in Mission than in Abbotsford (Statistics Canada, 2007). However, the tax base in Mission is predominantly residential, whereas Abbotsford has a larger industrial and commercial sector

(M. Younie, Personal communication, March 29, 2012). The two municipalities are distinct jurisdictions with their own elected Councils, decision-making structures, visions and priorities (M. Younie, Personal communication, April 2, 2012). This has resulted in different practices for water metering and billing.

Abbotsford has been fully metered for over 40 years (M. Younie, Personal communication, April 2, 2012) and the City of Abbotsford moved to a three-tier increasing block summer rate for residents in July 2011 (City of Abbotsford, n.d.b). However, the increasing block was cancelled in March 2012 due to concerns about fairness, particularly with regards to the impact on large households and those with secondary suites (Mills, 2012).

The District of Mission meters the Industrial, Commercial and Institutional (ICI) sector and has required that all new water service connections for single-family, duplex, triplex, fourplex and other multi-family residential developments be metered since 2008 (District of Mission, 2010, p.4). The Water Bylaw requires all new water connections to have a meter installed in a chamber or box at the property line, with a single meter serving multi-unit residential buildings (District of Mission, 2010, p. 4).

The District of Mission has 8,657 residential water consumers, of which 150 currently pay a metered rate, while the remainder pay a flat annual fee (M. Younie, Personal communication, June 21, 2011). The breakdown of unmetered residential water services is as follows:

- 7,353 single family homes
- 155 duplexes, triplexes and fourplexes
- 941 homes with secondary suites
- 58 commercial businesses located in old homes (M. Younie, Personal communication, June 21, 2011).

As well, the District provides approximately 400 metered commercial water services. Metered customers are charged a quarterly meter rental fee and decreasing block rate volumetric charge with a quarterly minimum charge (Table 2). The second block threshold is set such that regular domestic usage would be charged at the first block rate.

Table 2. District of Mission water and sewer rates, 2011

Rate type	**Water**		**Sewer**	
	Fixed	Volumetric	Fixed	Volumetric
Unmetered - flat rate (annual)	$447.48 (one unit); $894.95 (two units)		$340.44 (one unit); $680.88 (two units)	
Metered - decreasing block rate with minimum charge (quarterly)	$3.19 (quarterly meter rental fee)	$0.9742/m3 (0-300$m^3$); $0.7987/$m^3$ (300m^3-600m^3); $0.7238/$m^3$ (600m^3 - 900m^3); $0.6494/$m^3$ (900m^3-1,200m^3); $0.4991 (>1,200$m^3$); $106.19 quarterly minimum charge		$0.7501/m3 (0-300$m^3$); $0.6149/$m^3$ (300m^3-600m^3); $0.5573/$m^3$ (600m^3-900m^3); $0.5000/$m^3$ (900m^3 - 1,200m^3); $0.3843 (>1,200$m^3$); $81.76 quarterly minimum charge

Note: Both water and sewer rates are included for the reader's reference, in particular because the combined flat rate for unmetered households is used for comparison purposes at the end of this paper in the rate calculator.
Source: (District of Mission, 2011b)**.**

According to Abbotsford Mission Water and Sewer Services, residential water use accounts for half of water demand in Abbotsford and 64% in Mission (AECOM Canada Ltd., 2010, p. 45). Abbotsford's per capita residential water consumption is estimated to be less than two-thirds of that in Mission (Abbotsford Mission Water & Sewer Services, 2010). Both municipalities use a decreasing block rate for the ICI (Industrial, Commercial and Institutional) sectors.

As noted by the District, use of this type of rate structure was previously common for many municipalities and the need for conservation incentives was not prioritized (M. Younie, Personal communication, April 2, 2012). Close to a quarter of municipalities surveyed by Environment Canada used a decreasing block structure for the commercial sector in 1991 (Environment Canada, 2001, p. 46) compared to 11% in 2006 (Environment Canada, 2009, p. 19).

According to the 2010 Abbotsford Mission Water and Sewer Services Water Master Plan Update, new water sources will be needed to meet projected water demand by 2031 (AECOM Canada Ltd., 2010, p. i) (Table 3). Although a summer water sprinkling ban implemented in 2009 reduced peak water demand, the report projected summer water demand would exceed existing capacity by 2013. Improvements have since taken place to maximize supplies from existing sources in the short-term; however, the report recommended developing a new water source at Stave Lake and applying for a water license to extract an average 121 MLD, with maximum 300 MLD one-day withdrawal to meet medium and long-term water needs (AECOM Canada Ltd., 2010, pp. ii-iii).

Table 3. Abbotsford/Mission water supply and demand

Existing water supply	**Water demand – average**		**Water demand – maximum**	
	2007	2031 (projected)	2007	2031 (projected)
143 Million litres per day (MLD)	78	163	142	297

Source: (AECOM Canada Ltd., 2010, p. i).

Progress on the Stave Lake expansion to date includes preliminary studies and design (Abbotsford Mission Water & Sewer Services, n.d.). However, in April 2011, community concern about the P3 approach selected led the District of Mission to reject the plan for developing this water source (Sandborn, 2011). Similarly, Abbotsford voters rejected the proposal in a November 2011 referendum (Baker, 2011). As a result, federal funding that had been provided will not be available and development of new water sources for Abbotsford and Mission may be further delayed.

Since forecast water consumption was projected to exceed existing water capacity before the Stave Lake expansion could be completed, the Master Plan identified the need to progressively reduce maximum day water demand through demand management (AECOM Canada Ltd., 2010, p. 5). It recommended a number of strategies to reduce water demand by 27% in 2015 when the Stave Lake project was scheduled for completion, including Stage 3 water restrictions (lawn sprinkling ban) in summer, ICI and agricultural water audits, eliminating or deferring non-essential municipal activities during peak periods, and implementing an increasing block rate to encourage water conservation (AECOM Canada Ltd., 2010, pp. 6-14).

The Water Master Plan also recommended implementing the "enhanced efficiency" demand management tools identified by the University of Victoria's POLIS Project in its 'Soft Path for Water Strategy for Mission Abbotsford. These strategies, which included implementation of universal water metering for the District of Mission (Maas & Porter-Bopp, 2009, p. 30) may be even more important given the uncertainty surrounding new water developments.

The District of Mission is exploring whether or not to move forward with implementing water metering throughout the remaining residences. Various complicating factors have been raised by the District. For example, if rates are too high, greater than expected conservation could yield insufficient revenue to cover fixed costs, resulting in deficits and the need for large rate adjustments to cover costs. The fact that the District has a predominantly residential client base underscores the importance of setting residential rates that provide revenue stability. Users should pay rates that cover the full cost of what they consume, thereby supporting the ongoing financial sustainability of the water system. Price structures also need to accommodate situations where one meter services a multi-family dwelling.

The focus of this paper is residential metering and pricing, which is appropriate given the predominantly residential client base and higher residential water use. But while investigations and recommendations specific to the ICI sector are beyond the scope of this report, many of the findings are generally applicable and should be considered for ICI rates if the District opts to revise its residential rate structure. In particular, the decreasing block ICI rate currently used by the District does not support the objective of reducing water use while maintaining sufficient revenues to recover costs. With the decreasing block structure, fees decrease with quantity used, resulting in a price signal that encourages excess consumption. The rate types section covers the limitations of the decreasing block rate in more detail.

METHODS

Two main research methods, a literature review and a jurisdictional scan, were used to collect information on water metering and pricing. This information informs the options and recommendations developed for the District of Mission on the use of water metering and consumption-based rates to reduce water use while maintaining sufficient revenues to cover costs.

The literature review focused on studies of water metering and pricing, including studies evaluating rate structures that best meet efficiency, equity, cost recovery and other criteria, as well as studies examining the impact of various pricing structures on water demand. Searches made use of several search engines including the University of Victoria library journal search, Google Scholar, EconLit, and Scrirus, using terms such as “water metering,” “residential water metering,” “water metering and pricing,” “water pricing” and “residential water use,” with many sources taken from the environment and resource economics and resource management literature. The titles and abstracts of items in search results were scanned to identify sources referencing economic efficiency, marginal cost pricing, effects of price on consumption, cost recovery, rate types or equity. Sources not focused on residential water were eliminated. Canadian sources were prioritized. Although the University of Victoria library journal search was considered the most important, all search results were scanned. The other search engines provided results sorted by relevance. Based on that, the most relevant results from the first few pages were scanned.

References cited in relevant articles were checked to locate other potentially useful documents. Subsequent additions to the literature review include articles focusing on taxation and user fees. These were added to give the paper a better theoretical foundation for understanding user fees, their particular relevance to water metering and pricing, and why they should be implemented. For the jurisdictional scan, we reviewed Canadian municipal and regional government websites for information on water metering, pricing and implementation. We compiled lists of jurisdictions

to review using municipal association member lists, Wikipedia and the Census of Population. Municipal websites in British Columbia were checked first. All jurisdictions, including cities, districts, towns and villages were reviewed. We found that most communities with populations under 5,000 either have no water services, do not use meters or use water services provided by a larger jurisdiction. Based on this, we decided not to review jurisdictions with populations under 5,000 in other provinces. For Ontario and Quebec, we made an exception and did not review jurisdictions with populations under 10,000. This was due to the overwhelming number of total jurisdictions in these two provinces. By reviewing all cities, towns, townships, municipal districts, specialized municipalities, rural municipalities, regional municipalities and counties with populations over 5,000 in most provinces and over 10,000 in Ontario and Quebec, we were confident about covering the majority of jurisdictions using residential water metering and volumetric pricing. In total, 599 municipal websites were scanned, of which 300 were found to be using or planning on using residential water metering and pricing.

From our first interaction with the District, staff indicated a particular interest in documentation about water metering, volumetric pricing and implementation from other jurisdictions. Based on this, it was decided that where use or planned use of residential water metering was identified, we would request that the municipality send us any documentation relevant to their water metering program or pricing system, including metering or user pricing implementation reports, cost-benefit studies, evaluations of metering and pricing systems, including those identifying impacts on water use. After consulting with our supervisor, it was determined that this would be sufficient, given our client's needs, and no direct survey or follow-up questions would be required.

Correspondence was sent by email or through online request systems. This contact method was used so as to provide a clear, written explanation of our request and to make it as easy as possible for those contacted to send back any relevant documentation. From the 300 jurisdictions contacted, 117 responses were received, some providing reports including rate studies, financial information, memos or other information, some pointing to information available on the website and many others indicating no information was available. Records about which jurisdictions responded and what documentation they provided, if any, were kept in a spreadsheet. Since 183 did not respond and many of those that did were unable to provide any documentation, it must be acknowledged that the considerations underlying the choice of rate types in these jurisdictions remain unknown. Most relevant information and documentation found as part of the jurisdictional scan was taken from municipal websites or bylaws. If more supplementary documentation had been provided by other jurisdictions, the findings in the jurisdictional scan may have been different. Information on municipalities' metering and pricing practices found through these methods is summarized in Appendix B.

Findings from the literature review and jurisdictional scan enabled us to determine some of the main considerations related to the development of consumption-based rates and implementation of water metering. This information was used to develop possible pricing scenarios for the District of Mission. An excel-based rate calculator was developed (Appendix C), allowing the District of Mission to model different pricing options.

RESULTS OF LITERATURE REVIEW

The following section provides context for water fees, as well as information on water metering and pricing, specifically rate structures and some factors affecting water consumption.

User fees

User fees, Mission's mechanism for charging for water (M. Younie, personal communication, March 7, 2012), are covered extensively in the economic literature. The most salient point is that municipalities should charge for whatever they provide in all possible cases. There are various advantages to ensuring that those who benefit from goods and services "pay for what they get" (Bird, 2010, p. 16). While user fees can make that connection, property taxation cannot. Since property taxes are based on property value and fund a range of goods and services, there is no link between how much people pay and how much of any one good or service they consume (Kitchen, 1997, pp. 140-1). Directly connecting fees paid and goods or services consumed should in fact be the main consideration in determining prices (Kitchen, 1997, p. 164).

There are limits on when user fees should be employed: consumption and the marginal cost of provision must be measurable or at least reasonably estimable, and consumption must respond at least somewhat to price adjustments (Bird & Tsiopoulos, 1997, p. 49). However, user fees are particularly appropriate for goods and services from which residents receive virtually all the benefits of their consumption. This is clearly the case with water provision (Kitchen, 1984, p. 269).

The foremost advantage of user fees, even more important than revenue generation, is their potential for improving economic efficiency (Bird & Tsiopoulos, 1997, p. 36). Efficiency should be a key priority for any municipality (Kitchen, 1997, p. 139). "Efficiency favours the allocation of scarce resources to their most highly valued uses in order to maximize aggregate welfare" (Duff, 2004, p. 396). How to measure value is an important issue, since subjective notions of utility or happiness are too vague. Willingness to pay conveys value in a more precise and measurable way. Improving efficiency therefore requires devoting resources to purposes shown to be more valuable by residents' cumulative willingness to pay (Duff, 2004, p. 396). User fees thus have the potential to inform public spending so as to better serve "the real needs of society as determined by citizens" (Bird & Tsiopoulos, 1997, p. 81).

User fees support economic efficiency by restricting the production of goods and services based on how much value people place on them (Kitchen, 2000, p. 12). They reveal how much people are willing to pay, which indicates for officials the goods and services to be prioritized, the amounts to be made available and the levels of quality to be maintained. Property taxes, having no link between amount paid for a good or service and quantity consumed, are unable to provide this information (Kitchen, 2002, p. 121). User fees further support efficiency by conveying accurate costs about goods and services to those who use them. Consumers can weigh those costs against the benefits they anticipate receiving and make informed purchasing decisions. This promotes accountability, since they can signal through their collective willingness to pay whether the good or service is really worth providing (Kitchen, 1997, p. 139). Accountability is improved whenever the link between benefits and payments is made clearer (Kitchen, 2002, p. 123).

The consequences of failing to implement properly designed user fees are substantial. When people do not see a connection between what they pay and how much they consume, as with property taxation, they see the price of consumption as "being essentially zero" (Kitchen, 1984, p. 265). Without a price incentive to limit usage, or even if the price incentive is just too low, consumption will inevitably exceed efficient levels (Kitchen, 2000, p. 14). It will eventually reach a level that pushes the limits of the infrastructure capacity. This can lead to infrastructure expansion that would not be necessary with an efficient fee structure. Paying for the expansion through general revenues would only exacerbate the problem by once again disconnecting costs

from the price to the consumer (Bird & Tsiopoulos, 1997, p. 59). Water shortages, therefore, are often caused or worsened by incorrect prices (Bird, 1976, pp. 34-5).

Disregarding properly designed user fees also has adverse fairness implications. A fair pricing scheme requires that people pay for what they consume, such that "no one either receives a service without paying for it or pays without receiving a service" (Bird & Tsiopoulos, 1997, p. 50). However, incorrect fees can result in unanticipated subsidies. Fixed fees, for example, lead to subsidization for households that consume more water by those that consume less (Kitchen, 1997, p. 144). Volumetric rates that decrease as consumption rises have the same effect (Bird & Tsiopoulos, 1997, p. 51).

User fees are only feasible if the administrative costs of applying consumption-based rates to those who benefit from a service are not prohibitive (Duff, 2004, p. 410). User fees can lead to more expenses in various areas, for example communications and enforcement (Dewees, 2002, p. 591). Although other concerns may seem more complex, the administrative aspect of implementing user fees can be just as challenging (Bird, 1976, p. 118). Fortunately administrative costs for water fees can be kept relatively low (Kitchen, 1997, p. 152). This can be accomplished by minimizing requirements for reading meters, processing bills and managing records (Fortin, Slack, Loudon, & Kitchen, 2001, p. 9). For more complex rate types, however, administrative costs are typically higher. For example, rates that change based on volume consumed or time period need regular monitoring, smart meters, or even a fixed network system (Ayoo & Horbulyk, 2008, p. 96). If rates are too complex for consumers to easily understand, they are less likely to agree and comply with their bills, which also increases administrative costs (Fortin et al., 2001, p. 9). By comparison, simpler rate structures have the dual advantage of lower administrative costs and clarity for consumers (Nallathiga, n.d., p. 7).

It is important to keep in mind that mistakes made when setting user fees are rarely easy to reverse. Fees are politically "sticky" which means that major changes are typically slow in coming to fruition. Establishing rates that are as economically efficient as possible from the start is therefore essential (Bird & Tsiopoulos, 1997, p. 84). However, it is also important not to become trapped in seeking the perfect price. Approximately efficient fees are clearly better than those that are not efficient at all. In other words, "it is better to be roughly right … than to be clearly wrong" (Bird & Tsiopoulos, 1997, p. 60).

Economic efficiency and marginal cost pricing

Economic efficiency relates to the allocation of goods and services based on uses that maximize welfare (Duff, 2004, p. 396). It focuses on achieving the optimal distribution of goods and services based on consumers' willingness to pay. Economic efficiency involves the use of marginal cost pricing (Bird, 1976, p. 36; Bird & Tsiopoulos, 1997, p. 52); however, this is conditional on there being a competitive market, where there is freedom to enter and exit the industry (Bird, 1976, p. 53; Harris et al., 2002, p. 26).

Marginal cost is the cost of increasing production or consumption by one additional unit. Consumers will choose to consume an additional unit only so long as their marginal benefit exceeds the marginal cost. "Setting the price at any other level will lead to waste of one sort or another" (Dewees, 2002, p. 587). If prices are set lower than marginal cost, then an oversupply occurs (Kitchen, 1984, p. 265), "indicating that scarce resources used to produce the good or service could be employed more efficiently elsewhere" (Duff, 2004, pp. 398-9).

Economists recommend marginal cost pricing for water and wastewater services because it provides a price signal to consumers to use the optimal amount of water, resulting in efficient allocation of water among competing uses (Altmann, 2007, p. 23; Brandes et al., 2010, p. 17; Chambouleyron, 2004, p. 305; Harris et al., 2002, pp. 26-7; Howe, 2005, p. 44; Monteiro, 2005, p. 1; OECD, 2010, p. 27; Olmstead et al., 2007, p. 2; Renzetti, 2009, pp. 7-8). While marginal cost pricing may be ideal in theory, it should be noted that water utilities do not meet the criteria for competitive markets. Harris et al., note that "While there are few operating competitive markets in the water resources field, the traditional economic model does provide some useful insights into the economic and financial problems faced by municipal utilities" (2002, p. 29).

Pricing according to the marginal cost of water requires that municipalities are able to accurately determine water consumption (Chambouleyron, 2004, p. 306; Kitchen, 2000, p. 14; Kitchen, 2002, p. 138). Movement to marginal cost pricing in Canada has been limited, however, since many municipalities do not have water meters (Dewees, 2002, p. 595; Renzetti, 1999, p. 20).

Marginal costs can be calculated in the short run or the long run. While short run marginal cost is theoretically the preferred option to achieve allocative efficiency (Bird, 1976, p. 37; Bird & Tsiopoulos, 1997, p. 54; Della Valle, 1988, p. 283; Duff, 2004, p. 414; London Economics, 1997, p. 8), there has been some disagreement over which is more useful in practice (Della Valle, 1988, p. 283; Monteiro, 2005, p. 13). According to Turvey, "the argument about whether public enterprises should set prices equal to long-run or short-run marginal costs is only meaningful when capacity is not optimal" (Turvey, 1969, p. 283) since use of short run marginal cost implies that current infrastructure is appropriately sized (Bird & Tsiopoulos, 1997, pp. 54-5); in practice, however, this is often not the case. Most water utilities operate with excess capacity since they are designed to accommodate peak water use (London Economics, 1997, p. 9). Short run costs can also be unstable, requiring frequent changes in prices (Bird & Tsiopoulos, 1997, p. 55; Della Valle, 1988, p. 283; Marsden Jacob Associates, 2004, p. 3).

Prices based on long run cost estimates are less subject to price and revenue fluctuations (Harris et al., p. 129; Marsden Jacob Associates, 2004, pp. 8-9).The long run perspective, which takes the average life of assets and expected requirements for new infrastructure and system growth, can therefore be considered a useful option for water pricing (Dewees, 2002, p. 589; Harris et al., 2002, p. 129; London Economics, 1997, p. 8; Marsden Jacob Associates, 2004, pp. 8-9). Dewees states that "when the system is at capacity, marginal cost principles require charging the opportunity cost of system capacity, which may be equal to the cost of capacity expansion. Even before a utility builds new capacity, it is justified in raising prices to allocate available demand among consumers and to constrain demand until that capacity is built" (Dewees, 2002, p. 596). Under long run marginal cost pricing, consumers pay the full cost, including operating and capital costs, that results from their demand (Dewees, 2002, p. 596; London Economics, 1997, p. 10). However, one criticism of the use of long run marginal costs is that it may lead to underuse of overbuilt facilities (Bird & Tsiopoulos, 1997, pp. 54-5).

The importance of accounting for capital costs is particularly important with regards to seasonal or peak rates since capacity expansion can be driven by peak use. Kitchen states that "the additional capacity cost [of peak use] should be shouldered entirely by peak users" (Kitchen, 2002, p. 128). To resolve this problem, the literature indicates that off-peak prices should be set at the short-run marginal cost, or marginal operating cost, and peak or seasonal prices at the long-run marginal cost, equal to marginal capacity and operating costs (Bird, 1976, p. 39; Dewees, 2002, p. 589; Kitchen, 1997, p. 146).

Despite the theoretical preference for marginal costs, several sources indicate they are infrequently used in practice, due to practical difficulties associated with their implementation (OECD, 2010, p. 27; Swain et al., 2005, p. 61). For example, the administrative costs of implementing marginal cost pricing may be quite high, particularly if one goes by "much of the literature on marginal-cost pricing which seems to demand, for example, hourly data on the consumption by each unit" (Bird, 1976, p. 122). As well, difficulty in communication and consumers' lack of understanding of these rate structures may create implementation difficulties (Ruijs, 2009, p. 170). According to a 1999 study of 77 water utilities in Ontario, all of them priced water and wastewater services below the marginal cost (Renzetti, 1999 as cited in Kitchen, 2000, p. 14). Brandes et al. (2010, p. 17) and Kitchen (1997, p. 150) note that most Canadian utilities use a form of average cost pricing, while the OECD (p. 69) indicates that the use of average cost pricing is widespread for member countries.

One difficulty with implementing marginal cost pricing is that marginal costs are an economic concept rather than an accounting concept; they can therefore be difficult to calculate using available data (Bird & Tsiopoulos, 1997, p. 52; Dewees, 2002, p. 589; Duff, 2004, pp. 414-5; Turvey, 1976, p. 158). The calculation of marginal cost is also complicated since it can vary at different levels of output (Bird & Tsiopoulos, 1997, p. 53; Duff, 2004, p. 415). However, according to Harris et al. (2002, p. 131), these perceived difficulties, including the complexity of calculating marginal cost pricing and lack of accurate capital planning necessary to determine rates, are overstated. Renzetti (1999, p. 20)indicates that Environment Canada and the CWWA have developed a software tool to help water managers estimate marginal costs and Kitchen states that the Ontario Water Works Association (OWWA) "has developed a manual on marginal cost pricing" (Kitchen, 1997, p. 150).

Another difficulty with the use of marginal cost pricing is that water utilities are natural monopolies with large sunk capital costs, creating large economies of scale. The result is that the long run marginal cost is actually less than average cost (Altmann, 2007, p. xv; Harris et al., 2002, pp. 28-9; Marsden Jacob Associates, 2004, p. 3; Monteiro, 2005, p. 5; OECD, 2010, p. 27). This means that revenues (if based on marginal cost pricing) will be lower than the amount required for full cost recovery (Bird & Tsiopoulos, 1997, p. 588; Dewees, 2002, p. 55; Kim, 1995, p. 327; Kitchen, 1997, p. 145) with the difference paid through general taxation (R. H. Coase, 1970, p. 117). Various compromise pricing options have therefore been suggested in place of pure marginal cost pricing (Bird, 1976, p. 39; Duff, 2004, p. 417).

The most common way of dealing with the above problem, where revenues are less than average costs, is through the use of two-part tariffs, which include a volumetric charge set to approximate marginal costs and a fixed charge that is adjusted to meet revenue needs and fully recover total costs from consumers (Altmann, 2007, p. 9; Kitchen, 2002, p. 127; Marsden Jacob Associates, 2004, p. 6; Monteiro, 2005, p. 14). First recommended by Coase in 1946 (p. 173), the two-part tariff is widely supported by the economic literature (Bird, 1976, p. 39; Bird & Tsiopoulos, 1997, p. 57; Dewees, 2002, p. 588; Duff, 2004, p. 417; Kitchen, 1997, p. 145), as well as practitioner guides. For example, the CWWA recommends a two-part rate using marginal cost pricing, including use of long-term capital planning (Harris et al., 2002, p. 154).

Equity

The economics literature concerning user fees and taxes identifies fairness as "a central objective of public policy" (Duff, 2004, p. 401). In the context of taxation, ability-to-pay is the critical factor

in determining fairness. This perspective focuses on two related equity principles: horizontal equity means that those who are comparably well-off economically should pay similar amounts, while vertical equity means that those who are better off should pay relatively more than those who are less advantaged (Duff, 2004, p. 401). A key point underlying these principles is that the marginal utility of income typically decreases. As a result, if all households are taxed at the same rate, the poorest will feel the heaviest impact since their marginal utility of income is greater (Duff, 2004, p. 403).

For user fees, there is an alternative perspective that focuses on benefits received instead of ability to pay (Bird, 1976, p. 10). This view on equity is also known as the user-pay approach (Dewees, 2002, p. 590). It is the foundation of the argument for user fees and rests on the idea that the amounts people have to pay the government for services should depend entirely on the benefits they gain from the services, regardless of income. This reflects the notion that people should pay for what they receive; no more, no less. This perspective favours user fees because they can better establish the link between benefits and payments (Duff, 2004, p. 402). However, this approach is not appropriate for government services that are primarily focused on redistribution (Duff, 2004, pp. 402-3). Initiatives that redistribute income or wealth are typically concerned with achieving greater welfare for people who are less well-off. Some examples include income tax, public pensions and other social programs (Cowell, 2008). Such initiatives should have as a foundation an understanding of distributive justice (Duff, 2004, pp. 402-3). Since water services are not focused on redistribution (Duff, 2004, p. 436), distributive justice will not receive further consideration here.

The benefits-received perspective is particularly relevant in the municipal context, since various economic sources emphasize that redistribution should not be a priority at the local level. The underlying premise maintains that the foremost function of municipalities is making goods and services available for residents (Kitchen, 1997, p. 139). In other words, even though redistribution issues are quite relevant in society generally, “they should not be of prime concern to local governments” (Kitchen, 1984, p. 268). In addition, whenever municipalities attempt initiatives mainly focused on redistribution, they are not typically very successful. Local governments should simply embrace efficient pricing of their goods and services as a top priority (Bird & Slack, 1983, p. 81). They should set both the “level and structure” of pricing without trying to factor in redistribution (Bird & Tsiopoulos, 1997, p. 58).

This does not mean that concerns about ability to pay are unimportant. Nallathiga (n.d., p. 7) contends that fairness in setting fees requires considering financial hardship. Monteiro (2005, p. 14) argues that for all the benefits of economically efficient pricing, the potential for disproportionate financial impact on low income groups cannot be ignored. However, such concerns should be addressed using a subsidy outside the rate structure (Kitchen, 1984). This separation ensures that the efficiency and equity of the user fee, in terms of benefits received, are not compromised. By contrast, deviating from efficient rates leads to price distortion and hidden subsidization (Dewees, 2002, p. 587). For example, when volumetric rates are not used for water on the basis that they would be too costly for some households, those who use more water in effect have their consumption subsidized by those who use less (Kitchen, 2000, p. 13). This example demonstrates that redistribution concerns cannot properly be resolved just by lowering prices (Bird & Tsiopoulos, 1997, p. 83). Moreover, trying to address such concerns through rate structures often yields entirely new and unanticipated distributional consequences (Kitchen, 2002, p. 123).

This aligns with the broader view that dealing with redistribution considerations and setting economically appropriate pricing are separate issues (Bird, 1976, p. 10). A related point is that assessing redistribution within a whole set of taxes, fees, subsidies and other mechanisms is better than trying to assess one of those elements in isolation (Duff, 2004, p. 405). Even for goods and services that clearly should be made available on the basis of "right, need or merit," mechanisms outside the rate structure can mitigate affordability challenges. For example, bursaries can allow access to post-secondary education for students who cannot afford tuition fees (Duff, 2004, p. 407).

It should be noted that water (like many other goods/services that require public consideration of "right, need or merit") is (in economic terms) a private good, not a public good (Duff, 2004, p. 436). The standard economic definition of a public good requires that it be both non-excludable (once available, it can be used by everyone, regardless of whether they pay for it) and non-rival (one person's use does not reduce another's benefit, as for instance a fireworks show). As neither of these conditions apply to water, it is not a public good as technically defined by economists (Harris et al., 2002, p. 30).

However, there remain concerns that some "private" goods should be made available to all by the state. At its core, this perspective is about the notion of a human right to goods and services that meet basic needs, regardless of ability to pay; such as police and fire departments, health care, education, and presumably water. There would likely be substantial social and political backlash against any initiative to cut off certain households from water services, or to render household water unaffordable by rate changes. Given this perspective, there is significant latitude for prioritizing affordability concerns (Harris et al., 2002, pp. 30-31; Ward & Pulido-Velazquez, 2009, p. 301).

Equity also depends on various local circumstances. For example, a larger community in terms of geographical size might impose higher fees on those who live far from the source of a service due to the higher marginal costs of provision (Slack, 2010, p. 6). But if outlying neighbourhoods are predominantly lower income, the higher fees would have a greater adverse effect on affordability. This situation would require weighing the needs of a group with particular concerns about ability to pay against the fact that people chose to live where services are costlier to provide. Similar issues can arise when the cost of service provision varies based on population density (Nallathiga, n.d., p. 4).

Nallathiga argues that setting fees should involve consideration of the affordability impact on "different categories of consumers" in the community, especially differences based on income (n.d., p. 7). It is also important to consider differences among users in terms of seasonal trends and amount consumed (Nallathiga, n.d., pp. 8-9). Meanwhile, according to Slack (2010, p. 1), smaller communities tend to have more of an economically and socially homogenous population.

Addressing concerns about ability to pay can be particularly challenging for small communities. They are typically less able than larger municipalities to undertake complicated spending initiatives. They also tend to have lower revenue capacity and less financial independence. Even if an attempt is made to mitigate affordability problems through a local redistribution program, it "will likely result in the movement of high-income groups to low-tax areas and low-income groups to high-tax areas" (Slack, 2010, p. 1).

According to the OECD (2010, p. 28), although affordability is always related to the local context and there is no universally accepted affordability standard for residential water fees, various

agencies around the world use 3-5% of household income as a guideline. Meanwhile, Kitchen (1984, pp. 270-1) suggests that because water fees are often quite low and comprise "such a small fraction" of overall household spending, water bills are likely to be of negligible concern for many residents.

Elasticity and what it means for water consumption

Elasticity is a key concept in economics. It measures how one variable changes in response to change in another variable. Price elasticity of demand represents how changing the price of a good will affect the quantity demanded for that good. Income elasticity of demand concerns how quantity demanded reacts to changes in income. Elasticity is calculated by dividing the percentage change in the dependent variable (e.g. quantity demanded) by the percentage change in the independent variable (e.g. price or income). A result with an absolute value between zero and one is inelastic; greater than one is elastic (Harris et al., 2002, p. 89).

Price elasticity is particularly relevant to determining appropriate water rates. Used in conjunction with local data on current consumption, elasticity research can be used to project how price changes will impact the quantity of water demanded and by extension revenue. For inelastic goods, raising prices will yield more revenue, since any price change will yield a smaller percentage change in quantity demanded. Price elasticity of demand is negative, since the quantity demanded decreases as prices rise (Harris et al., 2002, p. 89).

Dalhuisen et al. (2003, p. 292) conducted an extensive meta-analysis on price and income elasticities for water, specifically focused on residential demand. Their sample included 314 estimates of price elasticity and 162 estimates of income elasticity. The average price elasticity was -0.41, with a -0.35 median, so consumption drops as prices increase. The average income elasticity was 0.43, with a 0.24 median, so consumption rises with income (p. 295). Since the absolute value of most estimates for each measure were between zero and one, water is inelastic with respect to both. In other words, changes in quantity demanded will be smaller than corresponding changes in price or income. Their analysis showed no significant difference for either elasticity measure in values from more recent research, as compared with older research (p. 306).

Similar results have been found by other researchers, such as Worthington and Hoffman (2008, p. 861), who concluded that price elasticity estimates are virtually always inelastic. Kitchen (2002, p. 134-5) includes a selection of studies on elasticity. They also indicate that household water demand is price inelastic, with most estimates between -0.05 and -0.4. But unlike with Dalhuisen et al., estimates in newer studies were often closer to zero. These conclusions generally seem intuitive, since water is an essential and mainly irreplaceable resource for daily living. Dalhuisen et al. (2003, p. 304) noted that water price elasticities are typically even closer to zero in Europe than the United States. This complements recent research by Di Cosmo (2011, p. 474) that cited -0.20 as the average European elasticity. These findings suggest that "substantial price increases are needed to significantly reduce [quantity] demand[ed]" (Dewees, 2002, p. 595). However, increasing fees should not have an adverse effect on revenue generation, since a drop in water use would be more than offset by the higher price (Howe, 2005, p. 45).

However, both price and income elasticities seem to vary from the short run to the long run. For example, many short run estimates of price elasticity fall between zero and -0.5, whereas long run estimates tend to fall between -0.5 and -1.0 (Worthington & Hoffman, 2008, p. 867). Kitchen identified one study with price elasticity estimates for both single-family and multi-family

premises, in both summer and winter. The long-run estimates were higher in every case (2002, p. 135). Researchers focused on Brisbane found that price elasticity ranged significantly from -0.0588 (inelastic) in the short run to -1.442 (elastic) in the long run (Hoffmann et al., 2006, pp. 354-6). These results demonstrate that people respond slowly to increased water prices. At first, their water use does not change very much, but over the longer term they take steps to substantially reduce consumption. For example, they may install low-flow toilets or water lawns less frequently. Results from other parts of the world also demonstrate that water price elasticities are typically greater in the long run (Martinez Espineira, 2007, p. 181).

Price and income elasticities can also vary depending on the price type and rate structure, both of which are explained in greater detail below. For example, using average or flat prices, as opposed to marginal price, results in higher elasticities. The use of block rates has a particularly distinctive impact, since marginal prices then jump from one block to the next. As a result, associated elasticities are discontinuous and non-linear (Dalhuisen et al., 2003, p. 293). Block rate price elasticities are relatively higher compared to uniform rate structures, while income elasticities are relatively lower (Dalhuisen et al., 2003, p. 304). Only flat rate elasticities show similarities with those of block rates (Dalhuisen et al., 2003, p. 302).

Several other factors can impact the price elasticity for water. Howe (2005, p. 49) found that water users' income level is one such issue. Olmstead and Stavins (2008, pp. 8-9) reported similar results, noting that low-income households respond much more to increased water prices than those with greater incomes. Using GDP per capita to represent income, Dalhuisen et al. (2003, p. 302) also found that in wealthier areas water tends to be more inelastic with respect to price, but more elastic with respect to income. Both elasticities are also greater among residences that are owned, as opposed to rented (Hoffmann et al., 2006, p. 347).

One perspective on income-level findings is that price elasticities for water-related necessities are lower than for discretionary uses, such as Jacuzzis, pools and garden irrigation, which are typically only affordable for higher income households (Worthington & Hoffman, 2008, p. 863). Researchers have also considered indoor versus outdoor demand, with most concluding that indoor water use is less elastic, since it often involves basic needs, whereas outdoor uses are easier to forego. Typical price elasticity estimates for indoor use were between -0.3 and -0.4, compared with -0.5 and -0.7 for outdoor use (Harris et al., 2002, p. 68). Findings for income elasticity were similar, with indoor use estimates ranging from 0.31 to 0.38, compared with 0.45 to 1.45 for outdoor use (Harris et al., p. 76).

Climate and season are both factors that significantly impact elasticities for water. Dalhuisen et al. (2003, p. 302) found in their meta-analysis that elasticities in arid regions of the United States were higher than elsewhere. They also demonstrated that elasticities for summer water use were typically higher than other seasons. Bird noted that "there is a good deal of evidence that summer sprinkling demand is both income- and price-elastic" (1976, p. 121). Research by Martinez Espineira (2002, p. 175) and Worthington and Hoffman (2008, p. 861) confirms the latter finding. Hoffman et al. (2006, p. 347) highlighted how climate affects water use, focusing in particular on warm days and rainy days. They found that more warm weather resulted in increased use, whereas more rain resulted in less use.

Several other notable factors have been considered in the literature for their impact on water price elasticity. Olmstead and Stavins (2008, p. 9) noted that simply including rate information on bills can inflate elasticity by 30 percent. Di Cosmo (2011, p. 476) found that among family types,

elderly couples have the greatest price and income elasticity. However, no significant correlation was found between elasticity and family size.

In this discussion, it is important to distinguish changes in “demand”, from changes in “quantity demanded”. Changes in **quantity demanded** for a good occur in response to a change in price for the good, when nothing else has changed—these are movements along an established demand curve. Changes in **demand** occur as a result of some external change (a change in income; increased population in the area; or a price change for a complement or substitute for the good in question)—changes in demand shift the entire demand curve. Higher water rates are intended to induce a reduction in **quantity demanded**. Rising population will increase **demand**; conservation programs (such as summer watering restrictions, or subsidies for water-conserving toilets) will reduce **demand**.

Water metering and pricing—Promising management practices

Growing interest in the use of water pricing to allocate water efficiently and ensure sustainable use also arises within the context of challenges such as population growth, increasing recognition of water requirements to support a range of other uses including ecosystem functions, and the possible effects of climate change (OECD, 2010, p. 9; Worthington & Hoffman, 2008, p. 842). Water scarcity is also an issue in many areas, with increased water withdrawals and decreasing water quality due to point and non-point sources of pollution, leading to decreasing available water supplies for system expansions (Ayoo & Horbulyk, 2008, p. 100; OECD, p. 66). At the same time, water utilities need to continue to supply affordable and high quality water, despite low levels of investment and deteriorating infrastructure (Brandes et al., 2010, p. 1).

Water managers have traditionally taken a supply-oriented approach to meet the needs of residential and institutional, commercial and industrial (ICI) users (de Loe et al., 2001, p. 66; Inman & Jeffrey, 2005, p. 127; Maas & Porter-Bopp, 2009, p. 6). However, given supply constraints, a new approach focused on water use efficiency and conservation is increasingly recommended in order to minimize environmental impacts, reduce operating costs, and defer construction of new infrastructure and/or development of new supplies (de Loe et al., 2001, p. 6). This demand-side management approach can include both conservation pricing and non-price approaches, such as legislated restrictions and outreach campaigns to reduce water use.

Although water is relatively price inelastic, especially in the short-run, the literature shows that raising prices is an effective way to reduce water use (Olmstead & Stavins, 2008, p. 7). According to Olmstead and Stavins (2008, p. 18), market-based conservation initiatives have been shown to be more cost-effective than prescriptive approaches. Price-based approaches allow water users to prioritize their own water needs and choose a level of use based on their willingness to pay (Edwards, 2006, p. s55; Howe, 2005, pp. 44-5; Inman & Jeffrey, 2005, p. 137; Olmstead & Stavins, 2008, p. 3). Higher prices and metering help to educate firms and households about the need for conservation (Inman & Jeffrey, 2005, p. 137), while encouraging them to implement their choice of water conservation practices, from replacing fixtures to reducing shower length. In this way, metering and pricing can help reduce water use more effectively than non-price approaches (Olmstead & Stavins, 2008, p. 18).

In 1994, the Canadian Council of Ministers of the Environment recognized that the cost of providing water was increasing as a result of stricter water quality standards and the need to expand water systems to meet demand, while at the same time the water pricing systems used by municipalities discouraged efficient water use. As a result, water prices were not reflective of the

true cost of providing and treating water. A key principle of their National Action Plan to Encourage Municipal Water Use Efficiency was that municipalities move towards full cost recovery rate structures for water and wastewater. It also recognized the importance of introducing mandatory metering for new construction and, over a longer period, moving towards universal metering so that users would be charged based on how much water they used (Canadian Council of Ministers of the Environment, 1994).

These issues have remained current, with several recent studies and reports documenting water pricing structures that encourage excess water use. According to Olmstead, Hanemann and Stavins (2007, p. 183), most water prices in North America are below the long run marginal cost of supplying water. The C.D. Howe Institute emphasizes the need to reform water prices and implement full cost recovery pricing (Renzetti, 2009, p. 1). They note that the low number of meters in Canada limits the ability to charge more efficient prices for water (Renzetti, 2009, pp. 3-5).

The University of Victoria's POLIS Project on Ecological Governance explains that despite a widespread belief that Canada has an abundant supply of water, availability is in fact limited in many populated areas (Brandes et al., 2010, p. 8). Their report indicates that "individually metered water connections, volumetric charging… and a water rate that is sufficiently high to affect a user's decision making" are preconditions to implementing a conservation-oriented pricing system (p. 2). The Canadian Federation of Municipalities has introduced a water and sewer rates cost recovery best practices guide. They argue that full metering is critically important for municipalities wanting to move towards rate equity and more efficient water use (Federation of Canadian Municipalities, 2006, p. 37).

Similarly, the OWWA (2005, p. 5) number one water efficiency best management practice is to implement universal water metering. Metering allows the municipality to assess performance and, when combined with volumetric pricing, provides a financial incentive to reduce water consumption. According to the OWWA, metering and volumetric pricing are more fair, as consumers pay for what they use (p. 5). Under volumetric pricing, low-volume users often pay less than they would otherwise.

Environment Canada indicates that water meters are "an important component of any water efficiency program that involves the use of price signals to encourage water conservation" (Environment Canada, 2011, p. 6). The department conducts a regular survey of water and wastewater practices and pricing. They note that as more households in a community are metered, per capita consumption drops (Environment Canada, 2010, p. 6). In 2006, municipalities with volume-based charges had an average daily water use of 263 L per capita compared to 464 L per capita for municipalities that employed a flat rate (Environment Canada, 2010, pp. 6-7).

According to Kitchen (2002, p. 138) and Harris et al. (2002, pp. 69-70), the impact of implementing metering on consumption is likely due more to the type of pricing structure used once meters are installed. As stated by Harris, "Metering by itself need have no impact on the demand for water since meters are merely a device attached to a water system to measure the intake of water for a set of customers"(Harris et al., 2002, p. 69). Kitchen (1997, p. 151) and Khawam (2006, p. 22) note that consumption normally drops shortly after meters are installed, but "then rebounds somewhat once consumers become familiar with the new pricing scheme" (Kitchen, 1997, p. 151). Kitchen also quotes studies showing a 30-50% decrease in water use due to implementation of metering and pricing (2002, p. 138).

A major challenge for municipalities that are not yet metered is that meter installation and operation can be quite costly. As a result, "criteria for deciding when and what to meter are of more than academic importance" (Matthewson & Quirin, 1972, p. 335). Chambouleyron indicates that cost-benefit analysis is needed and that as a result "selective metering policies" are often recommended (2004, p. 306).

Rate types

It is widely recognized that rate design is a complex process, largely as a result of the different goals that water utility managers must try to achieve. Cost recovery, economic efficiency, equity and simplicity are frequently cited objectives of rate design (Ayoo & Horbulyk, 2008, p. 94; Barberán & Arbués, 2009, p. 2101; Hall, 2009, p. 539; Marsden Jacob Associates, 2004, p. 2; Montginoul, 2007, p. 861; Worthington & Hoffman, 2008, p. 857). Administrative feasibility and political acceptability are also criteria that may be considered (Ayoo & Horbulyk, 2008, p. 96). Others include water conservation and environmental sustainability in their objectives more explicitly (Harris et al., 2002, p. 9). For example, Khawam, Virjee and Gaskin (2006, p. 20), cite the importance of conservation, revenue generation and equity when developing water rates. The OECD (2010, p. 85) considers four main policy objectives: environmental and financial sustainability, economic efficiency and social concerns. The Canadian *Municipal Water and Wastewater Rate Manual* emphasizes the following main goals for water tariffs: full cost recovery, equitable distribution and efficient use of water and financial resources (as cited in Marsden Jacob Associates, 2004, p. 22). The complicated challenge of trying to balance these factors typically results in competing demands requiring tradeoffs.

Jurisdictions around the world make use of a range of pricing structures that can generally be grouped into the following categories:

- Flat rates allow an unlimited amount of water use. Fees are most frequently uniform, but can also vary based on household or dwelling characteristics, e.g. property value, number of rooms, number of taps, number of people, presence of a swimming pool or secondary suite (Kitchen, 1997, p. 147). As water charges are not based on consumption, meters are not needed, reducing administrative costs.
- Volumetric rates are a user-pay approach where fees are based on the amount of water used, as determined through metering. Volumetric rates may be uniform, with a fixed price per cubic meter of consumption or prices can increase or decrease as water consumption reaches certain thresholds (increasing/decreasing block rates). As well, some municipalities have adopted humpback rates—named for their complex structure that includes both increasing blocks for residential and decreasing blocks targeted at higher ICI consumption levels (Kitchen, 1997, p. 150; Kitchen, 2002, p. 137).
- Two-part rates include a fixed service, connection, or meter fee, as well as a volumetric charge based on actual consumption, as determined through metering. The volumetric component can again be uniform or prices can increase or decrease incrementally based on the level of consumption. These rates may include a free allowance for water consumption under certain levels as part of the fixed charge, with use above this level subject a volumetric charge. Alternatively, all water use may be subject to the volumetric rate.

Montginoul (2007, p. 863) provides the following generic function to represent the above rates:

$$B = b + aX$$

The total water bill (B), equals the price per unit of water used (a), multiplied by the volume of water consumption (X), plus a fixed portion (b). For flat rates, B = b, for volumetric rates b=0, and for two-part rates, the whole formula applies (Montginoul, 2007, p. 863).

Variations on the above rates include seasonal rates, with higher volumetric charges during periods of water scarcity (Harris et al., 2002, p. 64) or as excess use charges with higher rates above set thresholds applied at peak periods (Kitchen, 2002, p. 138) and special low 'lifeline' rates and the use of rebates or discounts to aid low-income households (Brandes et al., 2010, p. 19; Kitchen, 1997, p. 149; Kitchen, 2002, p. 137). Some rate structures that incorporate volumetric charges also include a minimum charge (Bird, 1976, pp. 119-120; Kitchen, 1997, p. 148; OECD, 2010, p. 29). Wastewater fees are based on sanitary sewer flows and are generally calculated based on water consumption during winter months, since outdoor water use (e.g. for lawns and gardens) increases in summer (Howe, 2005, p. 44).

The OECD (2010, p. 85) summarizes the effects of these different rate structures on ecological sustainability, economic efficiency, financial sustainability and equity/affordability. These common rate structures are further described in Table 4 below.

Flat rates

Flat rates fare badly on efficiency measures, as they do not provide the price signals that help allocate water to uses that maximize social welfare (OECD, p. 85). Flat rate structures may encourage overuse of water as they do not provide incentives to conserve (Brandes et al., 2010, p. 19). "The marginal cost of consumption is zero, and the result is overconsumption of water and overinvestment in water capacity" (Bird & Tsiopoulos, 1997, p. 51). Similarly, use of a minimum charge or minimum volume has the same effect so long as many or most consumers use less than this amount (Kitchen, 1984, p. 271).

Used most frequently by utilities that do not meter water usage (Brandes et al., p. 19), flat rates can provide sufficient revenue to ensure financial sustainability, as long as the rate is set at a high enough level to ensure cost recovery. However, the OECD (p.85) also notes that these rate structures are highly regressive, such that the rate at which water is charged effectively decreases for higher levels of consumption. For example, flat rates generally favour residents who use more water, such as those with pools or large lawns, since they pay an equal share of common costs, despite consuming a larger volume. Their consumption is in effect subsidized by revenue collected from lower-volume users (Duff, 2004, p. 439; Kitchen, 2000, p. 13). Moreover since higher-volume residents tend to be wealthier, the subsidy is actually flowing from those with less income to those with more (Harris et al., 2002, p. 133; Kitchen, 1997, p. 144).

According to Environment Canada's Municipal Water and Wastewater Survey (MWWS), 16% of residential water customers in Canada were billed based on flat rates in 2006 (Environment Canada, 2009, p. 6) compared to 39% in 1991 (Environment Canada, 2001, p. 18). However, these figures are understated as they only include municipalities that use no volumetric pricing. For water systems that use both types of rates, i.e. volumetric pricing for metered customers and flat rates for unmetered customers, the survey report classifies the entire population as "served by volumetric pricing" (Environment Canada, 2012, p. 7). Kitchen states that charging for water through property tax assessments is "equivalent to a flat-rate" (2002, p. 130). Relatively few

municipalities charged customers for water based on assessed property tax values; the bulk of these were located in Quebec (Environment Canada, 2009, p. 6).

Volumetric rates

Where water is in short supply, volumetric or consumption-based rates are economically efficient, as they help encourage optimal water allocation among competing demands. If there is no shortage of water, encouraging water conservation through volumetric rates may be perceived to be less important, since it can result in underuse of existing water infrastructure (OECD, 2010, p. 86).

These rates align with the user pay view of fairness (Ontario Water Works Association, 2005, p. 5) under which "those who benefit from municipally funded services should pay for them" (Kitchen, 2000, p. 5). Affordability concerns related to volumetric rates include their impact on large households, which may face higher water bills than they would otherwise under flat rates. Low-volume users are likely to see lower bills decline (Ontario Water Works Association, p. 5).

One downside of introducing volumetric rates is that revenue will fluctuate as consumers respond to the price signal (Brandes et al., 2010, p. 23). The OECD (2010, p. 86) indicates that revenue may initially decrease when volumetric rates are implemented as a result of lower water consumption, although volumetric rates can be set to allow for full cost recovery.

The MWWS indicates that up to 77% of residential water customers were billed according to volumetric-based rates (Environment Canada, 2009, p. 6), although as noted above, this figure is overstated due to reporting methods. Uniform volumetric charges were most common type of volumetric rate (60%), followed by increasing block (28%), and lastly decreasing block rates (12%) (Environment Canada, p. 6).

While use of simple uniform, increasing, or decreasing block volumetric rates with no fixed service charge is possible, Brandes et al. (2010, p. 19) indicate that such rates are uncommon except at the wholesale level. The OECD indicates that such rates are efficient only if variable costs are high compared to fixed costs (OECD, 2010, p. 86), a condition that is not applicable for water utilities due to the large capital costs required for infrastructure. These rates can also result in large revenue fluctuations due to changes in weather and other factors.

Due to the limitations of single volumetric rates in terms of covering fixed costs, two-part rates, with a fixed and variable charge, are more commonly used. These rates have good potential to encourage water conservation, provided the volumetric component is set at a high enough level, while the fixed charge increases revenue stability (OECD, 2010, p. 86). The CWWA recognizes implementation of two-part rates as a best practice for water utilities (as cited in Brandes et al., 2010, p. 24). The OECD (2010, p. 86) and Bird and Tsiopoulos (1997, p. 57) indicate two-part rates are optimal provided that the volumetric charge reflects marginal cost.

Two-part rates with a uniform volumetric charge are the most frequently used rate structure in Canada (Kitchen, 1997, pp. 147-8). One benefit of uniform volumetric rates is that all consumers are treated equally in that they pay the same amount per unit (Brandes et al., p. 19; Edwards, 2006, p. 60).

Two-part rates using an increasing block volumetric component are less common, but are increasingly being used as a way to encourage water conservation since they are believed to "send an amplified price signal to consumers to conserve water" (Inman & Jeffrey, 2005, p. 131). According to results from the MWWS, use of increasing block structures has more than doubled

since 1991 (Environment Canada, 2001, p. 19; Environment Canada, 2009, p. 6). Increasing block rates can be economically efficient, where costs related to water provision increase with water use (Altmann, 2007, p. 51; OECD, 2010, p. 87), e.g. where water supply must be purchased to meet demand. According to Kitchen (2002, p. 133), these rates can be suitable for the residential sector since household use is normally responsible for peak demand. However, increasing block rates particularly target households that use a lot of water, leading to concerns they are unfair to large households (Arbués et al., 2003, p. 82; Barberán & Arbués, 2009, p. 2109; Brandes et al., 2010, p. 21; Edwards, 2006, p. S60; OECD, 2010, p. 87). Use of increasing block rates is also problematic where dwellings are not individually metered and multiple households share meters, for example with apartment buildings (OECD, 2010, p. 87).

In contrast, decreasing block rates are often criticized for having an adverse impact on water use efficiency (Brandes et al., 2010, p. 18) since the lower cost for higher consumption promotes water use and hastens the need for capital expansion (Bird, 1976, pp. 120-1). Decreasing block rates are also criticized from an equity perspective since low-volume water users, who are often poorer, end up subsidizing those who consume more (Bird, 1976, p. 120; Bird & Slack, 1983, p. 90; Kitchen, 1984, p. 270). Bird also notes that residential users end up subsidizing industrial users and states that "the only apparent reason for thus favouring industry is the …fear that large firms might otherwise choose to leave or not locate there"(Bird, 1976, p. 120). These rates are applied more frequently for the ICI sector than the residential sector—the second block is often set above the normal threshold for domestic usage (Kitchen, 2002, p. 132). Hanke and Davis (1973, p. 13) explain that these rates were previously common since utilities were making large investments in capacity and had excess water to sell.

Arguments have also been made in favour of decreasing block rates. Kitchen (2002, p. 132) indicates that decreasing block rates for industrial users can reflect economies of scale (Kitchen, 2002, p. 134) and that they may be an appropriate rate structure "if it is small customers who are responsible for the inefficient water use in a system." Bird and Tsiopoulos (1997, p. 58) state that these rate structures may make sense where there is "substantial excess capacity," but never where there are peak load issues. Some jurisdictions also combine a decreasing block rate for the ICI sector, reflecting economies of scale, with an increasing block rate for residents to target peak seasonal demand, to form a humpback rate (Kitchen, 2002, p. 134).

Seasonal rates involve higher charges during periods of water scarcity. Kitchen states that "the failure to use…seasonal prices for summer months generates excessive demand for water at these times" (1997, p. 152). These rates better reflect the cost of water during peak periods (Renzetti, 2009, p. 1) and provide an increased financial incentive to reduce water use (Harris et al., 2002, p. 63; Monteiro, 2005, p. 13). Peak water use is driven by seasonal activities such as lawn watering, which requires municipalities to maintain and build infrastructure that is otherwise larger than needed (Bird, 1976, p. 121; Dewees, 2002, p. 596). By charging seasonal rates, municipalities make consumers contributing to this peak usage responsible for the cost of this additional capacity (Harris et al., 2002, p. 64; Kitchen, 2002, p. 134). Similarly, excess use rates, with a higher volumetric rate above a specific level of consumption that is often set to approximate non-peak use, can be used to target peak or seasonal use (Brandes et al., 2010, p. 19; Kitchen, 2002, p. 135).

Implementation of seasonal and excess use rates may be difficult due to additional information requirements (Ayoo & Horbulyk, 2008, p. 96; Monteiro, p. 13), including more frequent meter reading or use of smart meters. To be effective, consumers must receive their bills frequently and

must have access to clear information about the rate structures (Howe, 2005, p. 48; Olmstead & Stavins, 2008, p. 9). Uniform volumetric rates are one of the easiest rates to understand and explain (Brandes et al., 2010, p. 21).

Some two-part rate structures include a water allowance as part of the fixed charge or first block. Others use a two-tiered volumetric structure with a low or subsidized 'lifeline' charge for basic needs, supplemented by a higher charge for discretionary consumption (Ward & Pulido-Velazquez, 2009, p. 301). However, while such allowances may increase political acceptability, they decrease the signal to reduce water use (Martinez Espineira, 2002, p. 173). Lifeline rates can also be criticized since they end up subsidizing all low-water use, not simply targeted low-income groups (Fortin et al., 2001, p. 63).

An additional variation on volumetric rates includes the use of a minimum bill or minimum volumetric charge, as an alternative means of ensuring fixed costs are covered. When applied to simple volumetric rates, it can be similar in function to the fixed charge of a two-part rate with water use allocation and is subject to the same limitations—set too high, these charges reduce the price signal provided by the volumetric charge (Fortin et al., 2001, p. 50). However, two-part rates are considered superior, since the fixed charge is a more explicit means of covering fixed costs. These rates are particularly criticized where the minimum bill is set too high and consumers use less than the minimum amount (Bird, 1976, p. 120). Kitchen states that where "users do not consume enough to raise the amount they pay above the minimum bill, then the true marginal price is effectively zero, exactly the same as…with flat rate charges (Kitchen, 1984, p. 271).

Table 4. Water rate types

Rate type	Description	Comments
Flat rate	Fees allow an unlimited amount of water for a fixed fee that may be uniform for all customers or that may vary based on different characteristics.	Does not require metering. Not an effective means of promoting water conservation. Economically inefficient. Seen as regressive.
Volumetric rate	Fees are based on the amount of water used (a per unit charge for water).	Requires metering. Provides a price signal to consumers that can support economic efficiency and encourage water conservation. Can result in revenue fluctuation and revenues that fail to cover fixed costs. Customers pay for water, supporting benefits received / user pay view of equity.
Two-part rate	Fees incorporate fixed and variable charges, with the variable charge based on the amount of water used. May include a water allowance as part of the fixed fee.	Requires metering. Price signal from volumetric rate component can promote water conservation. Fixed charge supports revenue stability. Rate structure most appropriate to support economic efficiency, given that water utilities are natural monopolies. A water allowance may be more politically acceptable, but decreases the price signal provided by the volumetric rate.

Table 5. Volumetric rate types

Rate type	Description	Advantages/Disadvantages
Uniform rate	Constant unit charge for water.	Easy to communicate and calculate. All customers face the same fee per unit.
Increasing block rate	Volumetric charge that increases at set volume thresholds	Provides greater price signal to conserve water. Efficient where water costs rise with consumption. Some controversy exists about the affordability impacts on large households and multi-residential dwellings, which leads to debate on how to set thresholds.
Decreasing block rate	Volumetric charge that decreases at set volume thresholds	Does not provide a price signal to limit water consumption, resulting in higher capacity utilization and earlier capacity expansion. Particularly unsuitable where peak capacity problems occur. May result in low-volume users subsidizing higher-volume users; however, lower rates for high volume usage reflect economies of scale.
Humpback rate	Volumetric charge that incorporates both increasing block rate for residential customers and decreasing block rate for high volume (ICI) users	May be appropriate where residential customers are responsible for peak demand and there are economies of scale at ICI usage levels. Inappropriate where residential customers end up subsidizing the ICI sector. *Also see above comments regarding increasing and decreasing block rates.*
Seasonal rate	Volumetric charge that increases during seasonal peak period (e.g. May-September).	Improves economic efficiency because it targets peak use. Use of these rates entails additional information and communication requirements including more frequent meter reading and billing.
Excess use charge	Volumetric charge on water use above a specified base allocation	Rate can be designed to target discretionary or peak use. Use of these rates entails additional information and communication requirements including more frequent meter reading and billing.
Lifeline rate	Volumetric charge that specifically considers affordability concerns, by providing a subsidy on water included in the base allocation, billing above the actual cost of water for discretionary usage.	May be more politically acceptable, but by including a water allocation it decreases the price signal to conserve. Does not accurately target low-income groups.
Minimum bill	Imposes a charge for a minimum level of consumption. Water use above this level is subject to the volumetric rate.	Can be similar in effect to the fixed charge portion of a two-part rate with a water use allocation, but less explicit. However, if the minimum charge Is too high, a minimum bill will function like a flat rate.

Sources: All sources for descriptions and comments included in Tables 4 and 5 are provided in the above section text. Note that (Brandes et al., 2010, p. 19; OECD, 2010, pp. 85-9; Ontario Water Works Association, 2005, p. 8) were particularly useful.

It is important to keep in mind that the actual efficiency of a specific water rate will depend on how prices are set in relation to costs. While Kitchen indicates that flat rates are not efficient and should not be used (1997, p. 152) he also states that "As long as some operating costs are ignored and real marginal costs are not measured, it may be folly to comment on the efficiency of existing volumetric pricing structures…whether prices should rise with consumption, decrease with consumption or remain at a fixed rate per unit consumed is an empirical question and one that depends on the marginal cost of production and delivery" (1997, p. 152).

RESULTS OF JURISDICTIONAL SCAN BY PROVINCE

The jurisdictional scan identified 300 municipalities across the country that meter the residential sector or that are in the process of implementing residential water metering. The following sections summarize the results of the jurisdictional scan by province. For a complete listing of rate information for those jurisdictions that use meters, please see Appendix B.

British Columbia

The Government of British Columbia has set water efficiency targets under its Living Water Smart Water plan: "by 2020 water use in B.C. will be 33% more efficient and 50% of new municipal demand will be met by conservation" (Government of British Columbia, 2011). According to the province, measures implemented by local governments, such as water efficiency requirements and water meter implementation, will help reduce water use. In 2006, only a third of residential clients were metered and average daily residential water use was 448L per person (Environment Canada, 2009, p. 5). In recent years, several municipalities have studied or begun implementation of residential water metering.

The review of municipal websites across the province identified 51 municipalities that currently meter or that are in the process of installing meters for residential customers (Table 6).[1] For those municipalities that do meter, not all have universal residential metering programs—some, including Vancouver, Surrey, Lake Country, Mission, Osoyoos, Prince George and Sicamous require meters only for new construction. Others, including Surrey, Richmond, Delta, Prince George and Comox, have implemented voluntary metering programs. Vancouver will also be considering development of a voluntary program in 2012 (City of Vancouver, 2011, p. 14).

Municipalities in B.C. have adopted a wide range of rate structures and billing practices for their metered customers. Armstrong, Osoyoos, Summerland, Castlegar and Enderby currently operate using flat water rates, but have begun installing meters and plan to implement universal water metering with new consumption-based water charges either this year or within the next few years. Kamloops recently installed meters and will be moving customers to the new rate structure in 2012-2013 after they have received at least two shadow bills (City of Kamloops, n.d.c). Osoyoos has installed pilot residential water meters and is currently using them for testing and research purposes.

[1] In some cases, no information was found indicating whether or not the municipality metered residential customers. The information presented in this and the following sections likely does not include all cases of residential metering despite best efforts to make a complete identification.

Where consumption-based billing was in place, two-part rates with fixed and uniform volumetric components were the most commonly used rate structure. In total, 21 municipalities used this rate structure, 4 of which included a water allowance as part of the fixed fee and 2 of which had a minimum consumption charge.

Two-part rates with fixed and increasing block conservation components were also common—15 municipalities billed according to this method, half of which included a water use allowance as part of the initial fixed charge. Only two municipalities that metered residential customers made use of a two-part fixed and decreasing block structure and in both cases the volumetric limit of the second block was set at a level well above normal domestic consumption. Seven municipalities' rate structures were based only on volumetric rates (uniform or increasing block), although two required minimum charges in order to ensure consistent revenues.

Pressures on water systems in B.C. tend to occur in summer, as a result of precipitation patterns and increased seasonal usage. Conservation measures such as lawn watering restrictions have been used in many areas for some time (BC Ministry of Environment, 1999), but some municipalities have also adopted seasonal water rates. For example, Abbotsford has developed a seasonal peak rate structure with a uniform rate in winter and an increasing block volumetric rate in summer (City of Abbotsford, n.d.b). Rates in Tofino's five-tier summer increasing block rate structure are double those used in winter (District of Tofino, 2009). Vancouver has also adopted a seasonal rate for metered customers, with a 25% surcharge in summer (City of Vancouver, 2012a). Kamloops meanwhile, allows a greater allocation of water use as part of its fixed rate during the summer months (City of Kamloops, 2011).

Some municipalities allow for rate reductions for specific groups in response to equity issues. For example, Parksville's increasing block rate structure includes higher consumption limits for large families (City of Parksville, 2012b) and Nanaimo has a reduced rate for low-income households (City of Nanaimo Finance Department, 2011). Rossland has a $20/year rate reduction for senior citizens (City of Rossland, 2011, p. 3). For unmetered customers paying flat rates, Delta provides a reduced rate for single-person households.

Implementation of metering, user pricing or conservation-based pricing appears to have reduced water use, although flow information was located only for a limited number of municipalities, long time series were generally not available, and results are not yet available for municipalities that are in the process of making this shift. Lumby introduced universal water metering in 2008/09 and by 2010 saw a 21% decrease in water use (Village of Lumby, 2011b). Port Alberni indicated it saw a 34% decrease in annual water use and a 39% decrease in peak day consumption (City of Port Alberni, n.d.).

Fort St. John installed fixed network smart meters as part of its universal metering program in 2006-2007, began mock billing in 2008 and started consumption-based billing in January 2009 (Coxon & Shopland, 2011). Total water usage and per capita daily usage declined significantly in 2009 and 2010 (Coxon & Shopland, 2011). Peachland began installation of water meters from 2007 to 2009 and started billing based on consumption in 2010. Water flows decreased 27% from 2009 to 2010 and were 34% lower than the previous 10-year (2000-2009 average) (District of Peachland Water Department, 2011). Meters were installed in Kelowna in 1996 and user-pay rates implemented in 1998 (City of Kelowna, 2009). According to the city, total water use increased only 2% from 1995 to 2009, despite a 30% increase in population and average monthly residential water use for single-detached dwellings dropped from 56m^3 to 39m^3 (City of Kelowna, 2009).

Parksville moved from combination parcel fees, flat user fees and consumption fees to a two-part increasing block rate in 2006 (City of Parksville, 2012b). Total per capita water flows in 2007 were 19% lower than the 2002-2006 five-year average (City of Parksville Operations and Utilities, 2011). In October 2009, the city implemented increasing block rates as part of a new water awareness program in response to increased water usage after one of the driest seasons on record (City of Parksville, 2012a). Total per capita water flows in 2010 were 17% lower than the 2002-2006 average and year-over year flows decreased 14% from 2009 to 2010 (City of Parksville Operations and Utilities, 2011).

The Regional District of North Okanagan recently studied water rate impacts on consumption for member jurisdictions. They found that consumption declined in Vernon and Coldstream from 2005 to 2010, possibly in response to increased prices. However, they note the validity of their conclusions is limited by the short time series of data available (Regional District of North Okanagan, 2011b). They also note that "the shift towards consumption-based pricing may have had an initially strong impact, but recent pricing policy dilutes price signals to consumers due to the largest proportion of each bill being the base fee. The change to a quickly accelerating block rate in 2011 may mitigate this" (Regional District of North Okanagan, 2011b).

Jurisdictions that have implemented universal metering have adopted a range of approaches to deal with customers that have refused meters. For example, according to Kelowna and Oliver's water use bylaws, customers that are required to have a meter but that do not are billed a monthly flat charge of $400 (City of Kelowna, 2009; Town of Oliver, 2010). Lumby will be charging unmetered customers an extra $50 per month for each quarter that a meter is not installed (Village of Lumby, 2011a). Similarly, Greater Vernon Water includes quarterly water consumption charges of $201.43 on top of their fixed charge for unmetered customers where metering is possible. This charge rises to $425.10 per quarter after a written warning is given (Regional District of North Okanagan, 2011a).

Implementation of residential water meters has become a political issue in some areas of the province. For example, use of water meters in Comox was a topic of debate leading up to the 2011 municipal election (Anderson, 2012). A recently-elected Vancouver councilor has publicly questioned whether meters will allow consumers to save money or if they will simply add to water costs and cost the city more to operate (Lazaruk, 2012).

In addition, public concerns about possible health impacts of smart meters have been widely discussed in B.C. media, largely as a result of BC Hydro's move to install smart water meters in residences across the province (Burrows, 2011; Burrows, 2012; Youds, 2011). As a result, Kamloops has included information on the safety of radio frequency signals on its website (City of Kamloops, n.d.a). It has also developed two options for those with concerns about radio frequency exposure: installation of a manual-read, non-radio-frequency meter hard-wired to an external touch pad, with an additional charge of $25 per quarter for meter reading or installation of a radio-frequency meter below ground at the property line, with a $1,000 fee for installation (City of Kamloops, n.d.a). At its 2009 Water Metering Open House, Oliver indicated that those who refused to have a meter installed on their property would be charged $750 to have the meter installed underground on the city right-of-way (Town of Oliver, 2009b).

Different jurisdictions bill customers on a wide variety of schedules including billing some or all charges annually with taxes, semi-annually, three times per year, quarterly, bi-monthly and monthly.

Table 6. Summary of water and sewer rate structures, British Columbia

Water Rates for Metered Customers						
Fixed fee	Uniform volumetric	Uniform volumetric, minimum charge	Increasing block rate (including 1 seasonal)	Increasing block rate, minimum charge	2-part rate, uniform volumetric, no water use allocation (including 1 seasonal)	2-part rate, uniform volumetric, with water use allocation (including 1 voluntary)
number						
6	3	1	2	1	15	4
2-part rate, uniform volumetric, no water use allocation, minimum charge	2-part rate, increasing block volumetric, no water use allocation (including 1 seasonal)	2-part rate, increasing block volumetric, with water use allocation	2-part rate, decreasing block volumetric,[1] no water use allocation	2-part rate, decreasing block volumetric,[1] no water use allocation, minimum charge	Total identified municipalities that meter residential water use	
number						
2	8	7	1	1	51	

Sewer Rates for Metered Customers						
Fixed fee	Uniform volumetric	Uniform volumetric, minimum volume	Joint water and sewer fixed charge, uniform volumetric	Joint water and sewer fixed charge, uniform volumetric, minimum charge	Joint water and sewer fixed charge, increasing block volumetric rate	Joint water and sewer fixed charge, decreasing block volumetric,[1] minimum charge
number						
22	4	3	2	1	1	1
2-part rate, uniform volumetric, no water use allocation	2-part rate, uniform volumetric, no water use allocation, minimum charge	2-part rate, uniform volumetric, with water use allocation	2-part rate, increasing block volumetric, with water use allocation	Septic only	Tax assessed	Total identified municipalities that meter residential water use
number						
8	1	3	1	3	1	51

1. Under normal usage, residential customers would only be charged at the first block volumetric rate.
See Appendix B for complete details for municipalities included in this table.

Alberta

At least since 1991, the provincial government has strongly encouraged volumetric rate structures through the Alberta Municipal Water / Wastewater Partnership (Government of Alberta, n.d.).

The program provides funding for communities trying to build certain types of water or wastewater infrastructure. But a key eligibility issue concerns residential metering: for jurisdictions where pricing is not based on consumption, grants are typically reduced (Government of Alberta, 2009). More recently, the government launched a full cost accounting program. Although water utilities are not yet required to take that approach, various resources have been made available to help them do so (Government of Alberta, 2008, p. 2).

Despite these initiatives, only 84.8% of the province's residential water customers are metered (Environment Canada, 2009). Alberta has 89 cities, municipal districts, specialized municipalities and towns with 5,000 or more people, of which 65 currently use volumetric pricing (Table 7). Uniform volumetric rates, currently used by 53 jurisdictions, are by far the most prevalent, and in 43 cases they are combined with a fixed charge as a two-part rate. Another 11 jurisdictions use increasing block rates, all but three with a fixed charge. No jurisdiction includes a water allocation in its pricing structure, and only nine incorporate a minimum bill.

Several communities in Alberta have implemented atypical pricing elements. Some jurisdictions charge higher rates for customers outside city or town limits. Some break fixed charges into components, such as separate maintenance and conveyance fees. Some collect a percentage of each bill as a "municipal franchise" fee. Calgary has a separate volumetric rate for irrigation. Banff offers a fee reduction for senior citizens. While most jurisdictions use monthly or bi-monthly billing periods, at least two calculate their fixed component on a daily basis.

Table 7. Summary of water and sewer rate structures, Alberta

Water Rates for Metered Customers				
2-part rate, decreasing block volumetric and fixed charge	2-part rate, increasing block volumetric and fixed charge	2-part rate, uniform volumetric and fixed charge	Increasing block volumetric	
Number				
1	8	43	1	
Increasing block volumetric with minimum bill	Uniform volumetric	Uniform volumetric with minimum bill		Total identified municipalities that meter residential water use
number				
2	3	7		65

Sewer Rates for Metered Customers				
2-part rate, increasing block volumetric and fixed charge	2-part rate, uniform volumetric and fixed charge	%-surcharge on total water bill	%-surcharge on total water bill and fixed charge	Assessed through taxes
Number				
1	34	5	2	1
Fixed charge	Included in water rate	Uniform volumetric	Unknown	Total identified municipalities that meter residential water use
Number				
11	3	3	5	65

See Appendix B for complete details for municipalities included in this table.

Saskatchewan

Use of water meters for residential customers is the norm in Saskatchewan. According to Environment Canada's Municipal Water and Wastewater Survey, 98.2% of residential clients in the province were metered in 2006, the highest proportion in the country, and average daily residential water use was 219L per capita (Environment Canada, 2009, p.5). Of the fifteen cities in Saskatchewan with a population over 5,000, all metered residential water use.

All municipalities that were reviewed as part of the scan used a two-part rate structure (Table 8). Two-part rates with fixed fee and uniform volumetric components were the most frequently used. Of the twelve municipalities using this type of rate structure, one included a water use allocation as part of the fixed rate.

Two-part decreasing block rate structures may previously have been more common in Saskatchewan—in 2006, Environment Canada found that the mean last block prices charged by Saskatchewan municipalities were $\$1.03/m^3$ compared to mean first block prices of $\$1.41/m^3$ (Environment Canada, 2009, p.9). However, of the fifteen municipalities reviewed, only Swift Current made use of decreasing block rates (City of Swift Current, 2011). Prince Albert moved from a decreasing block volumetric component to a uniform volumetric component in 2010 (City of Prince Albert, 2012). The city noted that "The majority of other Cities have already adopted rate structures that encourage water conservation and provincial agencies are requesting conservation plans as part of grant application process" (City of Prince Albert, 2012).

Saskatoon, the largest city in the province, uses an increasing block rate volumetric component (City of Saskatoon, 2011b). Lloydminster has instituted use of a two-part rate with an increasing block rate for 2012 (City of Lloydminster, 2010).

Most municipalities continue to use the older style mechanical dial-type meters. Meter readers visit homes at different intervals, from bi-monthly to less frequently. Several jurisdictions provided options for residents to submit meter readings, including submitting online, by phone or email. Saskatoon completed its switch to remote access meters in 2005, allowing meter reading from outside the home using a handheld device and exterior touchpad (City of Saskatoon, 2011a). Moose Jaw is also promoting the use of remote meters—customers can contact the city if they wish to have one installed (City of Moose Jaw, n.d.). All residential meters in Regina have been equipped with radio transmitters, allowing meter readers to collect readings from their vehicle (City of Regina, 2012).

Table 8. Summary of water and sewer rate structures, Saskatchewan

Water Rates for Metered Customers					
2-part rate, uniform volumetric, no water use allocation	2-part rate, uniform volumetric, with water use allocation	2-part rate, increasing block volumetric, no water use allocation	2-part rate, increasing block volumetric, with water use	2-part rate, decreasing block volumetric, no water use allocation	Total identified municipalities that meter residential water use
number					
11	1	1	1	1	15

Sewer Rates for Metered Customers						
Fixed fee	2-part rate, uniform volumetric, no water use allocation	2-part rate, increasing block volumetric, no water use allocation	2-part rate, increasing block volumetric, with water use	Included in water rate	Unknown	Total identified municipalities that meter residential water use
number						
2	8	1	1	2	1	15

See Appendix B for complete details for municipalities included in this table.

Manitoba

As in Saskatchewan, cities and towns in Manitoba have long used water meters. Environment Canada reports that 97.2% of residential clients in the province were metered in 2006, the second highest provincial rate in the country (Environment Canada, 2009, p.5).

The Public Utilities Board (PUB) of Manitoba regulates all water and sewer utilities outside of Winnipeg—their main role is to review rate applications, operating deficits and deficit recovery plans to ensure they are reasonable and appropriate (Province of Manitoba, 2009). The PUB provides guidelines on the calculation of uniform rates, block rates and commodity rates, bulk water sales, billing, contingency allowance, cash surplus, and service charges among other issues (Manitoba Public Utilities Board, 1978, pp. 1-16). Although municipalities may use other practices "where evidence indicates that variation is reasonable, subject to the responsibility of the board to ensure that the resulting rates are equitable to all customers, as far as possible, and that they will provide sufficient revenue to recover all maintenance and operating costs" (Manitoba Public Utilities Board, 1978, p.1) municipalities across the province adhere to very similar billing practices.

Of the 11 cities and towns in Manitoba with a population over 5,000, 10 metered residential water use (Table 9). The remaining city, Flin Flon, meters water in the ICI sector. All ten cities and towns that metered residential water used two-part rates, with decreasing block volumetric rate structures being the most common, followed by uniform volumetric rates. In effect, however, most residential users would normally be subject only to the first domestic rate block rather than the lower intermediate or wholesale rate blocks. Given that Environment Canada estimates that residential water use in Manitoba was 236L/per person/per day in 2006 (Environment Canada, 2010, p. 4), the average family of four should consume less than 30m^3/month. The first block rate exceeded this level for all jurisdictions studied except for Winnipeg and The Pas.

Of the four cities and towns that use two-part rates with fixed and uniform volumetric components, one recently moved from a flat-fee water tax. Seven of the ten cities and towns had quarterly minimum charges, with volumetric minimums ranging from 3.8m^3 to 15m^3 per quarter.

Rural municipalities with populations over 5,000 often provided some level of water and sewer service to residents, although use of private wells and/or septic systems was also common. Of the twelve rural municipalities reviewed, nine provided metered water service to some or all of their residents. All municipalities reviewed used two-part uniform volumetric rates for water. Minimum quarterly charges were in place for eight of nine rural municipalities, with volumetric minimums ranging from 11.45m^3 to 25m^3 per quarter.

The majority of residents were served with mechanical dial meters, including those in Winnipeg, the largest city in the province, who were also required to submit their own quarterly meter readings (City of Winnipeg, 2011). However, Selkirk recently replaced meters with radio-frequency meters (City of Selkirk, n.d.) and Thompson installed new radio-frequency meters in 2011 as part of its plan to create a new water utility (City of Thompson, n.d.). Ritchot uses electronic meters that can be read with a hand-held device (Ritchot Municipality, n.d.).

Table 9. Summary of water and sewer rate structures, Manitoba

2-part rate, uniform volumetric, no water use allocation	2-part rate, uniform volumetric, no water use allocation, minimum bill	2-part rate, decreasing block volumetric, no water use allocation	2-part rate, decreasing block volumetric, no water use allocation, minimum bill	Total identified municipalities that meter residential water use
number				
2	11	2	4	19

Joint water and sewer fixed charge, uniform volumetric	Joint water and sewer fixed charge, uniform volumetric, minimum bill	Joint water and sewer fixed charge, decreasing block volumetric	Joint water and sewer fixed charge, decreasing block volumetric, minimum bill	2-part rate, uniform volumetric, with water use allocation, minimum bill	Unknown or septic only	Total identified municipalities that meter residential water use
number						
4	6	1	2	4	2	19

See Appendix B for complete details for municipalities included in this table.

Ontario

Over ten years ago, following the Walkerton tragedy, the provincial government began to prioritize full cost recovery for water utilities. When the Sustainable Water and Sewage Systems Act was passed in 2002, its purpose was to force municipalities to identify all associated costs and generate sufficient revenue to avoid cutting corners (Canadian Environmental Law Association, 2004).

Another major development happened in 2007, again based on recommendations from the Walkerton Inquiry. The government changed the process for approving water permits by introducing the Municipal Drinking Water Licensing Program. Utilities must now abide by Ontario Regulation 453/07, which requires preparation and approval of comprehensive financial plans (Government of Ontario, 2011). Meanwhile, the Water Opportunities and Water Conservation Act is currently before the legislature. Its provisions include creation of a new oversight agency for water services (Government of Ontario, 2010).

The province has one of the highest metering residential water metering rates at 91.2% (Environment Canada, 2009, p.5). Ontario has 143 cities, municipalities, towns and townships with a population of 10,000 or more. An overwhelming majority of 120 jurisdictions already use volumetric pricing (Table 10).

Uniform volumetric is once again the most common rate type, employed by 87 jurisdictions, together with a fixed charge in 65 of those cases. Among the remaining 33 jurisdictions, 14 use an increasing block rate, 12 use a decreasing block rate and seven use a mixed block rate wherein

prices rise for the first few blocks, but drop back for the highest block(s), presumably because they cover volumes beyond what any household would ever use. Only thirteen jurisdictions use pricing structures that incorporate a minimum volume.

Several communities use atypical adjustments to more common pricing structures, such as premiums added to all consumption over a given threshold during spring and summer months. One jurisdiction sets the threshold as the consumer's average use between November and April. There are also various examples of infrastructure renewal, capital or facility financing charges, which may be flat fees, volumetric levies or percentage surcharges on the total water bill.

In terms of noteworthy administrative cases, the township of Adjala-Tosorontio reached an agreement to have the Ontario Clean Water Agency take over operation of its water utility. Barrie is using a new networking system called Advanced Metering Infrastructure (AMI) to automatically gather meter data. Oxford County began a metering program in 2009, which is now almost fully completed. Volumetric rates came into effect in April of 2011. Oxford County includes the city of Woodstock, which has approximately 35,000 people.

Table 10. Summary of water and sewer rate structures, Ontario

Water Rates for Metered Customers					
2-part rate, decreasing block volumetric and fixed charge	2-part rate, increasing block volumetric and fixed charge	2-part rate, increasing block volumetric and fixed charge with minimum bill	2-part rate, mixed block volumetric and fixed charge	2-part rate, uniform volumetric and fixed charge	2-part rate, uniform volumetric and fixed charge with minimum bill
12	11	1	7	63	2
Increasing block volumetric	Increasing block volumetric with minimum bill	Uniform volumetric	Uniform volumetric with minimum bill		Total identified municipalities that meter residential water use
1	1	13	9		120

Sewer Rates for Metered Customers						
2-part rate, decreasing block volumetric and fixed charge	2-part rate, increasing block volumetric and fixed charge	Increasing block volumetric with minimum bill	2-part rate, mixed block volumetric and fixed charge	2-part rate, uniform volumetric and fixed charge	Assessed through taxes	%-surcharge on total water bill
10	5	1	2	47	1	16
%-surcharge on total water bill and fixed charge	Fixed charge	Included In water rate	Unknown or septic only	Uniform volumetric	Uniform volumetric, minimum bill	Total identified municipalities that meter residential water use
1	2	4	12	12	7	120

See Appendix B for complete details for municipalities included in this table.

Quebec

Residential water metering is relatively uncommon in Quebec. According to Environment Canada, only 16.5% of residential clients and 33.6% of business clients were metered in 2006, one of the lowest rates in the country (Environment Canada, 2009, p. 5). Average daily residential water use was correspondingly high at 401L per capita (Environment Canada, 2009, p. 5).

The province, in its 2011 *Stratégie Québécoise d'économie d'eau potable,* recommended that municipalities adopt ICI metering in order to reduce water consumption (Gouvernement du Québec, 2011, p. 22). However, the strategy does not provide recommendations for the installation of meters in the residential sector (Gouvernement du Québec, 2011, p. 23).

Although adoption of residential water metering has been considered by municipalities such as Saint-Hyacinthe (Comité consultatif des citoyens et citoyennes pour la protection de l'environnement maskoutain, 2009, p. 15), others abandoned residential water metering and consumption-based billing following the municipal amalgamation that occurred in 2002. For example, in 2006, Lévis announced that it would stop billing based on water consumption in the ex-towns of Saint-Romuald, Saint-Jean-Chysostome, Saint-Nicolas and Pintendre, which were the only areas of the amalgamated region that metered residential customers (Ville de Lévis, 2006). In 2004, Terrebonne announced that it was harmonizing all residential water tariffs, would bill customers based on flat rates, and no longer install residential meters (Ville de Terrebonne, 2003).

Of the 92 cities and towns in Quebec with a population above 10,000 that were reviewed as part of the jurisdictional scan, 9 metered residential water use (Table 11). Seven of the nine municipalities that meter water made use of a two-part rate, although the fixed rate components for Pointe-Claire and Mont-Royal only included nominal meter rental charges. Two municipalities made use of volumetric charges only. Sewer charges were sometimes included as part of the water rate or were assessed through taxes or a fixed annual charge.

Where residential metering occurs, it appears to have been a longstanding practice and use of mechanical dial meters is usual. For example, metering has been in place for decades in Rouyn-Noranda (Ville de Rouyn-Noranda, 2007). Meters are usually read no more than once a year and in half the cities, customers are responsible for submitting their meter read to the city. Annual billing is the norm.

Table 11. Summary of water and sewer rate structures, Quebec

Water Rates for Metered Customers					
Uniform rate	Increasing block rate	2-part rate, uniform volumetric, no water use allocation	2-part rate, uniform volumetric, with water use allocation	2-part rate, increasing block volumetric, with water use allocation	Total identified municipalities that meter residential water use
number					
1	1	3	2	2	9

Sewer Rates for Metered Customers				
Fixed fee	Included in water rate	Assessed through taxes	Unknown	Total identified municipalities that meter residential water use
number				
1	4	2	2	9

See Appendix B for complete details for municipalities included in this table.

New Brunswick

Only 60.4% of New Brunswick's population receives domestic water service, by far the lowest rate in Canada. Among that group, 49.1% of customers are metered (Environment Canada, 2010, p. 4). Among 16 jurisdictions with a population over 5,000, eight have metered residential water services, three definitely do not, and five remain undetermined (Table 12). The only three municipalities with more than 50,000 people have all implemented water metering.

The pricing structures for water among jurisdictions with meters vary substantially, including increasing block, decreasing block and uniform volumetric rates. Most have fixed charges, and billing is almost always quarterly. There is also a range of pricing structures for sewer services. According to Environment Canada (Environment Canada, 2009, p. 4), one notable similarity is that less than 1% of the province's population has a pricing structure that includes a built-in minimum volume.

Moncton was the first Canadian city to fully employ a Fixed Network Radio Frequency Reading system by completing installation in 2007. Fixed networks are cutting-edge metering technology, transmitting data to a single computer without any requirement for manual or drive-by reading. Data can be gathered several times per day, which can be highly beneficial for identifying potential leaks, mechanical failure, usage trends and following up with customers (City of Moncton, 2010). Miramichi, which also has a fixed network, decided to involve an outside agency in the administration of water services. For over ten years, the Neptune Technology Group has handled all of the city's meter reading and billing (Neptune Technology Group, 2009).

Environment Canada (Environment Canada, 2010, p. 7) reports that volumetric pricing seems to have less impact on water use in New Brunswick than anywhere else. As in all other provinces, average per capita consumption is lower in municipalities with metered rates. But compared with consumption where rates are flat, there is only a 6.2% difference.

Table 12. Summary of water and sewer rate structures, New Brunswick

Water Rates for Metered Customers					
2-part rate, decreasing block volumetric and fixed charge	2-part rate, increasing block volumetric and fixed charge	2-part rate, uniform volumetric and fixed charge	Uniform volumetric	Uniform volumetric, minimum bill	Total identified municipalities that meter residential water use
number					
2	1	3	1	1	8

Sewer Rates for Metered Customers						
2-part rate, decreasing block volumetric and fixed charge	2-part rate, uniform volumetric and fixed charge	%-surcharge on total water bill	Fixed charge	Included in water rate	Uniform volumetric	Total identified municipalities that meter residential water use
Number						
2	1	2	1	1	1	8

See Appendix B for complete details for municipalities included in this table.

Nova Scotia

The Nova Scotia Utility and Review Board supervises over 50 individual utilities serving municipal jurisdictions throughout the province. It has broad authority over many aspects of water provision, especially with respect to finances. Board approval is required when implementing or changing any rates, charges or regulations, as well as for any capital expenditure over $250,000. The Board's mandate is to "ensure sound management and the provision of reasonably safe and adequate service at just and reasonable rates" (Utility and Review Board, 2008).

Given an oversight agency so focused on fiscal prudence, it is not surprising that 92.6% of Nova Scotia's residential water customers are metered, one of the highest rates in the country (Environment Canada, 2010, p. 4). But with only 71.3% of residents receiving domestic water service, Nova Scotia joins New Brunswick as the only provinces with access rates under 85% (Environment Canada, p. 5).

Nova Scotia has several types of municipal jurisdictions involved in water service provision, including various towns and at least two of the three regional municipalities. There are also counties and rural municipalities, only some of which provide water services. Among 45 jurisdictions with a population over 5,000, 12 have metered residential water services (Table 13). Halifax and Cape Breton, the two largest jurisdictions by far, as well as the five largest towns are all metered.

Not many types of metered pricing structures were identified in Nova Scotia. The majority use a two-part rate with uniform volumetric and fixed components. Three use two-part rates with decreasing block volumetric and fixed components, although in most cases the volume threshold for the second block is so high that for residential customers it does not really matter. One jurisdiction uses a two-part rate with an increasing block, while another employs a uniform volumetric rate with no fixed component. Known sewer rates were either uniform volumetric, some with an additional fixed component, or assessed through taxes. Most jurisdictions bill on a quarterly basis. In another example of apparent standardization, no jurisdiction uses a pricing structure that incorporates a minimum volume (Environment Canada, 2009p. 7).

The Regional Municipality of Cape Breton only finished implementing its metering program in 2006. All customers, residential and otherwise, now use meters (Cape Breton Regional Municipality, n.d.). Meanwhile, the Regional Municipality of Halifax has been working with several other groups on a new formula for a waste- and storm-water rate. As part of the initiative, Halifax will be completing a cost-of-service manual by August 2012. Based on a recently completed study, this manual will be used to break down costs and purposefully inform rate decisions (Zaccagna, 2012).

Table 13. Summary of water and sewer rate structures, Nova Scotia

Water Rates for Metered Customers				
2-part rate, decreasing block volumetric and fixed charge	2-part rate, increasing block volumetric and fixed charge	2-part rate, uniform volumetric and fixed charge	Uniform volumetric	Total identified municipalities that meter residential water use
number				
3	1	7	1	12

Sewer Rates for Metered Customers				
2-part rate, uniform volumetric and fixed charge	Assessed through taxes	Uniform volumetric	Unknown	Total identified municipalities that meter residential water use
number				
2	4	3	3	12

See Appendix B for complete details for municipalities included in this table.

Newfoundland and Labrador & Prince Edward Island

Only 0.02% of residential water customers in Newfoundland and Labrador are metered, the lowest prevalence among all Canadian provinces and territories (Environment Canada, 2010, p. 4). However, there are indicators that this is beginning to change. The capital, St. John's, passed a water meter by-law in 2011 requiring meter installation for all properties with three or more "dwelling units" (City of St. John's, 2011). While the by-law currently excludes single family residences or duplexes, a pilot project exploring comprehensive metering has already been completed (Bartlett, 2009).

Another of the province's largest municipalities is considering the benefits of water metering. Corner Brook launched a similar pilot project in 2008 by installing a sample of residential meters on a voluntary basis (Staff, 2008). However, they are only used for analyzing consumption trends and encouraging conservation. According to the city's Supervisor of Sustainable Development, Corner Brook will not be implementing volumetric water rates anytime soon (Staff, 2011).

The second lowest prevalence of water metering among residential customers at 1.5% is in Prince Edward Island (Environment Canada, 2010, p. 4). But there too municipalities are starting to take a new approach. In Charlottetown, the capital, all new water connections now have to be metered, and the city will provide a meter to any household at no cost. Compared with the $120.095 quarterly flat rate, the metered pricing structure, an $80.67 fixed charge and $0.788 volumetric rate, there is a slight potential for customers to save money. Through this process, Charlottetown is gradually transitioning to universal metering (City of Charlottetown, 2010).

Stratford may also move towards residential metering. In late 2011, a consultant hired by the town recommended abandoning flat rates. Although municipal officials emphasized at the time that no decisions about metering have yet been made, they also noted that the current water supply is almost at the point where it will no longer be able to meet consumption demands (Canadian Broadcasting Corporation, 2011).

RESULTS OF JURISDICTIONAL SCAN BY TOPIC

The following sections summarize the results of the jurisdictional scan by topic relevant to this research.

Factors considered when setting rates and selecting rate types

A scan of Canadian jurisdictions, particularly supporting documentation such as rate studies strategic plans, and financial plans, has uncovered a wide range of considerations that can underpin rate setting. As expected, factors directly impacting the bottom line are the most common.

Considerations for financial sustainability

A scan of other jurisdictions in Canada, particularly supporting documentation such as rate studies strategic plans, and financial plans, has uncovered a wide range of considerations that can underpin rate setting. As expected, factors directly impacting the bottom line are the most common. Many jurisdictions have found that the costs of providing water and wastewater services are increasing even faster than general inflation (BMA Management Consulting Inc, 2009a, p. 10; Loyalist Township, 2011a, p. 5). Others are concerned about the current and future financial impact of heavy debt burdens (BMA Management Consulting Inc, 2009b, p. 20). Stricter regulation imposed by higher levels of government, even as they reduce grants and transfers, can also be expensive (Loyalist Township, pp. 8-9).

Meanwhile as construction and energy costs have grown especially quickly, aging assets and deferred maintenance have become major challenges (City of Hamilton, 2010, p. 11; City of London, 2011a, p. 2; Earth Tech (Canada) Inc., 2007b, p. 3). One jurisdiction referred to this as a "new era" wherein infrastructure becomes outdated all at the same time (CH2MHILL, 2008, p. ii). Many are finding that they do not have anywhere near enough resources to complete necessary rehabilitation work. Facing massive expenditures for replacements, they are often left relying on the old infrastructure, hoping it can last until more resources become available (Hemson Consulting Ltd., 2006, p. 13). This route can ultimately lead to a range of problems, such as service interruptions, infrastructure failures and related property damage, increased fire risk and unsafe water quality (Windsor Utilities Commission, 2010, p. 36).

Some jurisdictions build depreciation into their rates, presumably to avoid any of the above situations. As assets wear down or become obsolete, they depreciate or lose their value over time. Translating that lost value into an annual expense and recovering it through the rate structure is a normal, reasonable budgeting practice (Urban Systems, 2008, p. 8). Depreciation is commonly used in the private sector. As a product is made, an asset used in the process will become worn out over time. Depreciation allows the producer to account for that as an expense and build it into the selling price (Watson and Associates Economists Ltd., 2010, pp. 3-5). The process of determining "industry standard life expectancies and valuations" for assets and assigning costs on that basis is sometimes called life-cycle planning (Hemson Consulting Ltd., 2007, p. 6). Projected life cycle costs should always be corrected for inflation (Loyalist Township, 2011b, p. 4). Incorporating this approach into fiscal planning is a key step towards safeguarding the financial sustainability of water and wastewater systems (City of Vaughan, 2011, p. 11)

Thinking long-term about asset value and infrastructure rehabilitation is a key element of full cost recovery, now widely accepted as a cornerstone for maintaining reliable service levels and

standards. Full cost recovery includes not only operations, repairs and administration, but also capital improvements, expansions and replacements (Earth Tech (Canada) Inc., 2007b, p. 3). This list can be expanded to specifically include staffing, equipment and supplies, along with any debt or reserve contributions associated with capital work (Watson and Associates Economists Ltd., 2010, p. 6). Ontario legislation specifies that all costs associated with "extracting, treating or distributing water to the public" should be considered, including even source protection (City of Quinte West, 2009, p. 22).

Full cost recovery allows jurisdictions to either maintain or move towards financial sustainability (Watson and Associates Economists Ltd., 2011, p. 23). Embracing this approach means no longer putting off major expenses without accounting for them (BMA Management Consulting Inc., 2009a, p. 22). It can lead to more accurate budgeting and rate-setting, a sharper focus on conservation, and greater accountability in terms of clarifying and providing the whole financial picture for constituents (Earth Tech (Canada) Inc., 2007b, p. 3). Advocates maintain that full cost recovery is also fundamentally about fairness. Since consumers contribute to ongoing infrastructure wear-and-tear, it is only reasonable that they pay life-cycle costs through ongoing rates (Hemson Consulting Ltd., 2006, p. 13). Those who wear out an asset are collectively responsible for contributing towards the replacement that will inevitably be necessary to maintain service in future (Watson and Associates Economists Ltd., 2010, p. 3).

The reality is that many utilities have been avoiding recovering full costs from users for a long time (Renzetti, 1999, p. 2). The resulting deferred maintenance can only lead to substantial infrastructure problems. As more things break down, more resources have to be spent haphazardly reacting to unanticipated contingencies and completing emergency work. Service quality diminishes, while the gap to financial sustainability keeps growing. The harsh consequence of such situations is often a "rate shock" wherein large increases are essential just to keep the system functioning at an acceptable level (Earth Tech (Canada) Inc., 2007b, p. 4).

The Quinte West Water and Wastewater Municipal Enterprise offers a snapshot of this type of experience. Only two years after implementing what turned out to be an insufficient rate structure in 2007, the jurisdiction found itself lending money to the utility just to pay its monthly operational bills. Quinte West experienced negligible rate increases for many years, which is partially why major increases were eventually required (City of Quinte West, 2009, p. 10). Cambridge provides another such example. By 2009, the city had a $70-million backlog in water and wastewater capital projects, but no funding to do the work. Residents were left facing the prospect of a "special surcharge" on their monthly bill to pay down new debt (BMA Management Consulting Inc., 2009a, p. 15).

Once decisions are made to implement full cost recovery and move towards financial sustainability, there are issues to address concerning implementation and timeframe. For example, a jurisdiction might reach 100% sustainability after five years of equivalent annual rate increases, or it might implement a large increase in the first year, followed by four smaller increases (Watson and Associates Economists Ltd., 2011, p. 7-2). Yet this is really only a choice about whether to pay now or later, since the revenue will be collected either way. The critical difference is that choosing later can mean borrowing substantially more. Alternatively, by growing reserves early and thereby lowering debt-related expenses, front-loading has the potential to substantially reduce risk (Hemson Consulting Ltd., 2011, p. 23). Among other benefits, this leads to well-managed water and wastewater systems, which add value to a community and by extension contribute to tax revenue stability (Municipality of Trent Hills, n.d., p. 22).

Proceeding with full cost recovery or more onerous rates can be difficult, and some jurisdictions have utilized a transitional period to make changes gradually (Hemson Consulting Ltd., 2006, p. 21). Maintaining rate stability and avoiding major spikes seem to be key reasons (C. N. Watson and Associates Ltd, 2002, p. 7-4). Trent Hills, for example, installed water meters and launched a volumetric rate structure in 2005. However, staff found that many residents were not prepared for the change, so the town launched a Leak Detection Program to help owners realize savings. Even though a 2005 rate study recommended increases for the following three years, they were all postponed. As a result, non-essential capital work continues to be deferred, likely for several more years (Municipality of Trent Hills, n.d., p. 5). Yet construction costs have often risen faster than inflation. Decisions to keep rates low in the short term may have drastic consequences with respect to borrowing more money for work that will only be even more expensive in the medium or long term (Loyalist Township, 2011a, p. 13).

Considerations for establishing rate structures

According to the American Water Works Association (AWWA), equity requires rate structures whereby customers pay the accurate cost of the service they receive (Regional Municipality of Durham, 2010, p. 34). Various jurisdictions stand by the user-pay equity standard (BMA Management Consulting Inc., 2009b, p. 8). Some referenced an intergenerational element, specifically that the financial burden of maintaining a sustainable water system should be shared equitably among current and future consumers (City of Vancouver, 2011, p. 9). The point was also made that structuring rates to intentionally benefit one type or class of customer is a subjective, political decision. This was not in accordance with the jurisdiction's preferred user-pay approach (City of London, 2008, p. 255).

Some jurisdictions argue that equity is too subjective to conclusively define. From this position, equity is understood only relative to tangential local circumstances such as how prices compare with nearby communities or whether any group pays more than another. There may be questions about whether strict user-pay is best, or whether ability to pay should matter, but without any clear direction. This perspective makes vague claims about equity being important "in light of many factors" for the community and goes no further (Watson and Associates Economists Ltd., 2010, p. 6).

Affordability or ability to pay is among the most fundamental principles of rate-setting for some jurisdictions (Hemson Consulting Ltd., 2011, p. 8). Research conducted for the City of Cambridge found that those utilities with better credit ratings typically prioritize affordability. This signifies that although financial sustainability is important, all options for cost control should be exhausted before resorting to rate hikes, and even then never more than absolutely necessary. Affordability concerns the relationship between income and cost of living. Considering combined water and wastewater rates as a percentage of income provides an indication of whether residents are reasonably able to pay. Although there is no widely-accepted single benchmark, various sources set the rate affordability threshold between 1.5% and 3% of average household income (BMA Management Consulting Inc., 2009a, p. 35). Another approach to affordability calculates rates as a percentage of overall typical residential utility expenses. One jurisdiction, for example, found that water and wastewater account for approximately 15% of the total, without including costs for internet or cell phone services. This demonstrates that water and wastewater are comparatively inexpensive (Regional Municipality of Durham, 2010, p. 30).

Communities that already have metered billing have found that switching to conservation-oriented pricing can pose concerns in terms of affordability, since raising rates high enough to

substantially affect consumption would likely be too expensive for some residents (BMA Management Consulting Inc., 2008, p. 11). In communities with other established conservation programs, if residents have already responded to those initiatives, there remains very little margin for a conversation rate to effect further change (BMA Management Consulting Inc., 2009a, p. 40). Users may reduce their discretionary consumption, but eventually further cutbacks are impossible, regardless of price, since they need enough water for basic needs (City of Hamilton, 2012, p. 64).

Hamilton has given special attention to the impact of rate increases on low-income consumers by maintaining a Utility Arrears Program, which targets vulnerable residents, such as seniors, people who are under-employed and participants in the Ontario Disability Support Program (City of Hamilton, 2012, p. 35). The city cost-shares the program with the Ministry of Community and Social Services. Newmarket has a similar rate rebate program tied to several key income support programs (Town of Newmarket, 2012). London has been considering a proposal from the London Coalition for Social Justice to establish a discount rate for families on low incomes to safeguard reasonable sanitation (City of London, 2008, p. 15). Guelph considered a low income initiative, but decided against it on the grounds that rates are already low. Moreover Guelph has had a similar tax deferral program for several years, but almost nobody has ever expressed interest (BMA Management Consulting Inc., 2008, p. 14). Nanaimo provides a substantial rate reduction for low-income households (City of Nanaimo Finance Department, 2011).

Many different principles can be used to inform rate-setting decisions, such as transparency in how costs are determined, clear disclosure of underlying assumptions and conservative projections designed to minimize risk (Urban Systems, 2008, p. 2). Other examples include conservation promotion, especially in peak seasons, ease of implementation and administration, alignment with affordable housing, density or agriculture policies and accessibility in terms of consumer understanding (City of Vancouver, 2011, p. A-9). Determining rates is ultimately an exercise in juggling competing priorities. A jurisdiction may wish to invest heavily in refurbishing infrastructure without making services any less affordable, but finding a balance between those two goals will likely be necessary (BMA Management Consulting Inc., 2009b, p. 6; City of Hamilton, 2012, p. 30).

Projecting water use is an essential step in determining rates, although it has become much more difficult in many Ontario jurisdictions in recent years as year-to-year consumption has declined faster than expected (City of London, 2011a, p. 2; City of Quinte West, 2009, p. 2; City of St. Catherine's, 2011, p. 6; Regional Municipality of Durham, 2010, p. 9). Decreasing usage will inevitably drive rates higher to offset revenue losses (BMA Management Consulting Inc., 2009a, p. 39). It is important to note the difference between projecting water consumed and water sold. Leaks and breaks in infrastructure, flushing mains, firefighter usage and supplying community sports facilities are all examples of consumption that does not generate revenue (City of Vaughan, 2011, p. 10). The industry standard for non-revenue water is approximately 10% of overall consumption (DFA Infrastructure International Inc., 2010, p. ES-1). However, water loss is likely to be greater in older systems with substantial deferred maintenance (BMA Management Consulting Inc., 2009a, p. 13).

The decline in consumption is at least partially due to the success of various initiatives that promote or incentivize conservation. For example, Ontario passed legislation in 2010 that limits the sale of toilets to models that use no more than six litres of water per flush. Hamilton found that toilets typically account for 30% of indoor water use. Since low-flow toilets use only about

one-third as much as traditional models, there will be a substantial revenue impact as households switch over (City of Hamilton, 2012, p. 62). Contemporary, conservation-oriented building standards have also resulted in lower residential consumption (Halton Region, 2012, p. 5).

Climate can also drastically affect water usage. During an unusually wet summer season, for example, there is likely to be much less consumption than in an average year. Without any warning, jurisdictions are left facing substantial revenue losses. Meanwhile, they have to spend more to process extra wastewater flows caused by the excess rainwater (BMA Management Consulting Inc., 2008b, p. 5; City of Vancouver, 2011, p. 8). One way to prepare involves testing different scenarios while determining rates, for example trial running how a rainy year with 15% less consumption would impact the budget (Earth Tech (Canada) Inc., 2007b, p. 22). At least one jurisdiction considers overall climate change effects, including flooding, to be a main strategic challenge for the years ahead (City of Hamilton, 2010, p. 11).

A reserve fund can be an invaluable stabilizing tool for mitigating unexpected changes in consumption (City of St. Catherine's, 2011, p. 8; DFA Infrastructure International Inc., 2010, p. ES-1). For example, Vancouver has used a stabilizing reserve over the past decade to hold increases to 5% on average, despite much greater fluctuation in annual costs (City of Vancouver, 2011, p. 7). Healthy reserves can also help address unexpected capital expenses or debt management issues (City of Hamilton, 2012, p. 53). However, in some cases reserves are low or even non-existent. Jurisdictions may have had strong reserves at one point, only to deplete them over time as a means to keep rates or taxes as low as possible. Unfortunately, such an approach can eventually result in a gap between resources and costs requiring, for example, a 100% rate increase (ND LEA Inc., 2007, p. 17).

There are several suggestions about how to maintain healthy reserves. According to the AWWA, between 5% and 15% of overall expenses should be directed to reserves (BMA Management Consulting Inc., 2009a, p. 26). Another recommendation highlights average capital amortization as a good lower threshold for reserve contributions (BMA Management Consulting Inc., 2010, p. 5). Inflation should always be factored into reserve plans. This improves equity in terms of sharing the cost burden between current and future users (Sharratt Water Management Ltd., 2009, p. 9). As opposed to simply building reserve contributions into the regular rate structure, some jurisdictions charge a special capital or reserve fund fee (Urban Systems, 2008, p. 11). Others ensure that any surplus is automatically directed to reserves (City of Vaughan, 2011, p. 11).

The AWWA considers the fixed and volumetric combined approach as “the heart of the methodology” for structuring rates (BMA Management Consulting Inc., 2009a, p. 56). However, a critical and complex issue concerns how to set the ratio between the two charges. Emphasizing the fixed component supports revenue predictability and stability, since it does not depend on the variability of consumption trends. However, emphasizing the volumetric component supports conservation by establishing a clear price signal for consumers about their usage; doing so is also better for affordability, since consumers have more control over their bill (Urban Systems, 2009, p. 5).

An objective approach to this problem involves categorizing each budgeted expense as either fixed or variable. The combined total of all expenses that do not change regardless of consumption is the amount of revenue to be generated through the fixed charge. The combined total of all expenses that vary depending on consumption is the amount of revenue to be generated through the volumetric charge (BMA Management Consulting Inc., 2009b, p. 6). One

jurisdiction simply assigns all capital expenses to the fixed charge and operational expenses to the volumetric charge (City of Quinte West, 2009, p. 4). Another uses the fixed charge to recover costs that are the same for all customers, such as administrative expenses, together with costs that depend on meter or pipe size (BMA Management Consulting Inc., 2008, p. 5). Whichever method is chosen, maintaining that approach for the long-term will afford some predictability and consistency for consumers (BMA Management Consulting Inc., 2009a, p. 25).

There is no definitive solution to this problem, and the relative balance between fixed and volumetric charges is always rooted in the values and preferences of the jurisdiction. Many previously noted considerations, such as conservation, affordability, equity and stability may be factored into the decision, along with local circumstances such as fee history. Yet there is no avoiding the capital intensive nature of water and wastewater provision, which means that a substantial portion of total expenses are fixed (BMA Management Consulting Inc., 2009a, p. 24). There would be significant implications of minimizing the fixed charge, despite having mainly fixed costs. Utilities must maintain sufficient output capacity and delivery networks for peak usage, without compromising water quality and safety. These expenses do not change, even if water use decreases, so relying heavily on volumetric revenues can pose substantial financial risk. There would also be questions “from a fairness and equity perspective” about offsetting capital renewal, debt-related or other fixed expenses that do not depend on usage through a variable charge based on consumption (BMA Management Consulting Inc., 2008b, p. 5).

Given the total revenue to be gathered through the fixed component, the next step is to distribute that amount among different types or classes of users. This step is easier because the AWWA has established an industry standard approach using meter equivalency factors, which are based on water meter size and capture the greater fixed costs associated with service provision through a larger meter. Multiplying the factors by the base fixed charge determines the equivalent monthly fixed component for each meter size (BMA Management Consulting Inc., 2008, p. 5).

This method has an inherent element of fairness since the fixed charge simply escalates for customers who place higher demands on the system (City of St. Catherine's, 2011, p. 8). For example, a standard 5/8” household meter can only manage about 10% of the volume capacity of a 2” meter. The physical infrastructure to support the larger meter must still be in place, regardless of whether the customer actually uses the maximum capacity. That infrastructure includes the water supply, treatment plant, pipes and more (Urban Systems, 2009, p. 6).

Considerations for choosing volumetric rate types

Several jurisdictions highlighted problems with volumetric only and minimum consumption charges, with some switching to a monthly fixed component instead (BMA Management Consulting Inc., 2007, p. 15). Relying only on consumption without a minimum charge compromises financial stability due to revenue fluctuations and undermines fairness, since some costs should be shared by everyone, even if their consumption is low (BMA Management Consulting Inc., 2009b, p. 13). A particular problem concerns the lack of revenue from users who temporarily re-locate elsewhere, for example snowbirds (Hemson Consulting Ltd., 2007, p. iii). However, minimum charges contradict the conservation incentive typically highlighted as the main appeal of volumetric only rates since customers pay the same for any amount up to the threshold (Hemson Consulting Ltd., 2006, p. 20). Dawson Creek found that households were billed on average for over 12 cubic meters bi-monthly that were not actually used. The minimum charge

was a de facto fixed charge, so the community simply switched to the latter (Urban Systems, 2009, pp. 4-7).

The increasing block rate is mainly used for encouraging conservation and, if successful, restricting seasonal peak demand. It has the potential to reduce the highest levels of consumption, which tax the system most heavily, thereby saving money and the environment by holding off infrastructure renewal and development (BMA Management Consulting Inc., 2007, p. 22). Setting the right block thresholds is important. If they are too high, most consumers will never exceed the first block (Watson and Associates Economists Ltd., 2010a, p. 1-8). One approach is to have the first block cover indoor consumption and the second outdoor consumption. But regardless of criteria, setting the thresholds is difficult simply because average household usage can vary significantly (BMA Management Consulting Inc., 2009a, p. 58). That is why this structure is most effective when family, dwelling and property sizes are all similar (City of Vancouver, 2011, p. 11). Even after the thresholds are set, determining the magnitude of price increase between blocks can cause major challenges, especially given the affordability concerns of low-income households, particularly big families (BMA Management Consulting Inc., 2009b, p. 13). Moreover by rewarding households with fewer people, increasing block rates also undermine any attempt at promoting residential density (City of Vancouver, 2011, p. 11).

Few jurisdictions were found to be using the declining block rate as their volumetric component for residences. More jurisdictions used this structure in the past, but at least in one case, staff found few benefits so they switched to a uniform volumetric rate beginning in 2011 (Watson and Associates Economists Ltd., 2011, pp. 6-10). The main reason to employ a declining block rate would be to recognize economies of scale. The first block can cover residential and small business use, whereas higher thresholds can correspond with the usage levels of big institutional or industrial consumers. Declining rates should correspond with the lower marginal cost of service provision at very high levels of consumption (BMA Management Consulting Inc., 2008b, p. 19).

The humpback rate structure combines the two block types so as realize the benefits of both. The first block is meant to cover standard household use. The second block is priced at a higher rate, thereby providing a conservation incentive. Beginning at a much higher threshold, the last block(s) can be priced at or near marginal cost to recognize economies of scale for institutional or industrial consumers (City of Niagara Falls, 2009, p. 8). Many of the challenges associated with increasing block rates would obviously apply. However, if the block thresholds can be set carefully based on local consumption trends, the opportunity to promote both conservation and economies of scale is certainly significant (BMA Management Consulting Inc., 2007, p. 7).

Several jurisdictions employ a uniform seasonal premium on water use or apply a surcharge to seasonal consumption over a given threshold, with examples ranging between 24 and 40 cubic meters per month. The charge typically applies throughout the spring and summer, for example from May through August or April through September (Township of Middlesex Centre, 2011, p. 3; Watson and Associates Economists Ltd., 2010b, p. 1-1). Vancouver places high priority on applying heavy economic pressure during summer months when excessive demand is most taxing on the infrastructure (City of Vancouver, 2011). This aligns with the economics of peak use rates, which suggest that because peak use stresses the system, thereby accelerating capital reinvestment, it should be more expensive for consumers than off-peak use (BMA Management Consulting Inc., 2009a, p. 59).

However, some jurisdictions oppose seasonal premiums. One recommendation contends that the increasing block structure has the same advantages, but all year long instead of only for a few

months (City of London, 2008b, p. 46). Meanwhile, several challenges of the increasing block structure were raised again, including difficulties with determining thresholds and relative pricing, along with affordability concerns of low-income households, particularly big families. Seasonal premiums can also cause problems for wastewater billing, since much of the extra consumption usually stays out of the wastewater system, instead going on lawns or in pools (BMA Management Consulting Inc., 2009b, p. 13). One solution involves using average winter consumption, for example between January and April, as the basis for a summer wastewater charge. This would not be perfect, since winter consumption might not correspond with summer wastewater use, for example when consumers temporarily re-locate elsewhere (Regional Municipality of Durham, 2010, p. 38). Another recommendation noted that if fixed charges are proportionately high, any conservation-oriented volumetric pricing will likely have minimal impact on the overall bill regardless (BMA Management Consulting Inc., 2008, p. 5).

Two other rate structures were considered by other jurisdictions, although only as topics of speculation. An excess use structure would establish an off-peak threshold for each consumer based, for example, on that consumer's average winter consumption. A peak use premium would apply to all consumption over the individualized threshold. This would support fairness and affordability by accommodating differences in households, but there are major administrative and technical challenges with tracking and billing individualized consumption. Windsor has tried an excess use rate. Meanwhile, a time-based structure would assess consumption at regular intervals throughout the day in order to apply peak and off-peak rates. Unfortunately, this is not feasible for most jurisdictions, given the advanced technology required to achieve such levels of precision (BMA Management Consulting Inc., 2009a, p. 60).

Considerations moving forward

There are a wide range of assumptions and variables built into water utility financial positions and rate structures, many of which are subject to change in future. Inflation rates are among the most important, specifically the consumer price index and construction cost index (City of London, 2011a, p. 6). Others include consumption trends, regulatory changes, interest rates, electricity costs, treatment chemical costs, regular maintenance costs and capital costs (Watson and Associates Economists Ltd., 2010, p. 6-2). Older infrastructure typically requires even more maintenance and capital work (Watson and Associates Economists Ltd., 2010, p. 6-2). Conservation initiatives also comprise an important factor. If successful, they can cause substantial revenue shortfalls (BMA Management Consulting Inc., 2008, p. 12). Another trend that can pressure revenues is housing density. Decreases in average property size would likely result in less outdoor summer consumption (Regional Municipality of Durham, 2010, p. 14). Adjala-Tosorontio offers an example of how some of these factors can have an impact. In 2008, the utility realized that growth had been slower than expected, which meant less revenue to address operating costs that had risen 8% compared with projected costs (Watson and Associates Economists Ltd., 2009, p. 2).

Many jurisdictions add extra capital costs to most or all utility bills. West Kelowna, for example, has a water maintenance fee (District of West Kelowna, 2011, p. 4). Melville has an infrastructure levy, while Weyburn has a service connection fee. Estevan has both, along with a drainage infrastructure charge. All of these are on top of regular fixed and volumetric rates. Such fees are sometimes collected for specified maintenance purposes, such as water main or connection work, and they are sometimes based on meter size (City of Prince Albert, 2007, pp. 29-31). Some extra

monthly fees are collected specifically to fund debt-servicing or new infrastructure projects (City of Quinte West, 2009, p. 3).

Borrowing remains a financing option for water and wastewater utilities. Vancouver used to fund water-related capital work entirely via debt, typically with ten-year amortization built into consumer fees. But while this softened the impact, consumers collectively paid an additional several million dollars in interest (City of Vancouver, 2011, p. 9). That is a major reason why fee revenues are the best source of financial sustainability for utilities (ND LEA Inc., 2007, p. 19). Meanwhile, rate increases are not always as tough as might initially be expected. As more consumers join the system, they help share the cost burden with everyone else (Sharratt Water Management Ltd., 2009, p. 11). And whenever inflation rises, rate increases may only really be keeping pace, in which case the real value of water will not change for consumers. This effect can have a detrimental impact on rates meant to incentivize conservation (City of Hamilton, 2012, p. 64).

Certainly there are no easy solutions to some of these challenges. In Niagara Falls, feedback from one person triggered a controversial multi-year rate structure review process that eventually engaged almost all of the community. Since any rate adjustment would inevitably result in higher bills for some and lower bills for others, everyone took a win-lose perspective, especially as the economy changed and tension rose. But even though there was never going to be an opportunity to make change easily, it had to happen (City of Niagara Falls, 2009, p. 1). Another jurisdiction must have anticipated similar challenges, since documentation advised no rate adjustments due to the fact that "full-recovery method ensures that any change to the rate structure will involve winners and losers" (KPMG, 2009, p. 23). However, a properly constructed rate structure can always be reduced to one especially compelling argument: "we've illustrated the investment required to maintain safe and reliable water, and we've illustrated the rates to support the investment" (Windsor Utilities Commission, 2010, p. 37).

Factors considered when implementing a new metering program

A number of municipalities have recently implemented or are currently implementing a new residential metering program. Most of these communities are located in British Columbia, but others are in Manitoba, Ontario, New Brunswick, Nova Scotia and Prince Edward Island (Table 14).

Table 14. Municipalities that have recently implemented or that are implementing a new metering program

Municipality	Non-Universal	Universal
	Comox, B.C.	Armstrong, B.C.
	Delta, BC.	Fort St. John, B.C
	Mission, B.C.	Kamloops, B.C.
	Osoyoos, B.C.	Kelowna, B.C.
	Prince George, B.C.	Gibsons, B.C.
	Richmond, B.C.	Ladysmith, B.C.
	Surrey, B.C.	Lumby, B.C.
	Vancouver, B.C.	Oliver, B.C.
	Charlottetown, P.E.I.	Peachland, B.C.
		Rossland, B.C.
		West Vancouver, B.C.

Non-Universal	Universal
	Lillooet, B.C.
	Castlegar, B.C.
	Thompson, Man.
	Kincardine, Ont.
	North Bay, Ont.
	North Perth, Ont.
	Trent Hills, Ont.
	Wasaga Beach, Ont.
	Welland, Ont.
	Woodstock, Ont.
	Cape Breton, N.S.

Note: This table lists municipalities that implemented a new water program within approximately the last 10-15 years or that have recently begun implementing a residential metering program. It was not always possible to determine when a water metering program began; therefore this table may not include all relevant cases.

Cost-benefit

For communities that are not currently metered, the cost associated with purchase and installation of water meters can be quite substantial. Municipalities may therefore conduct a cost-benefit study in order to decide whether or not to begin residential water metering. A limited number of such studies were found as part of the jurisdictional scan.

Results were mixed—although water conservation was invariably an expected outcome, the cost of implementing universal water metering frequently outweighed the identified savings, except where implementation allowed long-term deferral or avoidance of capital costs and sufficient grant assistance was received.

For example, Pemberton's conducted a cost-benefit study of universal metering in 2007. The amortized annual cost of universal metering (including capital costs, education and awareness campaign and meter reading) for 846 residential, 98 commercial and 5 institutional customers over a 10-year period ranged from $40,312 to $132,687 depending on the type of meters and installation method chosen (Earth Tech (Canada) Inc., 2007a, p. 9). Billing costs would also rise if bills were issued more frequently. Universal metering was expected to result in a 10-20% reduction in residential water use over the long-term. However, since a significant portion of expenses were fixed and not dependent on fluctuations in water use, the study estimated maximum savings of up to $24,904, based on water production costs of $0.158/m3, not including savings related to deferral of capital infrastructure. The study estimated metering would prolong existing infrastructure by two to five years (Earth Tech (Canada) Inc., 2007a, p. 14).

Prince George's Water Conservation Plan reported that their cost-benefit analysis indicated that universal residential water metering would be cost beneficial only if sufficient grant assistance were received to offset capital costs (City of Prince George Utilities Division, 2005).

Lillooet estimated universal metering would result in a sustained 20% reduction in water use, although initial reductions would likely be higher (TRUE Consulting, 2009, p. 23). Annual operational cost savings were estimated at $18,400 based on savings of $0.070/$m^3$, increasing to $34,160 at $0.13/$m^3$, due to avoidance of some costs associated with compliance with Interior

Health 43210 drinking water quality requirements. Taking into account reduced capital costs associated with meeting IHA objectives that could be realized by reducing maximum day water demand, savings associated with water metering would exceed costs, if sufficient grant funding were received (TRUE Consulting, pp. 23-24).

Kamloops indicated in 2007 that "the cost of installing meters is more than offset by the capital savings in the ten-year operating plan" (City of Kamloops Public Works and Utilities Department, 2007, p. 13). The city indicated that the cost of installing standard meters was between $6 million to $8 million, with an additional $2 million in capital costs if the city instead chose to use radio-frequency meters, compared to expected capital savings of approximately $30 million based on deferral of major water system upgrades (City of Kamloops Public Works and Utilities Department, 2007). The city also noted that the estimated 20% reduction in water use from universal metering would result in $340 thousand in hydro-electric savings (City of Kamloops Public Works and Utilities Department, 2007, p.13).

Universal and non-universal programs

Municipalities that are considering implementation of a new universal water metering program frequently estimate it will result in a 20% decrease in water use (City of Kamloops Public Works and Utilities Department, 2007, p. 13; Town of Comox, 2009; TRUE Consulting, 2009, p. 23). This assumption appears to be a reasonable based on results from municipalities that have implemented metering. Reductions in water flows in the range of 21% to 34% were identified in Lumby, Peachland and Port Alberni (City of Port Alberni, n.d.; District of Peachland Water Department, 2011; Village of Lumby, 2011b). Average monthly household water use decreased 30% in Kelowna in the years following water metering implementation (City of Kelowna, 2009) and per capita water use in Vernon decreased 19% after metering was implemented (as cited in TRUE Consulting, 2009, p. 21).

While several municipalities have made the shift from unmetered flat rates to universal metering, others have noted that they are moving towards residential water metering in an incremental way. One reason some municipalities choose non-universal residential metering program is that they allow implementation costs to be spread over a longer period of time. Typically, municipalities implementing water metering begin with the ICI sector before progressing to the residential sector (Zapp, n.d.). Residential metering may be phased in by requiring meters only in new construction, or at specific times, such as time of sale, ownership change, or major renovation. Use of voluntary programs is also common.

All new residential construction in Surrey has been metered since 1998 and at least 27,000 households have volunteered for metering under the city's volunteer metering program since it was implemented (City of Surrey, 2010). Richmond also requires meters in new construction and began a voluntary metering program in 2004 (City of Richmond, 2006)—by 2011, 61% of single family homes in the city were metered (Mui, 2011). The City of Charlottetown started implementing water metering and billing two years ago. Changing to metering is still voluntary for existing customers, with approximately 150 households having already switched. However, metered billing is mandatory for new construction (Doyle, 2012).

To encourage participation, voluntary metering programs need a rate structure that will allow households to save money. The Federation of Canadian Municipalities Infraguide suggests that unmetered customers should be paying 15% more than the average metered customer since they use more water (FCM, p. 31). Several municipalities, including Surrey, Richmond and Delta also

provide a one-year guarantee that volumetric bills will be lower than the fixed rate (Corix Inc., n.d.; Corporation of Delta, n.d.; Neptune Technology Group, n.d.). These programs typically attract low-volume water users (Doyle, 2012). As revenue declines from metered customers, flat water rates will need to be adjusted upwards. This adjustment may in turn encourage more households to move to voluntary metering (Town of Comox, 2009). Once the number of metered customers rises to a sufficient level, the municipality could then move forward with universal metering for its remaining unmetered customers.

Types of meters to install, meter reading systems, in-house or contracted operations

Municipalities have several options on the type of meter and meter reading system to use, as well as how to supply, install and collect meter data, bill customers and maintain systems.

There are several new automatic electronic meter reading options. In its most basic form, electronic meter reading involves physical access to the meter, a visual read and manual data entry into a handheld device. Remote reading involves accessing an external touch pad that transmits meter data to the handheld device. Mobile and fixed network meter reading do not require staff to physically access the meter. Instead, meter data is radio-transmitted to a mobile data collector with walk-by or drive-by capability or through a fixed network system. Other automatic read options exist but do not appear to be used frequently in Canada.

Meters that are hardwired to an external touch-pad read with a handheld-device will cost less to purchase compared smart meter systems; however, collection costs are reduced with smart meters (City of Kamloops Public Works and Utilities Department, 2007, p. 13). Kamloops and Thompson have estimated that radio-frequency meter systems increase capital costs by approximately one-third, but provide ongoing savings in meter reading costs (CH2MHILL, 2008; City of Kamloops Public Works and Utilities Department, 2007, p.12). Fixed network systems allow for the most frequent reading, can provide real-time information on water use throughout the day (Environment Canada, 2011, p. 6), and can help pinpoint water leaks or monitor compliance with water restrictions.

Abbotsford, Fort St. John, Miramichi and London have recently installed residential fixed network smart meter systems and North Bay plans to use a fixed network system (City of Abbotsford, n.d.a; City of London, 2011c; City of North Bay, n.d.; Coxon & Shopland, 2011; Neptune Technology Group, 2009). The following considerations influenced Miramichi's decision to move from remote read to fixed base technology: increased maintenance costs from older meters, expenses associated with seasonal meter reading, and more effective leak detection (Neptune Technology Group, 2009).

Other municipalities are installing touch pad or radio-transmission meters. For example, Gibsons recently installed touch pad meters for its new water meter program (Town of Gibsons, 2010), while Rossland switched from touch pad to radio-transmission meters as part of its transition to universal metering in 2011 (City of Rossland, 2010). Kamloops, Regina, Thompson have also chosen to install radio-frequency meters with mobile collection (City of Regina, 2012; City of Thompson, n.d.; Youds, 2011).

Meters can be installed in a pit at the property line or in the home at the water shut-off. Pit installation costs more—in 2007 Earthtech estimated the cost of pit installation at $800 for touch pad meters and $1,000 for radio transmitter meters compared to $275 for internal installation of

touch pad meters and $400 for radio transmitter meters. (Earth Tech (Canada) Inc., 2007a, p.6). While internal installation protects meters from cold weather, municipalities may experience problems with access for installation and meter reading. Installation at the property line, while more expensive, encourages customers to fix water supply leaks (Earth Tech (Canada) Inc., 2007a, p. 6; Neptune Technology Group, n.d.), can improve meter access for readers and may help reduce tampering. Delta, Richmond, Comox and Gibsons install meters at the property line (Corporation of Delta, n.d.; Neptune Technology Group, n.d.; Town of Comox, 2011; Town of Gibsons, 2010), while many others install meters in the home where it is feasible and at the property line in other situations.

Meter supply and installation can be done in-house or can be contracted out. Welland, Ontario examined the cost of these two options in 2006 and found that contracted installation was more cost-effective (City of Welland Engineering, Public Works and Transportation Services, 2005). Several municipalities including Welland, Gibsons, Kamloops, Lumby, Oliver, Richmond, Lumby, Thompson, and others have contracted with Neptune to supply and install meters, while Corix has been contracted to install meters in Surrey, Armstrong and Castlegar. Delta and Kelowna install meters using city staff.

Meter reading, maintenance and billing can also be conducted by city staff or contractors. For example, Miramichi contracted with Neptune in 1999 to perform meter reading, operation and maintenance and billing (Neptune Technology Group, 2009). Corix performs meter reading and maintenance for Surrey (Waterbucket, 2007).

Given that consumption can change from one month to the next, meters should be read at least once per billing period. Estimated bills based on a previous meter reading might be too high, which would be unfair to customers. More accurate billing also keeps customers better informed about their usage (BMA Management Consulting Inc., 2008c, p. 29).

Communication and billing

Communication is an important part of successful water conservation programs and is particularly necessary to inform residents about the importance and need for various conservation measures. Implementing water metering and volumetric billing may be controversial, particularly if it will result in increased bills for customers. As noted in the District of Lillooet's Water Conservation Plan, "providing information and educating the public may be the key to getting public support for a utility's water conservation efforts" (TRUE Consulting, 2009, p. 26). These efforts should include public announcements, website updates, community meetings and bill stuffers or letters.

Education and outreach has two main objectives: ensuring residents are informed about the new program (anticipated costs and benefits, timelines, scheduling meter installation visits etc.) and providing information on ways they can reduce their water consumption (fix leaks, low-flow toilets, waterwise gardening etc.).

One of the most commonly communicated messages included on municipal websites and in brochures was that metering and user rates were fairer since customers would be billed based on their own water usage (Corix Inc., n.d.; Corporation of Delta, n.d.). Websites usually also communicated that metering would allow households be more aware of their water usage and help them save money. Potential cost savings were particularly emphasized for voluntary meter programs (City of Surrey, n.d.; Corix Utilities Ltd., n.d.; Neptune Technology Group, n.d.). Other

key messages included the fact that metering would allow for better management and detection of leaks (Town of Gibsons, 2010), and deferral of costs for infrastructure (City of Kamloops, n.d.b).

The experience of other jurisdictions provides some suggestions concerning administration of billing. New rates should be implemented at the start of the budget year, since later implementation may cause discrepancies between revenue and planned expenses (Regional Municipality of Durham, 2010, p. 6). New water rates and bills need to be clear and understandable for consumers. Many communities, including Fort St. John, Kamloops, Armstrong and others planned between two quarters to a full year of shadow billing to give customers time to learn about their water usage and make water conservation improvements before volumetric billing was instituted.

Dealing with refusals and non response

Municipalities that are implementing universal metering may encounter difficulties when installing meters in existing dwellings. This resistance is likely due to concerns about increased water bills, but may, in light of recent anti-metering campaigns, also be due to health concerns over radio-frequency meters. It may also be harder to arrange installation where the property is rented.

Municipalities have taken different approaches to deal with this problem. Port Alberni noted that resistance to meter installation resulted in a higher percentage of meters installed in pits at the property line (City of Port Alberni, n.d.). The contractor was unable to complete meter installation within the scope of the contract, city staff had to install the remaining meters, and as a result final costs were double the original estimate (City of Port Alberni, n.d.).

The City of Kamloops and Town of Oliver pass along these additional charges to customers: for customers who do not want a meter installed in their home, Kamloops offers pit installation, but charges a $1000 fee (City of Kamloops, n.d.a), while Oliver has set its rate at $750 (Town of Oliver, 2009a). Kamloops also allows customers worried about radio frequencies to opt for a non-radio frequency meter, with an additional charge of $25 per quarter for meter reading (City of Kamloops, n.d.a).

Other municipalities instead increase the fixed water charge for customers that do not have a meter. The Regional District of North Okanagan – Greater Vernon Water increases the quarterly flat rate water consumption charge for customers that have not installed a meter. While unmetered residential customers are charged a $66 base fee and $131 consumption charge if metering is not possible, the District will increase consumption charges to $201 for the first quarter after a written warning is given and $425 for the second and subsequent quarters, if it has determined that metering is possible (Regional District of North Okanagan, 2011a). Kelowna charges a monthly flat rate of $400 for residences that are required to have a water meter, but that have refused meter installation (City of Kelowna, 2011). Lumby's water bylaw indicates that the fixed rate for customers who do not install a meter will rise by $50 per month in each subsequent quarter that a meter is not installed (Village of Lumby, 2011a).

Welland's initial approach to deal with refusals and non-response was to provide written notice that water would be shut-off should meter installation not be arranged and that charges would be incurred to have the water turned back on (City of Welland Engineering, Public Works and Transportation Services, 2006). However, because of the staff time required to implement this method, the large number of deficient water shutoff valves found that required replacement,

concerns the regional health department would object, (City of Welland Engineering, Public Works and Transportation Services, 2008b), complaints from residents and poor response to this approach (only 50% of remaining unmetered customers arranged for meters) (City of Welland Engineering, Public Works and Transportation Services, 2008a), the city changed tactics. It instead provided notice that water rates would be tripled for unmetered customers. As a result, 98% of remaining unmetered customers arranged for meters to be installed within that billing period (City of Welland Engineering, Public Works and Transportation Services, 2009).

DISCUSSION

According to the 2010 Abbotsford / Mission Water Master Plan, average day water demand was forecasted to exceed capacity between now and 2031, while maximum day demand is expected to exceed capacity by as early as 2011 (AECOM Canada Ltd., 2010, pp. i-ii). Although the municipalities may develop a new source of water at Stave Lake, water use is projected to exceed supplies before these sources come online. As a result, the AECOM report recommends a 27% decrease in the amount of water consumed by 2015, to be met through demand management tools (AECOM Canada Ltd., p. v). This report provides information on residential metering and consumption-based pricing options that should enable the District to reduce water use, while maintaining revenues at a sufficient level to recover costs.

Metering and consumption-based rates are considered to be some of the most effective tools to reduce the quantity of water demanded, with many estimates of the reduction ranging from 20% to 30% (TRUE Consulting, 2009, p. 23) and sometimes higher (Kitchen, 2002, p. 138). By itself, metering has sometimes been shown to induce a reduction in water use, but this is thought to be a temporary “psychological effect” (Harris et al., 2002, pp. 69-70). Impacts on consumption are likely due more to the type of pricing structure used once meters are installed (Harris et al., 2002, pp. 69-70; Kitchen, 2002, p. 138) and may initially decline steeply, then rise slightly once consumers become used to the new system (Kitchen, 1997, p. 151).

While price changes will influence the quantity of water demanded, Mission should consider that other factors can influence demand. For example, information provided by metering and billing might cause consumer preferences and activities in support of water conservation to rise over the long term, reducing demand; new regulations requiring or subsidizing low-flow toilets or increased watering restrictions would cause demand to fall; population growth would increase demand. This latter point in particular should be considered. Even if the District implements meters and develops water rates that achieve its current water reduction goal, sufficient population growth could lead to an increase in water use. For example, although Kelowna achieved a 30% drop in average monthly household water use from 1995 to 2009, overall water use increased 2% (City of Kelowna, 2009). If demand increases and threatens to exceed capacity, higher prices (reflecting long term marginal costs, including capacity expansion) might be needed to again reduce quantity, in order to efficiently postpone capital expansion.

Although Abbotsford has implemented universal metering, Mission currently only requires metering for ICI customers and for new residential construction. Consequently, while per capita residential water use is 293L/day in Abbotsford, Mission’s residential water use is estimated at 440L/day, based on the provincial average, for planning purposes (AECOM Canada Ltd., 2010, p. 4-7). As well, should Abbotsford’s water conservation strategies reduce its proportional share of water use, Mission would face higher water costs since the allocation in water expenses is based on water use (City of Abbotsford and District of Mission, 2005, p. 9).

The above literature review and jurisdictional scan provide much information that can inform Mission's decisions on metering and rate design. The economic literature indicates that user fees are the correct mechanism for pricing water—properly designed user fees support efficiency since consumers' willingness to pay results in the optimal distribution of goods and services (Kitchen, 2000, p. 12). As well, user fees are fair based on the principle of benefits received "since those who benefit from the service pay for it" (Kitchen, 2002, p. 123).

Use of marginal cost pricing is considered to be the first best method to achieving efficient pricing; however, because of various complicating factors, some compromises to this ideal are required in practice (Bird, 1976, p. 39; Duff, 2004, p. 417). The District should note that while consumption-based rates are more efficient than flat rates, the question of whether uniform, increasing block or seasonal rates are more efficient will depend on specific circumstances and actual costs (Kitchen, 1997, p. 152). Decreasing block rates are frequently criticized on both efficiency and equity principles (Bird, 1976, p. 120-1), and are considered to be particularly unsuitable in cases where peak load is a problem (Bird & Tsiopoulos, 1997, p. 58).

There is also strong support for the principle of full cost recovery, regardless of whether or not a municipality meters. Developing rate structures that ensure cost recovery is viewed as a best practice by the FCM (2006, p. 37), Canadian Council of Environmental Ministers (1994), OWWA (2005, p. 7) and full cost recovery is strongly encouraged by the Government of Alberta (2008) and Ontario (2011). Full cost recovery is needed to prevent deterioration and ensure sufficient investment in the water system, maintaining long-term sustainability.

Cost recovery can be applied under pricing structures that use flat or consumption-based rates. However, flat rates do not promote efficient allocation of water to optimal used and may result in investment in capacity that would otherwise not be needed (Duff, 2004, pp. 438-9; Kitchen, 1984, p. 271). The literature indicates that consumption-based rates are preferred since they support a fair distribution of costs to consumers based on the user-pay principle and can be designed to provide price signals that will encourage conservation, which is particularly important for Mission and Abbotsford, given the need to reduce average and maximum day water use.

Organizations and jurisdictions that recommend or use consumption-based rates often emphasize the sense of fairness in charging customers based on their actual water usage (Corix Inc., n.d.; Corporation of Delta, n.d.). This reflects the literature findings about the benefits-received view of equity, specifically that people should pay for what they receive; no more, no less (Duff, 2004, p. 402). Single-person households, seniors, and other low-volume water users often see their water bills go down when consumption-based billing is implemented (Ontario Water Works Association, 2005, p. 5).The jurisdictional scan indicated that this factor is frequently highlighted in communications to customers when municipalities move from flat to consumption-based billing.

Consumption-based billing is not possible without an effective way to measure water use. As such, residential metering is a prerequisite to efficient pricing (Kitchen, 2000, p. 14) and is considered to be a best practice (Ontario Water Works Association, 2005, p. 5). The majority of residents in Canada receive metered water service; however, metering is most common in the Prairies and Ontario. Only a third of B.C. residents were metered in 2006 (Environment Canada, 2009, p. 5), although residential metering has become more common in recent years—the jurisdictional scan identified 21 municipalities in the province that recently implemented or that are in the process of implementing residential metering.

In its most basic form, consumption-based billing consists of a simple volumetric charge. However such rates ignore water utilities' large fixed costs, which can lead to difficulties recovering sufficient revenue to cover costs. For example, in regions with many vacation properties or snowbirds, water revenues may be negatively impacted as these customers' water charges may be insufficient to cover their share of fixed water costs. This rate structure can also lead to revenue instability, since water demand will fluctuate based on factors such as weather (Hoffmann et al., 2006, p. 347). Likely as a result of these issues, in particular the need to cover fixed costs, the jurisdictional scan identified relatively few municipalities that base their water rates solely on volumetric charges. Across the country, only 26 municipalities that used volumetric rates only were identified (9% of the municipalities included in the jurisdictional scan), while 11 others used volumetric-only rates, but required a minimum usage, effectively charging a two-part rate with a fixed fee with water use allocation. Because of problems of increased rate instability and difficulty estimating revenue, Mission may wish to avoid a volumetric-only rate structure, although it is noted that Abbotsford bills residents using a volumetric-only rate structure.

A key difficulty with the use of marginal cost pricing is that water utilities are natural monopolies with large sunk capital costs, creating large economies of scale. The result is that the long run marginal cost is actually less than average cost (Altmann, 2007, p. xv; Harris et al., 2002, pp. 28-29; Marsden Jacob Associates, 2004, p. 3; Monteiro, 2005, p. 5; OECD, 2010, p. 27). This means that given use of marginal cost pricing, revenues collected from water fees will be lower than the amount required for full cost recovery (Bird & Tsiopoulos, 1997, p. 588; Dewees, 2002, p. 55; Kim, 1995, p. 327; Kitchen, 1997, p. 145) with the difference paid through general taxation (R. H. Coase, 1970, p. 117).

Various compromise pricing options have therefore been suggested in place of pure marginal cost pricing (Bird, 1976, p. 39; Duff, 2004, p. 417). Use of two-part rates that incorporate fixed and volumetric charges (with the volumetric charge set close to marginal cost) is the recommended way of dealing with this issue of insufficient revenues to cover costs (Bird & Tsiopoulos, 1997, p. 57; R. H. Coase, 1946, p. 143; Dewees, 2002, p. 588; Harris et al., 2002, p. 154) as they allow for the recovery of fixed costs. Several authorities, including the CWWA (as cited in Brandes et al., 2010), OWWA (2005, p. 8) and the OECD (2010, p. 86) also indicate that use of two part rates is a best practice. Accordingly, the jurisdictional scan found that the majority (86%) of municipalities in Canada that use consumption-based rates have adopted some type of two-part rate variation.

The jurisdictional scan highlighted different arguments regarding how to set the level of the fixed charge (Urban Systems, 2009, p. 5). Some municipalities have taken the approach that the fixed component should be based on fixed costs while volumetric components should be based on costs that fluctuate with water use (BMA Management Consulting Inc., 2009b, p. 6). The Alliance for Water Efficiency argues volumetric charges should make up two-thirds of water rates to take maximum advantage of the price signal provided (as cited in Regional District of North Okanagan, 2011b, p. 8). However, the lower the fixed cost, the more difficult it may be to accurately estimate revenue. The Federation of Canadian Municipalities Infraguide states that high fixed rate components discourage conservation and penalize efficient water users (2006, pp. 33-34). If the municipality is concerned with water use efficiency, it recommends a maximum fixed charge of 15% (p. 35) and recommends using a rate stabilization fund to manage revenue fluctuation rather than setting the fixed rate too high (p. 34).

Results of the jurisdictional scan showed a range of practices—in some instances, the fixed charge was a nominal meter rental, meter amortization charge, or other small fee, in others the fixed

charge made up the bulk of the water rate. Some municipalities that set low or no fixed charge instead require a minimum level of consumption per billing period—overall this approach should result in a similar outcome as setting a higher fixed cost with no volumetric minimum. More than three-quarters of reviewed municipalities across the country charge less than half the total water bill as a fixed fee or minimum charge (Table 15). In B.C. this practice was more evenly distributed.

Table 15. Water rates: Fixed charge as a proportion of total water charge

	Municipalities using two-part rates or volumetric rates with minimum charge			
	All provinces		British Columbia	
	Number	%	Number	%
Fixed charge < 25% of total water charge	87	34	10	26
Fixed charge 25-50% of total water charge	116	45	9	24
Fixed charge 50-75% of total water charge	40	16	10	26
Fixed charge >75% of total water charge	14	5	9	24
Total	257	100	38	100

Note: Calculation of the total water charge was based on an estimate of average water consumption per household, using Environment Canada's 2006 average per capita consumption (327L/person/day) (Environment Canada, 2010, p. 4) and the average 2006 household size (2.5 persons) from Statistics Canada's Census of Population (Statistics Canada, 2006). The resulting estimates assume monthly water usage equivalent to 25 m^3 per household. This table excludes some municipalities for which not all rate components were identified.

Although the District of Mission currently charges unmetered residential customers a flat annual charge of $447.48, the 150 metered residential customers pay a two-part rate consisting of a quarterly meter rental fee of $3.19 and a uniform volumetric charge. There is also a quarterly minimum volumetric charge of $106.19. This is equivalent to monthly consumption of 47 m^3 per household, a level that is unlikely to provide a major incentive to reduce water use and which is comparable to the flat charge for unmetered customers (District of Mission, 2011b). As noted by Kitchen, for households that consume less than the minimum charge, the "marginal price is effectively zero, exactly the same as …with flat rate charges" (1984, p. 271). Should the District implement universal metering, it should consider options to eliminate this minimum charge in order to encourage greater water conservation, without overly affecting revenue stability.

The fixed component of a two-part rate sometimes includes a water allowance, with the cost of providing this water embedded in the fixed rate. Extra water usage beyond this basic allowance can be billed as an 'excess charge.' The main benefit of this approach is that it may be an easier sell to customers concerned that their water bills will go up, since only supposed excessive water usage is targeted by the volumetric rate. For example, this is the approach currently taken by the Town of Comox for customers billed according to metered rates (Town of Comox, 2009). However, again, the price signal that results from use of volumetric is lost for those who consume less than this minimum (Martinez Espineira, 2002, p. 173).

The literature also describes lifeline rates, which include subsidized water at a level sufficient to meet basic needs as part of the fixed component. The argument for lifeline rates is that they provide water for low-income households. However, unless specific eligibility criteria are included, these types of rates may not accurately target low-income households, but instead subsidize all

low-water use households (Body of Knowledge on Infrastructure Regulation, 2009; Fortin et al., 2001, p. 63).

More importantly, the economic literature indicates that economic redistribution should not be a priority for municipalities (Kitchen, 1997, p. 139). Rather, they should provide services such as water based on the benefits-received notion of equity, with user fees in place so that consumers pay only for what they use (Duff, 2004, p. 402). Affordability concerns for low-income households should be dealt with outside the rate structure so as not to compromise the price signal provided by the user fee (Kitchen, 1984, pp. 268-9). By contrast, deviating from efficient rates leads to price distortion and hidden subsidization (Dewees, 2002, p. 587).

If Mission is concerned about water affordability for low-income customers, it could consider a means-assessed subsidy or rebate. However, the jurisdictional scan identified very few municipalities that provided targeted rate reductions—Nanaimo offers a 50% rate reduction for low-income households (City of Nanaimo Finance Department, 2011), while Hamilton maintains its Utility Arrears program to help low-income and disabled families and individuals with utility payments (particularly hydro and gas) (City of Hamilton, 2007), Newmarket maintains a rate rebate program similar to Hamilton's (Town of Newmarket, 2012) and other municipalities provide discounts for seniors.

Volumetric rate component options include uniform, increasing block and decreasing block rates, as well as other less frequently used rate structures including the humpback rate (combines increasing block for residential sector and decreasing block for ICI sector). According to the literature, uniform rates are the easiest to communicate to customers and tend to cost less to administer (Nallathiga, n.d., p. 7). They also treat all water users equally since everyone is charged an even amount per unit (Brandes et al., 2010, p. 19; Edwards, 2006, p. 60). Perhaps for this reason, these rates are the most commonly used type of volumetric component—59% of municipalities reviewed as part of the jurisdictional scan used a uniform volumetric charge as part of their two-part rate. Seven municipalities in Ontario (2% of those reviewed) used a two-part rate structure that had a mixed-block (humpback) volumetric charge, the least frequently used user-pay rate structure.

Increasing block structures can increase efficiency in cases where the cost of water provision increases with higher levels of water use (OECD, 2010, p. 87). These rates may be appropriate where conservation is a pressing concern and where average costs of water provision are rising (Altmann, 2007, p. 51) as they provide the strongest signal to reduce water use. Kitchen also indicates that these rate structures are often appropriate where "water conservation is considered appropriate (1997, p. 152). Across Canada, 15% of municipalities reviewed as part of the jurisdictional scan used two-part rates with an increasing block volumetric charge.

Kamloops argues that these conservation rates are fairer since they charge the highest unit prices to those who place the greatest strain on the water system (City of Kamloops Public Works and Utilities Department, 2007, p. 6). However, there are potential affordability concerns associated with these rates, particularly with regards to household size. Increasing block rates might provide no incentive for small families to conserve water if their usage is already within the first block—one municipality found that 75% of households did not reach the first threshold (Hemson Consulting Ltd., 2006, p. 20)—while larger families are penalized simply because more people live in the same dwelling. One way to reduce this inequity is to adjust the block limits for large families. However, this approach does not appear to be widely used—Parksville was the only municipality identified that adjusted rate blocks for large families (City of Parksville, 2012b).

The jurisdictional scan indicated that multi-residential buildings are normally equipped with a single bulk meter. For example the City of Surrey notes that strata units are not equipped with individual meters because there is often common water usage, installation is costly and water usage is more uniform (City of Surrey, n.d.). Applying an increasing block rate without modification to a duplex or multi-residential dwelling served by a single meter would also be inequitable since it is shared by several dwellings. If Mission decides to implement an increasing block rate, it should consider modifying the charges for duplex and other multi-residential dwellings. For example, Nanaimo calculates the water rate by dividing total consumption by the number of units and charges each unit at the tier equivalent to this average consumption (City of Nanaimo, 2011, p. 12). Peachland only applies the first tier volumetric rate to units in multi-residential dwellings (District of Peachland, 2012). London, Ontario meanwhile charges multi-residential dwellings according to the ICI (decreasing block) rate (City of London, 2011b, p. 4).

The jurisdictional scan identified 28 municipalities (9% of those reviewed) that used decreasing block rate structures; however, in most cases, the intermediate block was set at a level above normal household use, as these rates are generally targeted towards the ICI sector. However in 11 municipalities, high-volume residential water users would be able to take advantage of the lower rate block. Since high-volume water users are typically wealthier (larger lots, larger homes, pools etc.), these rates can be regressive (Bird, 1976, p. 120; Bird & Slack, 1983, p. 90; Harris et al., 2002, p. 132; Kitchen, 1984, p. 270). As well, these rates promote water use and hasten the need for capital expansion (Bird, 1976, pp. 120-1). While decreasing block rates for domestic users were more common in the past (Environment Canada, 2001, p. 46) when water supplies were more abundant (Altman, p. 51), with greater need for water conservation measures, they have become less common (Brandes et al., 2010, p. 18) since they provide no incentive to reduce water use.

As municipalities adopt volumetric rates, particularly increasing block rates, for the residential sector, the use of decreasing block rates for the ICI sector may become less politically-acceptable. For example, according to a media report, Abbotsford is now contemplating options to eliminate its ICI decreasing block structure (Mills, 2012).

The literature indicates that seasonal rates can better reflect the cost of water and provide a financial incentive to reduce water use during peak periods (Harris et al., 2002, p. 63; Monteiro, 2005, p. 13; Renzetti, 2009, p. 1). “Capacity constraints in the system and supply limitations are most likely in the summer, implying that prices should be higher in summer than during the rest of the year” (Dewees, 2002, p. 595). Failure to use a higher seasonal rate will result in capacity increases that are otherwise larger than needed (Bird, 1976, p. 121; Dewees, 2002, p. 596; Kitchen, 2002, p. 134). These rate structures can be a useful tool to reduce water use in regions where peak usage and seasonal water shortages are problems, but they require more frequent meter reading and billing for successful implementation.

Mission may wish to consider implementing a seasonal rate or surcharge, given that summer water use poses the most pressing problem. If so, the District should carefully consider the type of rate structure it will use: Abbotsford’s adoption of a three-tier summer rate structure attracted criticism from residents concerned that it penalized large families and those with secondary suites (Baker, 2012). Considering the 2006 Canadian average per capita water consumption of 327L/day, water usage for most households should be within the first tier;[2] however, a family of four would

[2] According to the 2006 Census of Population, the average household size in Canada is 2.5 persons (http://www40.statcan.ca/l01/cst01/famil53a-eng.htm).

use close to 40m^3 per month. Abbotsford subsequently considered options for a large family tier adjustment (Baker, 2012) and recently cancelled the seasonal rate altogether (Mills, 2012). The District of Tofino's increasing block structure with separate summer and winter rates was also controversial; however, "Tofino's leaders agreed that the changes were required in order to cover the cost of needed capital improvements (i.e., their infrastructure deficit) and to encourage necessary water conservation"(Brandes et al., 2010, p. 35).

Some other municipalities that use seasonal rates take slightly different approaches: Middlesex Centre, Ontario applies a seasonal water use surcharge equivalent to 15% of the volumetric rate for water use in excess of 120m^3 from April to September (Municipality of Middlesex Centre, 2011); Vancouver's 25% increased summer volumetric charge is applied uniformly to all metered water consumption (City of Vancouver, 2012b); and Windsor's volumetric charge increases by 85% in summer (Windsor Utilities Commission, 2011). Vancouver indicates that its seasonal rate targets all properties equally regardless of household size, unlike an increasing block structure which penalizes increased density (2011, p. 11).

Decreases in water use associated with new water conservation programs can result in revenue reductions if the expected declines were not taken into account during rate design. For example in its 2009 rate study, Cambridge, Ontario indicated that rate increases were necessary since billable consumption had declined by 15% due to conservation improvements while the majority of its costs were fixed (BMA Management Consulting Inc, 2009a, p. 39). Results from the jurisdictional scan show that universal water metering can result in reductions in water use of up to 20% or more. Rate increases are also linked to decreases in water use. However, the economic literature indicates price increases should increase revenues overall since water is relatively price inelastic (Harris et al., 2002, p. 89).

Implementing water metering can unlock a great deal of potential for Mission in terms of understanding local water consumption trends. Parksville has used meter results to better understand seasonal use, neighbourhood use, the effect of landscape type, high-use groups and outliers within groups (City of Parksville, 2009), while Comox has found that the top 10% of households disproportionately use 25% of all single family metered water (Town of Comox, n.d.). Fort St. John indicates its fixed network metering system aids in leak detection and provides "immediate warnings for high use, zero flow, or back flow (Coxon & Shopland, 2011, p. 23). Metering would allow similar discoveries in Mission, and will help inform water use projections and planning.

Communication is an important component of water metering program implementation. Should Mission move forward with water metering, some key messages to be communicated as part new water meter program implementation include:

- Metering will reduce water use, which is important since water supplies are not sufficient to meet projected water requirements. By reducing water use, it is possible to defer or avoid expansions to the water system.
- Metering is fair since water users are billed based on their consumption. Low-volume water users will no longer subsidize high-volume users.
- With metered water rates, those who use less water can save money compared to the fixed rates.

From a communication perspective, it may be preferable to focus on the change in the average household water bill rather than the change in the price of water if rate adjustments are necessary. If water consumption is decreasing, households may not experience higher water bills even if rates rise. If water bills are expected to rise significantly to cover increased costs and other investments in the water system, e.g. development of new water sources and improvements to existing supplies, the District should clearly communicate that water prices would increase even without implementation of water metering and pricing.

Should Mission decide to move forward with water metering, but not have the means to immediately implement a universal program, it could consider use of a voluntary metering program. A voluntary program may be more socially-acceptable than a universal program that imposes water meters on residents (ND LEA Consultants Ltd., 2005, p. 38).

Some Lower Mainland municipalities, including Surrey and Richmond, have achieved great success in metering a large proportion of the residential sector using only new construction and voluntary metering programs (City of Surrey, 2010; Mui, 2011). Other municipalities started with voluntary metering and have since transitioned to universal metering. However, the key to ensuring sufficient take-up through a voluntary program is to design rates so that those who volunteer are able to save money. Since most volunteers will likely be low-volume water users, this will require increases to the fixed rate.

OPTIONS

Recommendations

Aligning with the objectives of this report, the recommendations presented below will allow the District of Mission to reduce water use, other factors being equal, while maintaining revenues at a level sufficient to recover costs. They will be based on key findings from the literature review and jurisdictional scan, as outlined in the preceding discussion.

One of the most consistent points has been the importance of the two-part rate, which includes volumetric and fixed components. This rate structure can be used to approximate marginal cost pricing, which is critical for economic efficiency, while maintaining financial stability due to the guaranteed revenue collected via the fixed charge. It is a CWWA best practice, and it is by far the most commonly used consumption-based rate in Canada.

The two-part structure can also send a price signal to reduce water use, as long as the volumetric component comprises a significant portion of the consumer's total bill. While elasticity research shows that water is relatively unresponsive to price in the short run, that gradually changes in the long run as households begin to modify their consumption. It should be noted that, other factors being equal, simply implementing metering and consumption-based pricing will support the objective of reducing water use. Based on findings from the literature and other jurisdictions, the minimum initial reduction resulting from a new metering program would likely be in the range of 20%.

Emphasizing the volumetric component, and therefore minimizing the fixed component, also better supports economic efficiency by more closely approximating marginal cost pricing. However, this approach allows for greater revenue instability. That is why there is no single right answer in terms of balancing the two components, although it is best to emphasize the volumetric fee as much as possible.

The benefits-received notion of equity is important, given the inherent sense of fairness in consumers paying for precisely what they use, and it is a cornerstone of the rationale for user fees. However, there should also be consideration of ability-to-pay. Water is a basic human need, so affordability is important. The OECD's rough measure of affordability is to keep fees lower than 3% of average household income. According to census data (Statistics Canada, 2007), Mission's median household income was $56,717 in 2005. Considering that 3% is $1701.51, Mission's rates would have to grow astronomically to cross that threshold.

Elasticity research indicates that low-income households, and particularly elderly couples, are the most sensitive to price, so the impact of pricing on those groups should always be carefully considered. However, rate structures meant to benefit these groups typically do not work as planned. An option meant to support low-income residences, might instead support low-consumption residences, potentially excluding many people who need support and instead providing benefit to mid- or high-income residences. Strictly following the benefits-received principle and charging households the full cost for no more or less than they consume will avoid unwanted price distortions or subsidizations. For this reason, it is strongly recommended that Mission consider supporting low-income households via some mechanism outside of the rate structure, for example a rebate program.

Elasticity research also indicates that discretionary water use is much more responsive to price than necessities, that outdoor use is more responsive than indoor use, and that usage in summer is more responsive than in any other season. This is not surprising since discretionary, outdoor, summer water consumption might typically be for leisure purposes, such as pools and gardens. To reduce water use, seasonal volumetric rate types targeting this consumption should be prioritized. In addition, rates that impact outdoor discretionary use will have fewer affordability implications for low-income households.

The first volumetric type that aligns well with the above criteria is a uniform volumetric rate with a seasonal charge during the summer. This sends the best pricing signal about reducing water use during peak times when the water system is most strained, and helps avoid unnecessary capacity expansion. This charge should be a percentage increase applied to all summer consumption, so that there is no concern about penalizing large families, and no dispute about where to set a volume threshold for the charge to be applied.

Recognizing that there can be significant extra administrative requirements to implementing seasonal pricing, for example the need for more frequent meter reading, billing and communication, the increasing block type is also a good volumetric option. It has the added benefit of encouraging lower consumption throughout the year. In order to lessen controversy about where thresholds are set between blocks, and minimize concerns about penalizing large families, it is recommended to use two blocks instead of the usual three.

The first block should reflect consumption for basic needs, whereas the second should apply to discretionary use. Accordingly, the first charge should have a lower unit price, whereas the second should be significantly more expensive (approximating long term marginal cost) to send a price signal to reduce water use. Once metering is in place, the data collected can be analyzed to more accurately determine whether any blocks should be adjusted.

These two volumetric options have the advantage of relative simplicity, for example compared with complicated alternatives found in some jurisdictions that use several different blocks or

summer excess fees based on some calculation of winter consumption levels. Simpler rate structures support lower administrative costs and easier understanding for residents.

Charges for water and sewer should be combined, such that consumers pay one fee that includes both. This will also help keep rates and bills as simple and straight-forward as possible. If there are customers receiving metered water, but no sewer service, their bills can be proportionately discounted. For example, if 50% of total revenue is for water service, those customers can be charged 50% of what their bill would be for full service.

Upon choosing a rate type, the District should develop and implement a communication plan explaining the benefits of the change for residential users. The plan should clearly convey that residents will be able to control how much they pay based on their own water consumption preferences. In particular, it should highlight the potential for saving money. As demonstrated in the following section, lower-volume users would certainly pay less than the current flat fee.

Rate calculator

In order for Mission staff to examine the above options, a rate calculator worksheet has been developed in Microsoft Excel. The calculator can manipulate various user-input parameters to project the revenue potential of various rate types described in this paper. It can do so for different years or rate types at the same time to allow for comparison and longer-range planning. The file itself has been included as an appendix, but various points about the calculator are included below:

- Operating budgets, fund reserves and debt information have been added to the file as secondary spreadsheets. Key information can be found on main rate calculator, mainly as reference information. Budgeted user fee / levy revenues were used as a minimum revenue target. This information was taken from the 2012 Community Report and Financial Plan online (District of Mission, 2011a).
- Developing accurate projections is quite difficult because there is no accurate household water use data for Mission. Instead, several estimates from the Master Plan were used to establish an approximate figure of 42.21 m^3 for average household consumption per month (AECOM Canada Ltd., 2010). The equation, which indicates the precise figures used, is in the calculator file.
- The total numbers of residential and ICI clients were taken from personal correspondence from a Mission official (M. Younie, Personal communication, June 21, 2011).
- The estimated decline in consumption due to meter implementation is an important parameter. A reduction of approximately 20% has been cited as a reasonable expectation by other jurisdictions.
- User input fields have been included for determining the percentage ratio between the fixed and volumetric rates.
- For the fixed component, the calculator has been designed to compute a base rate using various inputs and meter equivalency ratios. The 19mm base rate can be multiplied by any ratio to determine the fixed charge for the corresponding meter size.
- For the volumetric component, the calculator has been designed to project revenues based on various inputs.
- The calculator has the capability of modeling residential and ICI rates separately. Because this paper does not focus on and makes no recommendations about ICI rate-setting,

details of the declining block structure currently used by Mission have been added as defaults (District of Mission, 2011b).

- The calculator can test up to five blocks in an increasing or decreasing structure. To test a structure with fewer than five blocks, initial block thresholds should be set to zero. For example, to test a two-block rate, the first three thresholds should be set to zero. To test a uniform rate, all four thresholds should be set to zero. The same approach should be used for inputting rate amounts.
- The calculator can also incorporate a percentage seasonal charge. To leave out the seasonal charge, the related input fields should be set to zero.
- Without more data, average residential seasonal use is very difficult to estimate for Mission. The overall average use estimate, factoring in the 20% decline anticipated after meter implementation, is 33.77 m^3. According to the Master Plan, Mission's maximum day demand was almost double its average (AECOM Canada Ltd., 2010, p. 4-5). However, it is unrealistic to project that maximum demand would be the norm through an entire summer season. Therefore, the default value in the calculator is 50 m^3, approximately two-thirds higher than average.

The calculator includes a summary of settings input by the user, together with four adjustable scenarios designed to show the financial impact on different households with different consumption levels. The summary also includes for comparison the actual/projected water and sewer total charge under Mission's current flat rate structure. The calculator was used to model the two options recommended above, and the summary and scenario data have been copied below (Table 16):

Table 16 Residential water rate options for Mission, parameters and impacts

Parameters	Option 1	Option 2
number of billing periods per year	12	12
number of months considered seasonal	4	4
estimated % decline in residential use after metering	20%	20%
% to be collected via fixed charge	35%	35%
% to be collected via volumetric charge	65%	65%
base rate for fixed charge per billing period	$27.26	$27.26
residential block 1 upper threshold (m^3 per billing period)	0	0
residential block 2 upper threshold (m^3 per billing period)	0	0
residential block 3 upper threshold (m^3 per billing period)	0	0
residential block 4 upper threshold (m^3 per billing period)	0	22
residential block 5 all remaining consumption	on balance	on balance
residential block 1 rate	0	0
residential block 2 rate	0	0
residential block 3 rate	0	0
residential block 4 rate	0	$0.90
residential uniform rate or top level block rate	$0.96	$1.60
seasonal charge (percentage rate increase)	40%	0
Scenario #1		
average winter use per billing period (m^3)	33.77	33.77
average seasonal use per billing period (m^3)	50	50
average winter cost per billing period	$59.67	$65.89
average seasonal cost per billing period	$94.46	$91.86
annual cost	$855.22	$894.52
Scenario #2		
average winter use per billing period (m^3)	40	40
average seasonal use per billing period (m^3)	40	40
average winter cost per billing period	$65.66	$75.86
average seasonal cost per billing period	$81.02	$75.86
annual cost	$849.31	$910.27
Scenario #3		
average winter use per billing period (m^3)	30	30
average seasonal use per billing period (m^3)	40	40
average winter cost per billing period	$56.06	$59.86
average seasonal cost per billing period	$81.02	$75.86
annual cost	$772.51	$782.27
Scenario #4		
average winter use per billing period (m^3)	25	25
average seasonal use per billing period (m^3)	30	30
average winter cost per billing period	$51.26	$51.86
average seasonal cost per billing period	$67.58	$59.86
annual cost	$680.35	$654.27
Budgeted Flat Rate		
actual/projected water and sewer total charge	$787.00	$787.00

The first option is the uniform volumetric rate with a seasonal surcharge. The fixed-volumetric ratio was set at 35%-65% in order to send a strong price signal to reduce water use. For the same reason, the seasonal surcharge was set at 40%. Given these parameters, a monthly fixed base rate of $27.26 and a $0.96 volumetric rate would meet the revenue target. Consumer bills would rise in comparison with Mission's actual budgeted flat rate for some households, but those who conserve water would save money.

The second option is the two-block increasing rate, with the threshold between the blocks set at 22 m^3. This figure is just below the 25 m^3 national average household consumption calculated based on Environment Canada's Municipal Water and Wastewater Survey and Statistics Canada's 2006 Census of Population (Environment Canada, 2010, p. 4; Statistics Canada, 2006). The fixed-volumetric ratio was again set at 35%-65% to reduce water use. The volumetric component would also send a strong price signal, especially given that the second $1.60 second block rate would be much higher than the $0.90 first block rate. To meet the revenue target, some bills would again have to rise compared with the actual flat rate, but conserving households would still save money. Meanwhile, even an $800 annual bill passes the affordability test, since it would certainly be less than 3% of average household income.

According to the Master Plan, Mission must decrease its water consumption, not only because there eventually will not be enough, but also because Mission will be responsible for a greater share of regional costs if Abbotsford's usage decreases further. Metered consumption and pricing, in particular the above options, can achieve the objective of reducing water use, while maintaining revenues at a level sufficient to recover costs. Bills would rise somewhat, but they would remain less than most television / Internet bundles.

While the estimates used in the calculator are necessarily approximate, given the lack of consumption data from Mission, once meters are in place, the potential to develop much more refined data and projections will be immense. Staff will be able to gather information about seasonal peaking, neighbourhood trends, outliers and more. This will facilitate a much better understanding of Mission's consumption, along with the development of rate structures that best meet the community's needs.

CONCLUSION

The District of Mission has identified a need to reduce water use without compromising cost recovery and is considering using universal water metering to achieve that goal. This report covers a wide range of topics and issues concerning water metering and pricing and proposes two pricing options for the District should it choose to implement metering.

The literature review revealed that water is quite inelastic with respect to price, which means that quantity demanded typically decreases more slowly than prices increase, although the response gradually improves over the longer term. There are also exceptions, including low-income households, which are typically more sensitive to rate increases, and outdoor water consumption, which tends to be more discretionary, whereas indoor uses are often necessities that have no substitutes.

A key finding from the literature is that user fees are the appropriate mechanism for pricing water services. They support the benefits-received principle by linking how much people pay with how much they consume. This commonly held view of equity is based on the idea that it is only fair for users to pay for their own consumption rather than subsidizing others. User fees set as closely to

marginal cost as possible also support economic efficiency, which is the most important reason to charge directly for services.

The user-pay principle is often cited as one of the main reasons for implementing metered pricing and is also frequently referenced with respect to full cost recovery—an important consideration for municipal service providers. Jurisdictions that set budgets and rates without considering long-term infrastructure needs, deferring required maintenance and investment, can experience deteriorating services and escalating costs, eventually requiring major rate increases and/or borrowing. Metered pricing instead allows jurisdictions to distribute the full costs of water services to consumers based on how much water they use.

Affordability is no less critical, especially given how rates can adversely impact low-income families. Certain rate structures, such as an increasing block structure with a low-price initial block to cover basic needs, can be designed to accommodate affordability concerns. However, the question of where to set the block thresholds remains a challenge. The recommended approach for local governments is to address affordability concerns outside the rate structure, for example by offering rebates. Meanwhile, it is worth considering that water services are typically cheaper than other utilities. One approximate measure of affordability is that rates should be less than 3% of household income.

The jurisdictional scan identified 300 municipalities that currently employ metered pricing. The vast majority use some form of two-part rate, with fixed and volumetric components. The uniform volumetric type is much more common than any of the block options. A few communities use seasonal rates to curtail peaking demand in summer, which is often driven by outdoor use.

Two consumption-based pricing options have been proposed for Mission including:

- a two-part rate with a uniform volumetric component, with a seasonal surcharge on all summer consumption
- a two-part rate with a two-tier increasing block volumetric component, with the first block set to reflect consumption for basic needs.

Two-part rate structures can approximate marginal cost pricing while ensuring sufficient revenues to cover costs; emphasis on the fixed charge promotes revenue stability, while emphasis on the volumetric component sends a price signal to reduce water use. New water rates should be set to recover costs and should anticipate a reduction in water use as a result of implementing metering. The included rate calculator will allow the District to model the effects of different rates on revenue.

There are various implementation issues to consider before moving forward with water metering. Determining how to bill multi-residential premises served by bulk meters often requires adjusting the regular rate structure, particularly where a block rate is in effect. One option is to divide the total quantity consumed equally among the total number of units. Another is to apply a single threshold to multi-residential units.

Municipalities that are implementing metering or replacing existing infrastructure frequently choose radio-frequency meters, which permit easy drive-by readings or data collection through fixed network systems, currently the most advanced technology. These systems are associated with higher capital costs, but can lower meter reading costs and provide more timely and frequent information to support management of the water system.

Communication, through measures such as town hall meetings, website updates and newsletters can help ensure consumers understand how the change will affect them. This is especially important, since widespread support can make implementing metered pricing much more successful. Shadow billing, which allows consumers to see the impact of new rates and make adjustments to their consumption, is a particularly effective communication tool.

APPENDIX A - METHODOLOGY

Table A-1. Methodology for identification of municipalities to include in jurisdictional scan

Province	Source information on municipality listings and populations	Population cut-off applied	# scanned	# identified	# responses
B.C.	• Union of British Columbia Municipalities (UBCM) http://www.ubcm.ca/EN/main/about/ubcm-members/municipalities.html • Statistics Canada, Census of Population, 2006, Population and dwelling counts http://www12.statcan.ca/census-recensement/2006/dp-pd/hlt/97-550/Index.cfm?TPL=P2C&Page=FLTR&LANG=Eng&T=302&S=1&O=A	• No population cut off was applied—all websites for the 160 UBCM member municipalities (cities, districts, towns, villages) were reviewed. • List of municipalities was cross-checked against Statistics Canada population by census subdivision geography, ensuring all identified cities, districts, towns and villages were included. Indian reserves, settlements and Nisga'a villages not included in review.	160	51	13
Alta.	• Government of Alberta, Municipal Affairs http://www.municipalaffairs.alberta.ca/mc_official_populations.cfm	• All websites for cities, towns, municipal districts, specialized municipalities and first nations with a population over 5,000 were reviewed. • The population information from the provincial government website is more recent than the 2006 census, although the two lists were cross-checked.	89	65	18
Sask.	• Saskatchewan Urban Municipalities Association (SUMA) http://suma.org/index.php?p=Cities%202 • Wikipedia list of communities in Saskatchewan http://en.wikipedia.org/wiki/List_of_communities_in_Saskatchewan • Statistics Canada, Census of Population, 2006, Population and dwelling counts http://www12.statcan.ca/census-recensement/2006/dp-pd/hlt/97-550/Index.cfm?TPL=P2C&Page=FLTR&LANG=Eng&T=302&S=1&O=A	• All websites for SUMA member cities,[1] cross-checked against information from Wikipedia and Statistics Canada, ensuring all 15 cities and towns with a population over 5,000 people were reviewed. Review included 1 rural municipality with a population over 5,000. 1. In Saskatchewan, communities must have a population greater than 5,000 to be classified as a 'city'; however, their status does not automatically revert to 'town' if the population drops below 5,000.	16	15	3
Man.	• Wikipedia list of communities	• All websites for the 11 cities	23	19	4

	in Manitoba http://en.wikipedia.org/wiki/List_of_cities_in_Manitoba • Statistics Canada, Census of Population, 2006, Population and dwelling counts http://www12.statcan.ca/census-recensement/2006/dp-pd/hlt/97-550/Index.cfm?TPL=P2C&Page=FLTR&LANG=Eng&T=302&S=1&O=A	and towns with a population over 5,000 people were reviewed. List was cross-checked against Statistics Canada's Census of Population census subdivision geography to ensure all communities over 5,000 were included. Based on this check, the websites of 12 rural municipalities with a population over 5,000 were also reviewed.			
Ont.	• Statistics Canada, Census of Population, 2006, Population and dwelling counts http://www12.statcan.ca/census-recensement/2006/dp-pd/hlt/97-550/Index.cfm?TPL=P2C&Page=FLTR&LANG=Eng&T=302&S=1&O=A	• All websites for cities, towns, municipalities and townships with over 10,000 people were reviewed, based on the 2006 Census of Population.	143	120	63
Que.	• Wikipedia list of cities and towns in Quebec that are designated 'ville' http://en.wikipedia.org/wiki/List_of_cities_in_Quebec • Canada, Census of Population, 2006, Population and dwelling counts http://www12.statcan.ca/census-recensement/2006/dp-pd/hlt/97-550/Index.cfm?TPL=P2C&Page=FLTR&LANG=Eng&T=302&S=1&O=A	• All websites for 'villes' with a population over 10,000 people were reviewed. This list of 89 municipalities was cross-checked against the Census of Population to ensure all relevant communities were included.	89	9	3
N.B., N.S., P.E.I., N.L.	• Statistics Canada, Census of Population, 2006, Population and dwelling counts http://www12.statcan.ca/census-recensement/2006/dp-pd/hlt/97-550/Index.cfm?TPL=P2C&Page=FLTR&LANG=Eng&T=302&S=1&O=A • Wikipedia overview of municipal government in Canada http://en.wikipedia.org/wiki/Municipal_government_in_Canada	• All websites for cities and towns with a population over 5,000 were reviewed. Nova Scotia also has regional municipalities, rural municipalities and counties with a population over 5,000, which were also reviewed. • The Wikipedia site was used as a quick reference for distinguishing different types of jurisdictions (e.g. the difference in regional and rural municipalities.	N.B. (16) N.S. (45) P.E.I. (3) N.L. (15)	N.B. (8) N.S. (12) P.E.I. (1) N.L. (0)	N.B. (5) N.S. (7) P.E.I. (1) N.L. (0)
Total			**599**	**300**	**117**

APPENDIX B – JURISDICTIONAL SCAN

See attached excel file for complete information on municipalities reviewed, water and wastewater rates charged and other information—the summary table below includes a subset of this information.

Table B-1. Summary of residential water and wastewater pricing for municipalities that meter water consumption, 2011

Community	Prov.	2006 Population	Water - Rate type	Sewer - Rate Type	Other Notes	Website
Abbotsford	BC	123864	Uniform rate with seasonal increasing block for residential; decreasing block for ICI / farms	Uniform rate only	seasonal increasing block rate; bimonthly billing; decreasing block rate for ICI; fixed network smart meters supplied and installed by Itron	www.abbotsford.ca/home
Anmore	BC	1785	Uniform rate only	Sewer not provided, individual septic system only		www.anmore.com/siteengine/activepage.asp
Armstrong	BC	4241	Fixed fee only	Separate fixed fee	plans for metering in 2012-13, with a small fixed fee, 3-tier increasing block rate and one year of shadow billing; meters to be installed inside and connected to an exterior radio transceiver by Corix; quarterly reading / billing proposed	http://cityofarmstrong.bc.ca/siteengine/activepage.asp
Castlegar	BC	7259	Fixed fee only	Separate fixed fee	universal metering program; Corix supplying and installing radio-read meters from 2011-13; metered rates begin in 2013	www.castlegar.ca/notice.php?id=174
Central Saanich	BC	15745	Two-part (fixed fee without water allocation + uniform rate)	Uniform rate only	10% discount if bill paid on time	www.centralsaanich.ca/Home.htm
Chilliwack	BC	69217	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate		www.chilliwack.com/main/
Coldstream	BC	9471	Two-part (fixed fee with water allocation + increasing block rate)	Separate fixed fee without water allocation + uniform rate	unmetered water fees where metering is not possible are $66.20 fixed fee + $131.23 consumption fee; unmetered customers where metering is possible pay $66.20 fixed fee + $201.43 consumption fee, rising to $425.10	www.districtofcoldstream.ca/

Community	Prov.	2006 Population	Water - Rate type	Sewer - Rate Type	Other Notes	Website
					consumption fee after a warning (water)	
Comox	BC	12136	Voluntary two-part (fixed with water allocation + uniform rate) OR flat rate	Separate fixed fee with water allocation + uniform rate	annual parcel taxes include $30 water + $60 sewer; installing meters for stratas, 600 meter-ready homes and others who volunteer (pit installation); metered billing voluntary; otherwise only monthly fixed charge applies; volumetric thresholds are per unit for multi-residential	http://comox.ca/
Dawson Creek	BC	10994	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee	metered water for 40 years; changed in 2011 from a frontage tax + high minimum volumetric charge to current two part rate	www.dawsoncreek.ca/
Delta	BC	96723	Increasing block rate with a minimum bill	Uniform rate only	unmetered annual fees: $440 + $240 (secondary suites) for water, $260 + $160 (secondary suites) for sewer; $340 (one-person declaration); metering program voluntary; one year guarantee that rates will not exceed fixed rates; meters read visually or from a touchpad; pit installation by Delta staff	www.corp.delta.bc.ca/
Enderby	BC	2828	Fixed fee only	Separate fixed fee	completed phase 1 - non-residential and pilot residential meters; ongoing phase 2 - full residential installation and new rate structure setting, with Towns for Tomorrow funding	www.enderby.com/
Esquimalt	BC	16840	Two-part (fixed fee without water allocation + uniform rate)	Assessed through taxes, based on evaluation		www.esquimalt.ca/
Fort St. John	BC	17402	Two-part (fixed fee without water allocation + uniform rate with a minimum bill)	Uniform rate only	universal installation in 2006-07, mock billing in 2008, metered billing began 2009; significant decline in water use 2009/2010; 5% discount if paid by 30 days of invoice date; fixed network allows real-time data and tracking of diurnal curves; plans for	www.fortstjohn.ca

Community	Prov.	2006 Population	Water - Rate type	Sewer - Rate Type	Other Notes	Website
					owner access to real-time data; unmetered rates are $150 water + $127.50 sewer	
Gibsons	BC	4182	Two-part (fixed fee without water allocation + increasing block rate)	Separate fixed fee	annual parcel taxes include $150 water + $241 sewer; tiered rates began 2011; Neptune Canada installed meters in pits; quarterly reading via external touchpad and auto-downloads	www.gibsons.ca/
Kamloops	BC	80376	Two-part (fixed fee with water allocation + increasing block rate)	Separate fixed fee	bills include flat rate, user and irrigation charges based on property size; Neptune Canada installing residential meters; metered billing scheduled to begin in 2012-13, with higher summer allocation; shadow billing will be used first; developed options for customers worried about meter frequencies	www.kamloops.ca
Kelowna	BC	106707	Two-part (fixed fee without water allocation + increasing block rate)	Separate fixed fee	meters installed 1996; metered billing began 1998; avg. monthly water use dropped from 56m^3 to 39m^3; $400 monthly fee for residences required to have meters but that do not	www.kelowna.ca
Ladysmith	BC	7538	Two-part (fixed fee with water allocation + increasing block rate)	Separate fixed fee	implemented metering / user pay in 2003; increasing block rate began 2010	www.ladysmith.ca/
Lake Country	BC	9606	Two-part (fixed fee with water allocation + uniform rate)	Separate fixed fee	annual unmetered water fees $486 + $77/acre/yr irrigation tax in Lake Country or $510 in Coral Beach; $225 parcel tax for properties capable of being connected + $250 annual user fee for sewer; meters required for new construction since 1995; planning for universal metering 2013-2015; volumetric threshold and billing are semi-annual	www.lakecountry.bc.ca

Community	Prov.	2006 Population	Water - Rate type	Sewer - Rate Type	Other Notes	Website
Langley	BC	23606	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate	almost all properties metered; annual readings; billing on tax notice	www.city.langley.bc.ca/
Lantzville	BC	3661	Two-part (fixed fee with water allocation + increasing block rate)	Separate fixed fee with water allocation + increasing block rate	many residences are on septic systems	www.lantzville.ca/
Lillooet	BC	2324	Fixed fee only	Separate fixed fee	water and sewer currently billed on taxes; issued RFP in 2011 for supply and installation of meters for universal program	www.lillooetbc.com/
Lumby	BC	1634	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate	unmetered water and sewer fees: $60 + $60 outside municipal boundary and where metering is not possible; $62 + $62 where metering is possible, rising $50/month each quarter that meter is not installed; universal meters installed in 2009 by Neptune Canada; moved from flat to new rates in 2012	www.lumby.ca/
Metchosin	BC	4795	Uniform rate only	Sewer not provided, individual septic system only	water services provided by CRD	www.district.metchosin.bc.ca
Mission	BC	34505	Two-part (fixed fee without water allocation + decreasing block rate with a minimum bill)	Joint water and sewer fixed charge + decreasing block rate	meters required for new residences since 2008; unmetered customers billed on property taxes; metered customers billed quarterly; unmetered fees: $447.48 + $340.44, 2-unit: $894.96 +$680.88	www.mission.ca
Nanaimo	BC	78692	Increasing block rate only	Separate fixed fee	universal metering; implemented limited income fees based on 50% of minimum charge; water is billed 3x/year; volumetric blocks all in gallons	www.nanaimo.ca/
North Cowichan	BC	27557	Two-part (fixed fee with water allocation + uniform rate)	Separate fixed fee	$167 (Chemainus), $290 (Crofton), $135 (South End) annual flat water rates on property taxes; $206 (Chemainus), $146 (Crofton), $158 (South End) water parcel taxes; $132 (Chemainus), $123 (Crofton), $231 (South End)	www.northcowichan.ca

Community	Prov.	2006 Population	Water - Rate type	Sewer - Rate Type	Other Notes	Website
					sewer user charges; $391 (Chemainus), $355 (Crofton), $167 (South End) sewer parcel taxes; semi-annual water consumption billing	
North Saanich	BC	10823	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee	water consumption billed 3x/year	www.northsaanich.ca
Oak Bay	BC	17908	Two-part (fixed fee without water allocation + uniform rate)	Uniform rate only	almost all properties metered; billing 3x/year	www.oakbaybc.org/
Oliver	BC	4370	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee	water consumption billed quarterly; initiated universal metering with Neptune in 2009-10; for customers who refuse installation, meters will be pit installed on the street right-of-way for $750; unmetered customers who refuse installation pay $400/month	www.oliver.ca
Osoyoos	BC	4752	Fixed fee only	Separate fixed fee	meters required for new construction; test meters for experimental purposes only in several locations; bylaws provide for two-part rates (water $136 + $0.36/m³, sewer $0.65/m³ for 80% of recorded volume of water use), but no metered water billing yet; quarterly billing	www.osoyoos.ca
Parksville	BC	10993	Two-part (fixed fee with water allocation + increasing block rate)	Separate fixed fee with water allocation + uniform rate	switched to volumetric-based rates in 2006; instituted large family rates which allow higher consumption per block; introduced increasing block rate and new awareness program in 2009; 17% decrease in per capita water use in 2010; billing 2x/year	www.parksville.ca/
Peachland	BC	4883	Two-part (fixed fee without water allocation + increasing block rate)	Separate fixed fee	meters installed 2007-09; mock billing in 2009; metered billing in 2010; single volumetric rate only for multi-residential; consumption dropped 27% from 2009-10 and 34%	www.peachland.ca

Community	Prov.	2006 Population	Water - Rate type	Sewer - Rate Type	Other Notes	Website
					from the previous 10-year average	
Port Alberni	BC	17548	Two-part (fixed fee without water allocation + decreasing block rate)	Separate fixed fee	universal meters installed 1996-99 via Waste Management Technologies; due to opposition more meters pit installed at property line than expected; consumption dropped 34%; average household in 2007 used 800L daily i.e. inside the lowest block rate; reading and billing 3x/year; annual sewer charge	www.portalberni.ca
Prince George	BC	70981	Two-part (fixed fee without water allocation + uniform rate)	Uniform rate only	began volunteer metering in 2005; new construction metering required since 2008; monthly unmetered rates: water $27.12, strata $20.22, sewer $22.20, strata $16.56	
Qualicum Beach	BC	8502	Two-part (fixed fee without water allocation + increasing block rate)	Separate fixed fee without water allocation + uniform rate	semi-annual billing; April sewer volumetric billing based on Oct- Apr consumption; September billing based on lower of the previous Oct-Apr consumption and current May-Sep consumption	www.qualicumbeach.com
Richmond	BC	174461	Two-part (fixed fee without water allocation + uniform rate with a minimum bill)	Joint water and sewer fixed charge + uniform rate	unmetered customers pay annual $621.51 water tax + $400.25 sewer tax; voluntary meter program offers free installation through 2012; administered by Neptune Technology; one-year guarantee that meter bill will be less than 2011 flat rate; pit installation	www.richmond.ca
Rossland	BC	3278	Two-part (fixed fee without water allocation + increasing block rate)	Separate fixed fee without water allocation + uniform rate	metered multi-unit residentials pay 70% base charge per unit; unmetered annual fees $387 water + $280 sewer; universal metering since 2011; free meters ended 2011; $20 annual senior citizens' discount; switching touchpad system for radio-frequency devices, planned completion end 2011	www.rossland.ca/

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Saanich	BC	108265	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate	billing is 3x/year; sewer volumetric charge based on lowest of the three water bills	http://saanich.ca/
Sicamous	BC	2676	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate	metered properties billed 2x/year; meters required for new construction; unmetered fees: water $598.95 + sewer $398	www.sicamous.ca
Sidney	BC	11315	Uniform rate with a minimum bill	Uniform rate only	volumetric rates only	www.sidney.ca/
Sooke	BC	9704	Uniform rate only	Separate fixed fee	water services provided by CRD; sewer services billed annually on taxes	www.sooke.ca/
Spallumcheen	BC	4960	Two-part (fixed fee with water allocation + increasing block rate)	Sewer not provided, individual septic system only	unmetered water fees where metering is not possible are $66.20 + $131.23 usage charge; where metering is possible they are $66.20 + $201.43 usage charge, rising to $425.10 after a warning; the township manages four water utilities due to its large size	www.spallumcheentwp.bc.ca
Summerland	BC	10828	Fixed fee only	Separate fixed fee	universal installation began 2009 through Neptune; consumption billing not yet in place; bills mailed monthly	www.summerland.ca/
Surrey	BC	394976	Two-part (fixed fee without water allocation + uniform rate)	Joint water and sewer fixed charge + uniform rate	voluntary, free metering program since 1998 through Corix; meters required for new construction; reading and billing 3x/year; annual unmetered fees are water $637 + sewer $428; meters inside homes read from exterior touchpads; exterior meters read with electronic reader from lids of meter boxes	www.surrey.ca/
Tofino	BC	1655	Two-part (fixed fee without water allocation + winter and summer increasing block rates)	Joint water and sewer fixed charge + winter and summer increasing block rates	Summer rate applies April-September; unmetered residential water $100/quarter, sewer $90/quarter per suite, billed annually; separate increasing block tiered	http://www.tofino.ca/siteengine/activepage.asp

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					rates for different classes of users.	
Vancouver	BC	578041	Two-part (fixed fee without water allocation + uniform rate)	Joint water and sewer fixed charge + uniform rate	meters required for new single family / duplex construction; considering voluntary meter program for existing homes; may redesign rates in 2012; metered billing quarterly; 25% seasonal premium; annual unmetered fees are water $513 + sewer $273	http://vancouver.ca/
Vernon	BC	35944	Two-part (fixed fee with water allocation + increasing block rate)	Separate fixed fee with water allocation + uniform rate	unmetered water fees where metering is not possible are $66.20 + $131.23 consumption charge; unmetered fees where metering is possible are $66.20 + $201.43 consumption charge, rising to $425.10 after warning	www.vernon.ca/
Victoria	BC	78057	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee	phasing in volumetric pricing for sewer services; billing 3x/year	www.victoria.ca
West Kelowna	BC	28972	Two-part (fixed fee without water allocation + increasing block rate)	Separate fixed fee	implemented consumption based rates for all districts in 2011; water fixed component is $257 for Pritchard, West Kelowna Estates or Sunnyside, $86.50 for Westbank and $42.00 for Lakeview	http://districtofwestkelowna.ca/
West Vancouver	BC	42131	Two-part (fixed fee without water allocation + increasing block rate)	Separate fixed fee without water allocation + uniform rate	began universal metering in 2005; started fully metered rate structure in 2008; new customers pay for meters in quarterly installments of $16.67 until paid off	www.westvancouver.ca
White Rock	BC	17755	Two-part (fixed fee with water allocation + uniform rate)	Separate fixed fee	EPCOR purchased White Rock Utilities in 2005 and operates water on behalf of the city; sewage managed by the city, through Metro Vancouver. as a privately-owned system EPCOR must file revenue requirements and rates to the BC Comptroller of Water Rights; water bills issued bimonthly	www.epcor.ca/en-ca/about-epcor/operations/operations-bcp-pnw/white-rock/Pages/WhiteRockWaterRates.aspx

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Airdrie	AB	39822	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate		www.airdrie.ca/utilities/index.cfm
Athabasca County	AB	7592	Uniform rate with a minimum bill	Unknown		www.athabascacounty.com/Safety%20and%20Utilities/SafetyUtilities.asp
Banff	AB	8721	Two-part (fixed fee without water allocation + uniform rate)	Surcharge on water bill	127.5% sewer surcharge; consumers 65 and older are eligible for a $50.00 per annum reduction; rural rates higher	www.banff.ca/town-hall/utilities.htm
Beaumont	AB	12586	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate		www.town.beaumont.ab.ca/pages.php?pg1=1005&pg2=2006&pg3=3002&pg4=4006
Beaver County	AB	5676	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee		www.beaver.ab.ca/municipal/beaver/beaver-website.nsf/AllDoc/A5476E90C968BE4287256FCB0077AB34?OpenDocument
Blackfalds	AB	5610	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + surcharge on water bill	40% sewer surcharge	www.blackfalds.com/bylaws.htm
Bonnyville	AB	6470	Two-part (fixed fee without water allocation + uniform rate)	Unknown		http://town.bonnyville.ab.ca/index.php/services-a-departments/administration-a-finance/utility-billing-a-accounts-receivable
Bonnyville no. 87	AB	9047	Two-part (fixed fee without water allocation + uniform rate)	Included with water rate		http://md.bonnyville.ab.ca/residents/finance-and-administration/utilities
Brazeau County	AB	7040	Uniform rate with a minimum bill	Assessed through taxes		www.brazeau.ab.ca/departments/administration

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Brooks	AB	13581	Uniform rate with a minimum bill	Separate fixed fee		www.brooks.ca/index.php?option=com_content&view=article&id=103&Hid=124&Subid=125&Preid=124&Itemid=125
Calgary	AB	1071515	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate	different rates (including irrigation service volumetric) for residences with more than two dwellings	www.calgary.ca/UEP/Water/Pages/Customer-service/Water-and-wastewater-rates/Water-and-Wastewater-Rates.aspx
Camrose	AB	16543	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate	sewer volumetric is $0.55 if no weeping tile connection	www.camrose.ca/index.aspx?nid=194
Canmore	AB	12226	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate		www.canmore.ca/Municipal-Services/Utilities/Utility-Billing.html
Chestermere	AB	14285	Two-part (fixed fee without water allocation + increasing block rate)	Separate fixed fee without water allocation + increasing block rate		http://chestermere.ca/connecting_with_your_town/bylaws
Coaldale	AB	6943	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate	$4.95 monthly storm drainage surcharge; sewer based on average winter water use; higher rural rates	www.coaldale.ca/content-detail.asp?ID=105&CatID=2
Cochrane	AB	15424	Increasing block rate only	Uniform rate only	sewer rate based on average water consumption October - March	www.cochrane.ca/municipal/toc/webcms.nsf/AllDoc/CE720550A5EF0AF4872576FE0075A253?OpenDocument
Cold Lake	AB	13924	Uniform rate only	Included with water rate		www.coldlake.com/municipal/coldlake/webcms.nsf/AllDocSearch/9ECFE8A2FD90655987257830006E1935/$File/P.R.%20Utility%20Rates%20Increase.pdf?OpenElement

Community	Prov.	2006 Population	Water - Rate type	Sewer - Rate Type	Other Notes	Website
Cypress County	AB	6729	Two-part (fixed fee without water allocation + increasing block rate)	Separate fixed fee		www.cypress.ab.ca/Public%20Works/public_works.htm
Devon	AB	6534	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate		www.devon.ca/Government/Departments/PlanningandInfrastructure/WaterUtility.aspx
Drayton Valley	AB	6893	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate	higher rural volumetric rates	www.draytonvalley.ca/town-services/fees/
Drumheller	AB	7932	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate	sewer volumetric charged on 80% of water consumption	www.dinosaurvalley.com/utilities
Edmonton	AB	782439	Two-part (fixed fee without water allocation + increasing block rate)	Separate fixed fee without water allocation + uniform rate		www.epcor.ca/en-ca/Customers/water-customers/water-rates/edmonton-rates/Pages/residential-rates.aspx
Edson	AB	8365	Two-part (fixed fee without water allocation + uniform rate)	Included with water rate		www.townofedson.ca/municipal/edson/edson-website.nsf/AllDoc/778B1AC3BBCFEBCA87256F040077065E?OpenDocument
Foothills no. 31	AB	19736	Increasing block rate with a minimum bill	Surcharge on water bill	60% sewer surcharge	www.mdfoothills.com/residents/utilities/sewer__septic_systems.html
Fort Saskatchewan	AB	18653	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate		www.fortsask.ca/ftsk_Community_Services/ftsk_Utilities.aspx
Grande Prairie	AB	50227	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate	additional 10% of total bill for municipal franchise fee	www.aquatera.ca/our-company/corporate-info/
Grande Prairie no. 1	AB	17989	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate	additional 10% of total bill for municipal franchise fee	www.aquatera.ca/our-company/corporate-info/

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High River	AB	11783	Two-part (fixed fee without water allocation + increasing block rate)	Separate fixed fee without water allocation + uniform rate	sewer rate based on average water consumption November - April	www.highriver.ca/town-hall/town-manager-a-departments/corporate-services/water-and-utility-services/overview-of-utility-services
Innisfail	AB	7883	Two-part (fixed fee without water allocation + uniform rate)	Uniform rate only		www.townofinnisfail.com/municipal.htm
Lacombe	AB	11733	Two-part (fixed fee without water allocation + uniform rate)	Surcharge on water bill	35.8% sewer surcharge	www.lacombe.ca/index.php?option=com_content&task=view&id=690&Itemid=174
Lacombe County	AB	10507	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate		www.lacombecounty.com/index.php?option=com_docman&task=cat_view&gid=137&Itemid=38
Leduc	AB	23293	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate		www.leduc.ca/AssetFactory.aspx?did=3452
Leduc County	AB	13260	Uniform rate only	Uniform rate only		www.leduc-county.com/waste-a-water-management/utilities-water-a-sewer
Lethbridge	AB	86659	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate		www.lethbridge.ca/living-here/Utilities-Waste-Recycling/Pages/default.aspx
Lethbridge	AB	10302	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee		www.lethcounty.ca/municipal/lethbridge/lethbridge-website.nsf/AllDoc/7215FE17EBA9D18887256F20005C35CC?OpenDocument

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MacKenzie County	AB	10002	Two-part (fixed fee without water allocation + uniform rate)	Surcharge on water bill	33.5% sewer surcharge	www.mackenziecounty.com/index.php?option=com_content&view=article&id=21&Itemid=16
Medicine Hat	AB	61097	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee	smart metering project	www.medicinehat.ca/CityGovernment/Departments/Utilities
Morinville	AB	7636	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate	planned meter replacement program	www.morinville.ca/residents/public-works/utilities
Okotoks	AB	23201	Two-part (fixed fee without water allocation + increasing block rate)	Separate fixed fee without water allocation + uniform rate		www.okotoks.ca/default.aspx?cid=1681&lang=1
Olds	AB	7248	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate		www.olds.ca/pubworks.html
Peace River	AB	6315	Two-part (fixed fee without water allocation + decreasing block rate)	Surcharge on water bill	42% sewer surcharge; maximum sewer charge is $16.43	www.peaceriver.ca/utilities
Ponoka	AB	6576	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate		http://ponoka.org/municipal/ponoka/ponoka-website.nsf/0/28280C5D9E3AF94287256E4000775CCE?OpenDocument
Red Deer	AB	90084	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee	$1.529 volumetric sewer rate for residences with more than two dwelling units	www.reddeer.ca/City+Government/City+Services+and+Departments/Utility+Billing+Service+Centre/Residential+Customers/default.htm
Red Deer County	AB	19108	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate	uniform volumetric amounts vary depending on area	http://rdcounty.ca/Residents/Operations-Services/Utilities

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Redcliff	AB	5096	Increasing block rate with a minimum bill	Separate fixed fee		www.town.redcliff.ab.ca/page2main-municipal.htm
Rocky Mountain House	AB	7231	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate		www.rockymtnhouse.com/town-utilities.htm
Slave Lake	AB	7031	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate		www.slavelake.ca/siteengine/activepage.asp?PageID=17
Spruce Grove	AB	24646	Uniform rate only	Unknown		www.sprucegrove.org/services/taxes/utilities.htm
St. Albert	AB	60138	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate		www.stalbert.ca/utilities
St. Paul no. 19	AB	5925	Two-part (fixed fee without water allocation + uniform rate)	Unknown	three different two-part rates for three different areas	www.county.stpaul.ab.ca/Utilities
Stettler	AB	5843	Two-part (fixed fee without water allocation + uniform rate)	Unknown		www.stettler.net/admin/contentx/default.cfm?h=3&grp=1&PageId=9722
Stony Plain	AB	14177	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate		www.stonyplain.com/admin/contentx/default.cfm?PageId=4515
Strathcona County	AB	87998	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate		www.strathcona.ab.ca/departments/utilities.aspx
Strathmore	AB	12139	Two-part (fixed fee without water allocation + increasing block rate)	Separate fixed fee without water allocation + uniform rate		www.strathmore.ca/news.php?viewStory=178
Sturgeon County	AB	19165	Two-part (fixed fee without water allocation + increasing block rate)	Separate fixed fee without water allocation + uniform rate		www.sturgeoncounty.ab.ca/SERVICES/CountyServices/UtilityServices/tabid/123/Default.aspx

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Sylvan Lake	AB	11115	Two-part (fixed fee without water allocation + increasing block rate)	Separate fixed fee without water allocation + uniform rate	sewer volumetric charged on 80% of water consumption	https://sylvanlake.civicweb.net/Documents/DocumentList.aspx?ID=11498
Taber	AB	7821	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate	$12.78 (water)+ $13.68 (sewer) fixed charges for each additional unit for multi-unit complexes	http://taber.ca/index.aspx?NID=131
Taber	AB	6714	Uniform rate with a minimum bill	Separate fixed fee		www.mdtaber.ab.ca/government-amp-departments/utilities-garbage-collection-amp-transfer-stations
Vegreville	AB	5834	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee with water allocation + uniform rate	maximum sewer charge is $12.40	www.vegreville.com/main.asp?MainID=63
Wainwright	AB	5775	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee		www.wainwright.ca/residents/gaswater.shtml
Westlock County	AB	6910	Uniform rate with a minimum bill	Separate fixed fee		www.westlockcounty.com/services/utilities/rates
Wetaskiwin no. 10	AB	10535	Uniform rate with a minimum bill	Separate fixed fee	minimum bill varies depending on area	http://county.wetaskiwin.ab.ca/municipal/cntywtsk/cntywtsk-website.nsf/AllDoc/8EA4E2A5967B3B71872575B300737ED6?OpenDocument
Whitecourt	AB	9202	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate		www.whitecourt.ca/LivingInWhitecourt/Utilities/UtilityCustomerAccounts/tabid/261/Default.aspx
Wood Buffalo	AB	91612	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate	rural areas pay lower fixed rates	www.woodbuffalo.ab.ca/Assets/Departments/Legislative+and+Legal+Services/Bylaws/UtilityRates.pdf

Community	Prov.	2006 Population	Water - Rate type	Sewer - Rate Type	Other Notes	Website
Yellowhead County	AB	10045	Uniform rate with a minimum bill	Separate fixed fee without water allocation + surcharge on water bill	60% sewer surcharge	www.yellowheadcounty.ab.ca/departments/dep_002e.html
Estevan	SK	10084	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate	extra fixed charges are for building service and drainage infrastructure	http://estevan.ca/
Humboldt	SK	4998	Two-part (fixed fee + uniform rate)	Unknown	water provided by Crown Corp SaskWater	www.cityofhumboldt.ca/
Lloydminster	SK	8118	Two-part (fixed fee with water allocation + increasing block rate)	Separate fixed fee with water allocation + increasing block rate	switched from decreasing to increasing block rate in 2012	www.lloydminster.ca/
Martensville	SK	4968	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee	water provided by Crown Corp SaskWater	http://martensville.iwebez.com/siteengine/activepage.asp; www.ecdev.martensville.ca
Meadow Lake	SK	4771	Two-part (fixed fee with water allocation + uniform rate)	Separate fixed fee with water allocation + uniform rate		www.meadowlake.ca/
Melfort	SK	5192	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee	purchases water from the SaskWater Codette Lake regional water supply	www.cityofmelfort.ca/
Melville	SK	4149	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate	extra fixed charges are for infrastructure and an environmental levy; bimonthly readings	www.city.melville.sk.ca
Moose Jaw	SK	32132	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate	meters read quarterly; customers can call in readings or submit online; customers can have remote meters installed to avoid having staff enter their homes; equalized monthly installment plans are available	www.moosejaw.ca/
North Battleford	SK	13190	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate	installment payment plans available; quarterly billing	www.cityofnb.ca/

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Prince Albert	SK	34138	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate	switched from a decreasing block in 2010; customers may call, mail, email, fax or submit online meter readings	www.citypa.ca/
Regina	SK	179246	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate	meters equipped with radio-transmitters for drive-by reading; equalized billing plan available	www.regina.ca/
Saskatoon	SK	202340	Two-part (fixed fee without water allocation + increasing block rate)	Separate fixed fee without water allocation + increasing block rate	residents can submit readings online; automated reading change-out occurred from 1995-2005 allowing remote reading from outdoors and facilitating future transitioning to radio-read; quarterly readings	www.saskatoon.ca
Swift Current	SK	14946	Two-part (fixed fee without water allocation + decreasing block rate)	Included with water rate		www.city.swift-current.sk.ca/
Weyburn	SK	9433	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate	summer volumetric rates do not include sewer charge for lawn and garden watering.	www.weyburn.ca/
Yorkton	SK	14038	Two-part (fixed fee without water allocation + uniform rate)	Included with water rate	Meters read 3x/year; bills alternate between actual and estimates; customers can phone in readings; fixed charge for utility account (sewer, recycling, garbage); bimonthly billing	www.city.yorkton.sk.ca/
Brandon	MB	41511	Two-part (fixed fee without water allocation + decreasing block rate)	Joint water and sewer fixed charge + decreasing block rate	average monthly consumption for 4-person household in Canada approximately 36m³	www.brandon.ca/
Dauphin	MB	7906	Two-part (fixed fee without water allocation + decreasing block rate)	Joint water and sewer fixed charge + uniform rate		www.dauphin.ca/
East Saint Paul	MB	8733	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate		www.eaststpaul.com/index.php
Gimli	MB	5797	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate	water fixed component is $20.99 (urban), $19.26 (Pelican Beach), $12.72 (industrial park); water minimum bill is $35.84	www.gimli.ca

Community	Prov.	2006 Population	Water - Rate type	Sewer - Rate Type	Other Notes	Website
					(urban), $41.67 (Pelican Beach), $35.81 (industrial park); sewer minimum bill of $50.48; some areas have private wells / septic systems	
Hanover	MB	11871	Two-part (fixed fee without water allocation + uniform rate)	Joint water and sewer fixed charge + uniform rate	most residents on wells and/or septic; includes 3 urban districts; rates quoted are for Grunthal	www.hanovermb.ca/
MacDonald	MB	5653	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate	Each has a regular sewer commodity fee: $15.20 (Oak Bluff), $11.27 (Sanford), $15.30 (Starbuck); water minimum bill is $30.60 (urban), $32.90 (rural); sewer minimum bill is $21.70 (Oak Bluff), $18.06 (Sandford), $27.40 (Starbuck); all three have access to water system or standpipes and low pressure sewage system; quarterly billing	http://rmofmacdonald.com
Morden	MB	6571	Two-part (fixed fee without water allocation + decreasing block rate)	Joint water and sewer fixed charge + decreasing block rate		www.mordenmb.com/
Portage la Prairie	MB	12728	Two-part (fixed fee without water allocation + decreasing block rate)	Joint water and sewer fixed charge + decreasing block rate		www.city.portage-la-prairie.mb.ca/
Ritchot	MB	5051	Two-part (fixed fee without water allocation + uniform rate)	Unknown	electronic meters read manually, using handheld / through walk-by from the street	www.ritchot.com
Rockwood	MB	7692	Two-part (fixed fee without water allocation + uniform rate)	Joint water and sewer fixed charge + uniform rate		www.rockwood.ca/
Selkirk	MB	9515	Two-part (fixed fee without water allocation + uniform rate)	Joint water and sewer fixed charge + uniform rate	most old water meters were recently replaced with radio-frequency meters	www.cityofselkirk.com/
Springfield	MB	12990	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate	many residents on wells and/or septic	www.rmofspringfield.ca/

Community	Prov.	2006 Population	Water - Rate type	Sewer - Rate Type	Other Notes	Website
Stanley	MB	6367	Two-part (fixed fee without water allocation + uniform rate)	Sewer not provided, individual septic system only	most communities (Massey, Schanzenfeld, Reinfeld, Blumstein, Colert, Dunston, Three-Four) have water service; it appears residences use private septic systems	www.gimli.ca
Steinbach	MB	11066	Two-part (fixed fee without water allocation + uniform rate)	Joint water and sewer fixed charge + uniform rate		www.steinbach.ca/
Taché	MB	9083	Two-part (fixed fee without water allocation + uniform rate)	Joint water and sewer fixed charge + uniform rate	joint fixed + uniform volumetric sewer rate applies to Landmark; Lorette has $11.78 customer service fee + 35.47 usage fee	www.rmtache.ca/
The Pas	MB	5589	Two-part (fixed fee without water allocation + decreasing block rate)	Joint water and sewer fixed charge + uniform rate		www.townofthepas.com/
Thompson	MB	13446	Two-part (fixed fee without water allocation + uniform rate)	Joint water and sewer fixed charge + uniform rate	radio meters installed 2010 by Neptune; water utility created in 2011; fees previously collected as taxes; proposed structure rejected by Public Utilities Board; currently operating on interim rates set by PUB	www.thompson.ca/dbs/cityhall/jmjdbz.cfm
Winkler	MB	9106	Two-part (fixed fee without water allocation + uniform rate)	Joint water and sewer fixed charge + uniform rate	readings can be submitted by mail or online; 2008 rates taken from Public Utilities Board application; no info on municipal website	www.cityofwinkler.ca/
Winnipeg	MB	633451	Two-part (fixed fee without water allocation + decreasing block rate)	Joint water and sewer fixed charge + uniform rate	metered for at least 40-50 years; readings once per year in summer; customers can phone in reading 3x/year; quarterly billing	www.winnipeg.ca
Adjala-Tosorontio	ON	10695	Two-part (fixed fee without water allocation + uniform rate)	Assessed through taxes	OCWA operates water systems on behalf of the jurisdiction	www.townshipadjtos.on.ca/Council/By-laws/index.htm
Ajax	ON	90167	Two-part (fixed fee without water allocation + decreasing block rate)	Separate fixed fee without water allocation + decreasing block rate		www.durham.ca/finance.asp?nr=departments/finance/financeinside.htm

Community	Prov.	2006 Population	Water - Rate type	Sewer - Rate Type	Other Notes	Website
Aurora	ON	47629	Uniform rate only	Uniform rate only	$4.11 storm sewer monthly rate	www.aurora.ca/aurora/index.aspx?ArticleID=3317&lang=en-CA
Barrie	ON	128430	Two-part (fixed fee without water allocation + increasing block rate)	Separate fixed fee without water allocation + increasing block rate		www.barrie.ca/Living/Water/Operations/Pages/WaterMeterServices.aspx
Belleville	ON	48821	Two-part (fixed fee without water allocation + decreasing block rate)	Surcharge on water bill	70% sewer surcharge	www.city.belleville.on.ca/CityHall/Departments/Finance/Pages/FIN-WaterCustomerService.aspx
Bracebridge	ON	15652	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate		www.muskoka.on.ca/siteengine/ActivePage.asp?PageID=14
Bradford West Gwillimbury	ON	24039	Two-part (fixed fee without water allocation + increasing block rate)	Separate fixed fee without water allocation + increasing block rate		www.townofbwg.com/TownHall/Finance/TaxesRates/index.htm
Brampton	ON	433806	Uniform rate only	Uniform rate only		www.peelregion.ca/pw/water/rates/waterbills/
Brant (Paris-Burford-St. George)	ON	34415	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate		www.brant.ca/ourcounty/public_works/water/index.shtml
Brantford	ON	90192	Two-part (fixed fee without water allocation + uniform rate)	Uniform rate only		www.brantford.ca/residents/health/water_quality/Pages/Rates.aspx
Brighton	ON	10253	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate		http://brighton.ca/waterandsewagechargesp64.php
Brock	ON	11979	Two-part (fixed fee without water allocation + decreasing block rate)	Separate fixed fee without water allocation + decreasing block rate		www.durham.ca/finance.asp?nr=departments/finance/financeinside.htm
Brockville	ON	21957	Uniform rate with a minimum bill	Unknown		www.brockville.com/index.cfm?ID=143

Community	Prov.	2006 Population	Water - Rate type	Sewer - Rate Type	Other Notes	Website
Burlington	ON	164415	Two-part (fixed fee without water allocation + increasing block for residential; decreasing block for ICI / farms	Separate fixed fee without water allocation + uniform rate	maximum sewer charge is $59.19	www.halton.ca/cms/One.aspx?portalId=8310&pageId=11423
Caledon (Bolton)	ON	57050	Uniform rate only	Uniform rate only		www.peelregion.ca/pw/water/rates/waterbills/
Cambridge	ON	120371	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate	$0.79 monthly infrastructure renewal charge	www.cambridge.ca/article.php?ssid=402
Central Elgin	ON	12723	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate		http://centralelgin.iwebez.com/siteengine/activepage.asp?PageID=112
Centre Wellington	ON	26049	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate		www.centrewellington.ca/departments/finance/default.aspx
Chatham-Kent	ON	108177	Two-part (fixed fee without water allocation + decreasing block rate)	Separate fixed fee without water allocation + decreasing block rate		www.chatham-kent.ca/council+and+administration/municipal+departments/chatham-kent+public+utilities+commission/About+Water+Wastewater.htm
Clarence-Rockland	ON	20790	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate		http://en.clarence-rockland.com/siteengine/activepage.asp?PageID=52
Clarington (Bowmanville-Newcastle)	ON	77820	Two-part (fixed fee without water allocation + decreasing block rate)	Separate fixed fee without water allocation + decreasing block rate		www.durham.ca/finance.asp?nr=departments/finance/financeinside.htm
Clearview	ON	14088	Two-part (fixed fee without water allocation + uniform rate)	Surcharge on water bill	89.9% or 105.9% sewer surcharge depending on area	www.clearview.ca/home/municipal-services/water-and-sewer

Community	Prov.	2006 Population	Water - Rate type	Sewer - Rate Type	Other Notes	Website
Cobourg	ON	18210	Two-part (fixed fee without water allocation + increasing block rate)	Separate fixed fee without water allocation + increasing block rate		www.lusi.on.ca/lakefront-utility-services-inc/water.php
Collingwood	ON	17290	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate	$0.853 (>40) summer water premium; $0.43 summer sewer rate	www.collus.com/node/347
East Gwillimbury (Holland Landing-Sharon)	ON	21069	Two-part (fixed fee without water allocation + increasing block rate)	Separate fixed fee without water allocation + uniform rate		www.eastgwillimbury.ca/Town_Hall/Departments/Corporate_and_Financial_Services/Finance_Branch/Revenue_Services/Water___Wastewater.htm
Erin	ON	11148	Two-part (fixed fee without water allocation + uniform rate)	Unknown		www.erin.ca/Departments/Water/information.aspx
Essa	ON	16901	Two-part (fixed fee without water allocation + uniform rate)	Surcharge on water bill	95% sewer surcharge	www.essatownship.on.ca/LocalGovernment/WhatsNew/index.htm
Essex	ON	20032	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate	different uniform volumetric rates for different areas	www.essex.ca/index.php?option=com_content&view=category&layout=blog&id=43&Itemid=134
Fort Erie	ON	29925	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate		www.forterie.on.ca/WebSite/tofeweb.nsf/0/2F1F8192908836B485256F8C00736E03?OpenDocument
Georgina (Keswick-Sutton)	ON	42346	Two-part (fixed fee without water allocation + uniform rate)	Surcharge on water bill	113% sewer surcharge	www.georgina.ca/tax-water.aspx
Gravenhurst	ON	11046	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate		www.muskoka.on.ca/siteengine/ActivePage.asp?PageID=14
Grimsby	ON	23937	Two-part (fixed fee without water allocation + uniform rate)	Unknown		www.town.grimsby.on.ca/Water/Main/

Community	Prov.	2006 Population	Water - Rate type	Sewer - Rate Type	Other Notes	Website
Guelph	ON	114943	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate		http://guelph.ca/living.cfm?smocid=2763
Guelph/Eramosa	ON	12066	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate		www.get.on.ca/news.aspx
Haldimand (Cayuga-Caledonia-Hagersville)	ON	45212	Two-part (fixed fee without water allocation + decreasing block rate)	Unknown		www.haldimandcounty.on.ca/Business.aspx?id=1136
Halton Hills (Georgetown)	ON	55289	Two-part (fixed fee without water allocation + increasing block for residential; decreasing block for ICI / farms	Separate fixed fee without water allocation + uniform rate	maximum sewer charge is $59.19	www.halton.ca/cms/One.aspx?portalId=8310&pageId=11423
Hamilton	ON	504559	Two-part (fixed fee without water allocation + uniform rate)	Surcharge on water bill	100% sewer surcharge	www.hamilton.ca/CityDepartments/PublicWorks/WaterAndWasteWaterDev/
Hamilton	ON	10972	Two-part (fixed fee without water allocation + increasing block rate)	Unknown	higher fixed rate for multi-residential accounts	www.hamiltontownship.ca/UserFiles/files/BYLAW%202011-20%20PERMIT%20FEES%20CHARGES%20SCHEDULE%202011.pdf
Hawkesbury	ON	10869	Two-part (fixed fee without water allocation + decreasing block rate)	Separate fixed fee without water allocation + decreasing block rate		www.hawkesbury.ca/compteurse.html
Huntsville	ON	18280	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate		www.muskoka.on.ca/siteengine/ActivePage.asp?PageID=14
Innisfil (Alcona-Lefroy-Gilford)	ON	31175	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate		www.innisfil.ca/utilities-information
Kawartha Lakes (Lindsay)	ON	74561	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate		www.city.kawarthalakes.on.ca/residents/water-and-wastewater/reading-repairs-billing/water-rates

Community	Prov.	2006 Population	Water - Rate type	Sewer - Rate Type	Other Notes	Website
Kincardine	ON	11173	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee	two-part rate definitely in use	www.kincardine.net/public-works-water-wastewater.cfm
King	ON	19487	Two-part (fixed fee without water allocation + increasing block rate)	Separate fixed fee without water allocation + uniform rate		www.king.ca/government/departments/Finance/Pages/WaterandWastewater.aspx
Kingston	ON	117207	Two-part (fixed fee without water allocation + increasing block rate)	Separate fixed fee without water allocation + uniform rate		www.utilitieskingston.com/Water/
Kingsville	ON	20908	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee		http://town.kingsville.on.ca/wps/wcm/connect/KINGSVILLE/KINGSVILLE/MUNICIPAL+INFO/Municipal+Departments/Environmental+Services/
Kitchener	ON	204668	Uniform rate only	Uniform rate only		www.kitchener.ca/en/livinginkitchener/WaterAndSewerRates.asp
Lambton Shores	ON	11150	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate		www.lambtonshores.ca/living/municipalservices/drinkingwater.htm
LaSalle	ON	27652	Two-part (fixed fee without water allocation + increasing block rate)	Unknown		www.town.lasalle.on.ca/Environmental/enviro-water_rates.htm
Leamington	ON	28833	Two-part (fixed fee without water allocation + uniform rate)	Uniform rate with a minimum bill		www.leamington.ca/residents/water_home.asp
Lincoln (Beamsville-Vineland)	ON	21722	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate		www.lincoln.ca/siteengine/activepage.asp?PageID=18
London	ON	352395	Two-part (fixed fee without water allocation + increasing block rate with a minimum bill)	Uniform rate only		www.london.ca/d.aspx?s=/Water/Drinking_Water_System/Rates_Budgets_and_Bylaws.htm

Community	Prov.	2006 Population	Water - Rate type	Sewer - Rate Type	Other Notes	Website
Loyalist	ON	15062	Two-part (fixed fee without water allocation + uniform rate)	Uniform rate only		http://loyalisttownship.ca/living-financewatersewer
Markham	ON	261573	Uniform rate only	Included with water rate		www.markham.ca/wps/portal/Markham/Residents/Water/!ut/p/c5/04_SB8K8xLLM9MSSzPy8xBz9CP0os3gTf3dnZ58wi0CjIBMDA09PlzBTP5dAQ_cAU6B8JEjePMjIJ9TY19HF29HAM9TR1MDDx9nIwNyMgO5wkH24VbiY4JcHmgCVx20_SN4AB3A00PfzyM9N1S_IjTDI9NR1BABP4oPd/dl3/d3/L2dJQSEvUUt3QS9ZQnZ3LzZfNE9HQ0NMVjhRMlI0MDBJSURWNU5EUTFHRDQ!/
Meaford	ON	10948	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate		www.meaford.ca/corporate-services/financial-services-division.html
Middlesex Centre	ON	15589	Uniform rate with a minimum bill	Uniform rate with a minimum bill	$2.40 seasonal premium April – September	www.middlesexcentre.on.ca/page.asp?id=13
Midland	ON	16300	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate		www.midland.ca/town-hall/Departments-Services/Treasury-Department/utilities/index.htm
Milton	ON	53939	Two-part (fixed fee without water allocation + increasing block for residential; decreasing block for ICI / farms	Separate fixed fee without water allocation + uniform rate	maximum sewer charge is $59.19	www.halton.ca/cms/One.aspx?portalId=8310&pageId=11423
Mississauga	ON	668549	Uniform rate only	Uniform rate only		www.peelregion.ca/pw/water/rates/waterbills/

Community	Prov.	2006 Population	Water - Rate type	Sewer - Rate Type	Other Notes	Website
Napanee (Greater Napanee)	ON	15400	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate	33.33% maintenance reserve and 33.33% major capital reserve surcharges on total bill	www.greaternapanee.com/siteengine/activepage.asp?PageID=217
New Tecumseth (Alliston)	ON	27701	Uniform rate only	Uniform rate only		www.town.newtecumseth.on.ca/TownHall/DepartmentsServices/Finance/WaterWasteWaterRates/newtec_000083
Newmarket	ON	74295	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate	rate rebate program	www.newmarket.ca/en/townhall/utilitywaterandsanitarysewerrates.asp
Niagara Falls	ON	82184	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate		www.niagarafalls.ca/city-hall/finance/water-information.aspx
Niagara-on-the-Lake	ON	14587	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate		www.notl.org/siteengine/activepage.asp?PageID=438
Norfolk (Simcoe-Port Dover)	ON	62563	Two-part (fixed fee without water allocation + uniform rate)	Surcharge on water bill	89.6% sewer surcharge	www.norfolkcounty.ca/living/roads-water-wastewater/water-and-wastewater-rates/
North Dundas	ON	11095	Two-part (fixed fee without water allocation + uniform rate)	Surcharge on water bill	148% sewer surcharge	www.northdundas.com/locgovt/corprate/watersewer.htm
North Grenville	ON	14198	Uniform rate with a minimum bill	Included with water rate		http://northgrenville.on.ca/water.cfm
North Perth	ON	12254	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate		www.northperth.ca/municipal/water_billing.php
Oakville	ON	165613	Two-part (fixed fee without water allocation + increasing block for residential; decreasing block for ICI / farms	Separate fixed fee without water allocation + uniform rate	maximum sewer charge is $59.19	www.halton.ca/cms/One.aspx?portalId=8310&pageId=11423

Community	Prov.	2006 Population	Water - Rate type	Sewer - Rate Type	Other Notes	Website
Orangeville	ON	26925	Uniform rate only	Unknown		www.orangeville.org/page.php?id=548&s=287
Orillia	ON	30259	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate		www.orillia.ca/residents/utilities_water&sewer.htm
Oro-Medonte	ON	20031	Uniform rate only	Sewer not provided, individual septic system only	$206 annual infrastructure renewal charge	www.oro-medonte.ca/MunicipalServices/DepartmentServices/Finance/index.htm
Oshawa	ON	141590	Two-part (fixed fee without water allocation + decreasing block rate)	Separate fixed fee without water allocation + decreasing block rate		www.durham.ca/finance.asp?nr=departments/finance/financeinside.htm
Ottawa	ON	812129	Uniform rate only	Surcharge on water bill	117% sewer surcharge	www.ottawa.ca/env_water/water_sewer/billing/index_en.html
Owen Sound	ON	21753	Two-part (fixed fee without water allocation + increasing block rate)	Surcharge on water bill	100% sewer surcharge; higher rural rates	www.owensound.ca/water/
Pelham	ON	16155	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate		www.pelham.ca/Departments/CorporateServices/WaterBillsRates/tabid/283/Default.aspx
Perth East	ON	12041	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate		www.pertheast.on.ca/Templates/workingfileindex.html
Pickering	ON	87838	Two-part (fixed fee without water allocation + decreasing block rate)	Separate fixed fee without water allocation + decreasing block rate		www.durham.ca/finance.asp?nr=departments/finance/financeinside.htm
Port Colborne	ON	18599	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate		www.pcetdc.ca/page/water
Port Hope	ON	16390	Two-part (fixed fee without water allocation + increasing block rate)	Separate fixed fee without water allocation + increasing block rate		www.porthope.ca/en/municipaldepartments/Publications.asp?_mid_=23866

Community	Prov.	2006 Population	Water - Rate type	Sewer - Rate Type	Other Notes	Website
Prince Edward (Picton)	ON	25496	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate	three different two-part rates for three different areas	www.pecounty.on.ca/government/public_works/water_wastewater/water/index.php
Quinte West (Trenton)	ON	42697	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate	fixed charges include $4 plant financing fees	www.quintewest.ca/en/cityhall/watersewerrates.asp#07
Richmond Hill	ON	162704	Uniform rate only	Included with water rate		www.richmondhill.ca/subpage.asp?pageid=finance_water
Russell	ON	13883	Two-part (fixed fee without water allocation + uniform rate)	Surcharge on water bill	38% sewer surcharge; fixed component depends on dwelling type	www.russell.ca/publicutilities.php?id=157
Sarnia	ON	71419	Two-part (fixed fee without water allocation + uniform rate)	Surcharge on water bill	110% sewer surcharge	http://sarnia.ca/visit.asp?sectionid=179
Saugeen Shores (Port Elgin-Southampton)	ON	11720	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate	maximum sewer charge is $106.30; lower fixed rate for multi-residential accounts	www.saugeenshores.ca/downloads/municipal/Saugeen_Shores_Water_and_Sewer_Rates_2011.pdf
Sault Ste. Marie	ON	74948	Two-part (fixed fee without water allocation + increasing block for residential; decreasing block for ICI / farms	Unknown		www.ssmpuc.com/index.cfm?fuseaction=content&PageID=1027&PageCategory=36
Scugog	ON	21439	Two-part (fixed fee without water allocation + decreasing block rate)	Separate fixed fee without water allocation + decreasing block rate		www.durham.ca/finance.asp?nr=departments/finance/financeinside.htm
Severn	ON	12030	Uniform rate with a minimum bill	Uniform rate with a minimum bill		www.townshipofsevern.com/seweringo.asp
Smith-Ennismore-Lakefield	ON	17413	Two-part (fixed fee without water allocation + uniform rate with a minimum bill)	Uniform rate with a minimum bill	rates are for Lakefield only	www.smithennismorelakefield.on.ca/en/townshiphall/waterandsewer.asp

Community	Prov.	2006 Population	Water - Rate type	Sewer - Rate Type	Other Notes	Website
South Frontenac	ON	18227	Uniform rate with a minimum bill	Unknown		www.township.southfrontenac.on.ca/Treasury+Department
South Glengarry	ON	12880	Uniform rate with a minimum bill	Uniform rate with a minimum bill		http://southglengarry.com/waterinfoforms.htm
Springwater	ON	17456	Two-part (fixed fee without water allocation + increasing block rate)	Separate fixed fee without water allocation + increasing block rate		www.springwater.ca/Services/Finance/WaterSewer/index.htm
St. Catharines	ON	131989	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate		www.stcatharines.ca/en/livein/WaterWastewater.asp
St. Clair	ON	14649	Two-part (fixed fee without water allocation + uniform rate)	Surcharge on water bill	125% sewer surcharge	www.twp.stclair.on.ca/waterrpt.htm
St. Thomas	ON	36110	Two-part (fixed fee without water allocation + uniform rate)	Uniform rate only	$7.12 storm sewer monthly rate	www.city.st-thomas.on.ca/siteengine/activepage.asp?PageID=285
Stratford	ON	30461	Two-part (fixed fee without water allocation + uniform rate with a minimum bill)	Surcharge on water bill	153% sewer surcharge	www.city.stratford.on.ca/site_ourcitylife/city_services_water.asp
Strathroy-Caradoc	ON	19977	Uniform rate with a minimum bill	Uniform rate with a minimum bill		www.strathroy-caradoc.ca/siteengine/activepage.asp?PageID=37
Sudbury (Greater Sudbury, Grand Sudbury)	ON	157857	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + surcharge on water bill	113.3% sewer surcharge	www.greatersudbury.ca/agendas/index.cfm?pg=feed&action=file&agenda=report&itemid=31&id=368
Tecumseh	ON	24224	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate		www.tecumseh.ca/townhall/departmental-services/water-dept
Thames Centre	ON	13085	Increasing block rate with a minimum bill	Increasing block rate with a minimum bill		www.thamescentre.on.ca/index.php?option=com_content&view=category&layout=blog&id=121&Itemid=

Community	Prov.	2006 Population	Water - Rate type	Sewer - Rate Type	Other Notes	Website
						229
The Nation / La Nation	ON	10643	Increasing block rate only	Unknown	separate $12.50 capital cost charge; second utility in the same jurisdiction has a uniform volumetric rate only $1.42 m³	www.nationmun.ca/images/finance_pdf/Water%20&%20Sewer-Brochure11%28E%29.pdf
Thorold	ON	18224	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate		www.thorold.com/siteengine/activepage.asp?PageID=40
Thunder Bay	ON	109140	Two-part (fixed fee without water allocation + uniform rate)	Surcharge on water bill	75% sewer surcharge; $0.743 for non-single family metered water	www.thunderbay.ca/Living/Environment/Water.htm
Tillsonburg	ON	14822	Two-part (fixed fee without water allocation + increasing block for residential; decreasing block for ICI / farms	Separate fixed fee without water allocation + increasing block for residential; decreasing block for ICI / farms	higher rural rates	www.tillsonburg.ca/site/399/default.aspx
Toronto	ON	2503281	Uniform rate only	Included with water rate	using link, click various budget committee entries and scroll down for wide-ranging documentation	http://app.toronto.ca/tmmis/findAgendaItem.do?function=doSearch&termId=4&decisionBodyId=362&includeTitle=on&includeSummary=on&includeStaffRec=on&includeDecision=on&word=water&Search=
Trent Hills	ON	12247	Two-part (fixed fee without water allocation + uniform rate)	Surcharge on water bill	182%, 178% or 134% sewer surcharge; three different rates for three different areas	www.trenthills.ca/en/services/waterrates.asp
Uxbridge	ON	19169	Two-part (fixed fee without water allocation + decreasing block rate)	Separate fixed fee without water allocation + decreasing block rate		www.durham.ca/finance.asp?nr=departments/finance/financeinside.htm
Vaughan	ON	238866	Uniform rate with a minimum bill	Uniform rate with a minimum bill		www.vaughan.ca/vaughan/departments/financial_services/index.cfm

Community	Prov.	2006 Population	Water - Rate type	Sewer - Rate Type	Other Notes	Website
Wasaga Beach	ON	15029	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate		www.wasagabeach.com/town_hall.municipal_departments.treasury_tax_water_sewer.gk
Waterloo	ON	97475	Two-part (fixed fee without water allocation + uniform rate)	Uniform rate only		www.city.waterloo.on.ca/desktopdefault.aspx?tabid=389&all=open
Welland	ON	50331	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate	sewer volumetric charged on 92% of water consumption; multi-residential discount if seven units or more	www.welland.ca/Finance/Water.asp
West Grey	ON	12193	Uniform rate with a minimum bill	Surcharge on water bill	150% or 230% sewer surcharge; not fully clear which due to website formatting	www.westgrey.com/departments.cfm?departmentid=66
West Lincoln	ON	13167	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate		www.westlincoln.ca/departments/treasury
Whitby	ON	111184	Two-part (fixed fee without water allocation + decreasing block rate)	Separate fixed fee without water allocation + decreasing block rate		www.durham.ca/finance.asp?nr=departments/finance/financeinside.htm
Whitchurch-Stouffville	ON	24390	Uniform rate only	Uniform rate only		www.townofws.com/water_rates.asp
Wilmot	ON	17097	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate		www.wilmot.ca/departments-public-works-index-details.php?Public-Works-Department-1
Windsor	ON	216473	Two-part (fixed fee without water allocation + uniform rate)	Unknown	$0.249 summer premium on excess of average daily winter consumption; 45% water main replacement surcharge on total bill	www.wuc.on.ca/information/water_reports.cfm
Woodstock	ON	35480	Two-part (fixed fee without water allocation + increasing block for residential; decreasing block for ICI / farms	Separate fixed fee without water allocation + increasing block for residential; decreasing block for ICI /	$0.07 volumetric water surcharge for facilities upgrade; $0.83 monthly for a Community Servicing and Assistance Program	www.oxfordmeter.ca/rates.html

Community	Prov.	2006 Population	Water - Rate type	Sewer - Rate Type	Other Notes	Website
				farms		
Woolwich	ON	19658	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate		www.woolwich.ca/en/townshipservices/finance_water_billing.asp
Beaconsfield	QC	19194	Two-part (fixed fee without water allocation + uniform rate)	Included with water rate	annual staff readings; volumetric rate covers full cost including purchase, distribution, sewage system maintenance and administration (excluding capital costs)	www.beaconsfield.ca/FRANCAIS/accueil.html
Boisbriand	QC	26483	Two-part (fixed fee with water allocation + uniform rate)	Included with water rate	owners must submit readings or pay a $35 fee	www.ville.boisbriand.qc.ca
Brossard	QC	71154	Increasing block rate only	Included with water rate	meters read once in spring; billed once in September; if staff cannot access meter, customers must submit meter reading card or billing will be based on estimates	www.ville.brossard.qc.ca/
Kirkland	QC	20491	Two-part (fixed fee with water allocation + increasing block rate)	Unknown	owners must submit readings by late October or a staff-person will be sent and a fine imposed; a $100 surcharge applies if readings are not submitted on time two years in a row	www.ville.kirkland.qc.ca
L'Assomption	QC	16738	Two-part (fixed fee with water allocation + uniform rate)	Assessed through taxes, based on evaluation	owners must submit meter reading cards annually	www.ville.lassomption.qc.ca/index.html
Mount Royal	QC	18933	Two-part (fixed fee without water allocation + uniform rate)	Assessed through taxes, based on evaluation	annual billing based on actuals or estimates taken by a meter reader; estimates may be used for a maximum of two billing periods	www.ville.mont-royal.qc.ca/

Community	Prov.	2006 Population	Water - Rate type	Sewer - Rate Type	Other Notes	Website
Pointe-Claire	QC	30161	Two-part (fixed fee without water allocation + uniform rate)	Unknown	rates changed in 2008, moving towards annual charge based on consumption and minimal fixed charge for meter rental; previously minimum charge was $127 + charge for consumption over 205m³; changes designed to be revenue neutral, but should encourage conservation and postpone the need for increased plant capacity	www.ville.pointe-claire.qc.ca/
Repentigny	QC	76237	Two-part (fixed fee without water allocation + increasing block rate)	Separate fixed fee	owners must submit meter reading cards as required by the municipality	http://ville.repentigny.qc.ca
Rouyn-Noranda	QC	39924	Uniform rate only	Included with water rate	customers must submit readings by late August; online submission available; bills sent twice annually; areas without meters are billed on a consumption estimate of 50,000 gallons annually	www.ville.rouyn-noranda.qc.ca/maville.asp?mode=menu
Bathurst	NB	12714	Two-part (fixed fee without water allocation + uniform rate)	Surcharge on water bill	73% sewer surcharge	www.bathurst.ca/media_uploads/pdf/1671.pdf
Fredericton	NB	50535	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate		www.fredericton.ca/en/environment/waterutility.asp
Miramichi	NB	18129	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee	meter reading/billing contracted out to Neptune Technology	www.miramichi.org/en/dept-finance-e.asp
Moncton	NB	64128	Two-part (fixed fee without water allocation + decreasing block rate)	Separate fixed fee without water allocation + decreasing block rate	fixed network gathers meter data four times daily	www.moncton.ca/Residents/Water_and_Sewer.htm
Oromocto	NB	8402	Uniform rate only	Uniform rate only		www.oromocto.ca/userimages/files/bylaw%20318-I.pdf

Community	Prov.	2006 Population	Water - Rate type	Sewer - Rate Type	Other Notes	Website
Quispamsis	NB	15239	Two-part (fixed fee without water allocation + increasing block rate)	Surcharge on water bill	160% surcharge on water bill only applies to water volumetric component	http://quispamsis.ca/utilities.htm
Sackville	NB	5411	Uniform rate with a minimum bill	Included with water rate		www.sackville.com/budget2012/
Saint John	NB	68043	Two-part (fixed fee without water allocation + decreasing block rate)	Separate fixed fee without water allocation + decreasing block rate		www.saintjohn.ca/en/home/cityservices/environment/drinkingwater/default.aspx
Amherst	NS	9505	Uniform rate only	Uniform rate only		www.amherst.ca/tax-rates.html
Bridgewater	NS	7944	Two-part (fixed fee without water allocation + decreasing block rate)	Assessed through taxes		www.bridgewater.ca/rates-and-fees/water-rates.html
Cape Breton	NS	102250	Two-part (fixed fee without water allocation + decreasing block rate)	Assessed through taxes		www.cbrm.ns.ca/water-utility.html
Colchester	NS	50023	Two-part (fixed fee without water allocation + uniform rate)	Unknown	two water utilities	www.colchester.ca/public-works
East Hants	NS	21387	Two-part (fixed fee without water allocation + uniform rate)	Uniform rate only		www.easthants.ca/content/water-utility-rates-in-east-hants
Halifax	NS	372679	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate	sewer fixed charge includes stormwater	www.halifax.ca/hrwc/
New Glasgow	NS	9455	Two-part (fixed fee without water allocation + uniform rate)	Uniform rate only		www.newglasgow.ca/lifestyle/profile
Richmond	NS	9740	Two-part (fixed fee without water allocation + uniform rate)	Assessed through taxes	sewer tax rate based on the prior year water consumption	www.richmondcounty.ca/default.asp?mn=1.48
Truro	NS	11765	Two-part (fixed fee without water allocation + decreasing block rate)	Unknown		www.truro.ca/public-notices-directory.html

Community	Prov.	2006 Population	Water - Rate type	Sewer - Rate Type	Other Notes	Website
Victoria	NS	7594	Two-part (fixed fee without water allocation + increasing block rate)	Unknown	second block threshold unknown	www.victoriacounty.com/victoria-county-water-utility-main.html
West Hants	NS	13881	Two-part (fixed fee without water allocation + uniform rate)	Assessed through taxes	two water utilities	www.westhants.ca/public-works.html
Yarmouth	NS	7162	Two-part (fixed fee without water allocation + uniform rate)	Separate fixed fee without water allocation + uniform rate	sewer fixed charge is $57 for apartments	http://townofyarmouth.ca/services/yarmouth-water-utility/overview
Charlottetown	PEI	32174	Two-part (fixed fee without water allocation + uniform rate)	Included with water rate	meters required on all new connections and existing customers gradually transitioning	www.city.charlottetown.pe.ca/volunteermeterprogram.php

Note: This list contains all identified municipalities that currently meter residential water use or that are implementing residential water metering programs. Although every attempt was made to make this review comprehensive, it was not always possible to determine whether a given municipality metered. Some municipalities may therefore be excluded.

Sources: Population data taken from Statistics Canada, 2006 Census of Population, Community Profiles http://www12.statcan.ca/census-recensement/2006/dp-pd/prof/92-591/index.cfm; Alberta population data taken from slightly more recent data from the provincial government. Information on municipalities' water and wastewater rate types taken from their websites, bylaws or from documents posted on the web or provided by the municipality.

Jurisdictional scan information request letters:

Information request – Residential water metering and pricing

I am contacting you regarding water metering in ___. My partner ___ and I are graduate students in the School of Public Administration at the University of Victoria. We are currently working on a Master's project focused on water metering. We are gathering as much information as possible from Canadian jurisdictions that currently meter residential water use.

If you have any documentation that you could share with us about residential metering and water pricing in your jurisdiction, it would be greatly appreciated. In particular, we are interested in metering or user pricing implementation reports, cost-benefit studies for implementation, evaluations of metering and pricing systems, including impacts on water use or other related reports.

If someone else with the city would be better placed to respond to this request, please let me know. I'd also be happy to answer any questions you have about the project. Thank you for your consideration.

Demande - Informations sur les compteurs d'eau et la tarification d'eau

Je vous contacte au sujet de l'utilisation des compteurs d'eau dans la ville de ___. Mon partenaire ___ et moi sommes des étudiants à l'Université de Victoria dans le programme d'administration publique. Nous travaillons sur un projet de maîtrise sur l'utilisation des compteurs d'eau dans le secteur résidentiel. Nous recueillons des informations auprès des villes canadiennes qui utilisent actuellement des compteurs d'eau dans le secteur résidentiel.

Si vous avez des documents que vous pourriez nous envoyer sur l'utilisation des compteurs d'eau dans le secteur résidentiel ou bien sur la tarification de l'eau, il serait grandement apprécié. En particulier, nous serions intéressés par des études coût-avantage sur la mise en œuvre de nouveaux programmes de comptage ou tarification d'eau, par les rapports d'évaluation, y compris ceux concernant les impacts sur l'utilisation de l'eau, ou par d'autres rapports qui touchent sur le sujet des compteurs d'eau.

Si quelqu'un d'autre avec la ville serait mieux placé pour répondre à cette demande, s'il vous plaît faites le moi savoir. Je serais heureuse de répondre à toutes vos questions sur le projet. Merci pour votre considération.

APPENDIX C – WATER CALCULATOR

See attached excel file for full version of the Water Calculator. A static version of the summary page is included below.

Figure C-1 Rate calculator (static)

RATE CALCULATOR

cells with borders like this are user-defined parameters	2010	2011	2012	2013	2014	2015	2016

Mission Financial Snapshot and Budget Forecast Data

these data are for reference; updates on any other tab will be reflected back here

	Actual	Budget	Draft Budget	Forecast	Forecast	Forecast	Forecast
Actual/Projected Residential Charge - Water	389	447	470	493	518	544	571
Actual/Projected Residential Charge - Sewer	309	340	357	375	393	413	434
Utility Fund Total - Water	7,100,984	6,050,091	5,554,411	7,593,351	8,009,740	11,894,599	16,891,062
Utility Fund Total - Sewer	9,013,008	8,910,215	6,571,705	3,182,670	2,983,253	4,654,923	4,294,171
Utility Debt - Water	2,647,346	784,805	261,888	261,888	207,746	207,746	207,746
Utility Debt - Sewer	1,760,125	761,972	172,669	172,669	172,669	172,669	167,021
Total Operating Expenses & Transfers - Water	5,382,253	5,741,099	5,968,463	6,306,271	6,677,700	7,096,649	7,574,787
Total Operating Expenses & Transfers - Sewer	4,539,041	4,160,970	4,280,237	4,414,169	4,616,739	4,888,741	5,167,758
Non User Fee / Levy Revenue - Water	-623,236	-272,199	-303,688	-342,497	-357,246	-398,144	-475,571
Non User Fee / Levy Revenue - Sewer	-1,365,053	-612,170	-623,737	-562,669	-533,189	-559,123	-577,199
User Fee / Levy Revenue - Water	-4,759,017	-5,468,900	-5,664,775	-5,963,775	-6,320,453	-6,698,505	-7,099,215
User Fee / Levy Revenue - Sewer	-3,173,988	-3,548,800	-3,656,500	-3,851,500	-4,083,550	-4,329,619	-4,590,558

Consumption and Revenue Parameters

number of billing periods per year		12					
number of months considered seasonal		4					
total water supplied to Mission (mega-litres)		6,846					
estimated % use - residential		64%					
estimated % use - ICI		18%					
estimated % use - non revenue water		18%					
# of customers - residential		8,650					
# of customers - ICI		400					
estimated average residential use per billing period (m^3)	#DIV/0!	42.21	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
estimated average ICI use per billing period (m^3)	#DIV/0!	256.73	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
estimated % decline in residential use after metering		20%					
adjusted average residential use per billing period (m^3)	#DIV/0!	33.77	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
budgeted revenue from user fees	$7,933,005.00	$9,017,700.00	$9,321,275.00	$9,815,275.00	$10,404,003.00	$11,028,124.00	$11,689,773.00
extra revenue from user fees							
total revenue from user fees	$7,933,005.00	$9,017,700.00	$9,321,275.00	$9,815,275.00	$10,404,003.00	$11,028,124.00	$11,689,773.00
% to be collected via fixed charge		35%					
% to be collected via volumetric charge		65%					

Fixed Component Parameters and Results							
# of customers - meter size 19mm	8650	1.0	AWWA/CWWA meter equivalency ratio				
# of customers - meter size 25mm	400	2.5	AWWA/CWWA meter equivalency ratio				
# of customers - meter size 37mm	0	5.0	AWWA/CWWA meter equivalency ratio				
# of customers - meter size 50mm	0	8.0	AWWA/CWWA meter equivalency ratio				
# of customers - meter size 75mm	0	17.5	AWWA/CWWA meter equivalency ratio				
# of customers - meter size 100mm	0	30.0	AWWA/CWWA meter equivalency ratio				
# of customers - meter size 150mm	0	62.5	AWWA/CWWA meter equivalency ratio				
# of customers - meter size 200mm	0	80.0	AWWA/CWWA meter equivalency ratio				
# of customers - meter size 250mm	0	115.0	AWWA/CWWA meter equivalency ratio				
base rate (19mm) for fixed charge per billing period	**#DIV/0!**	**$27.26**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**

Residential Volumetric Component Parameters and Results							
block 1 upper threshold (m³ per billing period)		0.00					
block 2 upper threshold (m³ per billing period)		0.00					
block 3 upper threshold (m³ per billing period)		0.00					
block 4 upper threshold (m³ per billing period)		0.00					
block 5 all remaining consumption	on balance	on balance	on balance	on balance	on balance	on balance	on balance
block 1 rate		$0.00					
block 2 rate		$0.00					
block 3 rate		$0.00					
block 4 rate		$0.00					
uniform rate or top level block rate		$0.96					
average residential consumption in block 1	#DIV/0!	0.00	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
average residential consumption in block 2	#DIV/0!	0.00	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
average residential consumption in block 3	#DIV/0!	0.00	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
average residential consumption in block 4	#DIV/0!	0.00	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
average residential consumption in block 5	#DIV/0!	33.77	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
total consumption revenue - residential	**#DIV/0!**	**$3,364,945.92**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**

ICI Volumetric Component Parameters and Results							
block 1 upper threshold (m³ per billing period)		100.00					
block 2 upper threshold (m³ per billing period)		200.00					
block 3 upper threshold (m³ per billing period)		300.00					
block 4 upper threshold (m³ per billing period)		400.00					
block 5 all remaining consumption	on balance	on balance	on balance	on balance	on balance	on balance	on balance
block 1 rate		$1.72					

block 2 rate		$1.41					
block 3 rate		$1.28					
block 4 rate		$1.15					
uniform rate or top level block rate		$0.88					
average ICI consumption in block 1	#DIV/0!	100.00	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
average ICI consumption in block 2	#DIV/0!	100.00	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
average ICI consumption in block 3	#DIV/0!	56.73	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
average ICI consumption in block 4	#DIV/0!	0.00	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
average ICI consumption in block 5	#DIV/0!	0.00	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
total consumption revenue - ICI	**#DIV/0!**	**$1,855,009.91**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**

Residential Seasonal Charge Parameters and Results

uniform rate		$0.96					
seasonal charge (percentage rate increase)		40%					
average residential seasonal use per month (m³)		50.00					
total consumption revenue - seasonal charge	**$0.00**	**$664,320.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**

Revenue Summary

revenue to be collected via fixed charge	**$0.00**	**$3,156,195.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
total fixed revenue	**#DIV/0!**	**$3,156,195.00**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**
revenue to be collected via volumetric charge	**$0.00**	**$5,861,505.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
total consumption revenue per year	**#DIV/0!**	**$5,884,275.83**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**
TOTAL REVENUE	**#DIV/0!**	**$9,040,470.83**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**
surplus / deficit	**#DIV/0!**	**$22,770.83**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**

Summary of Settings and Residential Scenario Projections

number of billing periods per year	0	12	0	0	0	0	0
number of months considered seasonal	0	4	0	0	0	0 v	
estimated % decline in residential use after metering	0%	20%	0%	0%	0%	0%	0%
% to be collected via fixed charge	0%	35%	0%	0%	0%	0%	0%
% to be collected via volumetric charge	0%	65%	0%	0%	0%	0%	0%
base rate for fixed charge per billing period	#DIV/0!	$27.26	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
residential block 1 upper threshold (m³ per billing period)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
residential block 2 upper threshold (m³ per billing period)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
residential block 3 upper threshold (m³ per billing period)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
residential block 4 upper threshold (m³ per billing period)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
residential block 5 all remaining consumption	on balance	on balance	on balance	on balance	on balance	on balance	on balance

residential block 1 rate	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
residential block 2 rate	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
residential block 3 rate	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
residential block 4 rate	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
residential uniform rate or top level block rate	$0.00	$0.96	$0.00	$0.00	$0.00	$0.00	$0.00
seasonal charge (percentage rate increase)	0%	40%	0%	0%	0%	0%	0%
		Scenario #1					
average winter use per billing period (m^3)		33.77					
average seasonal use per billing period (m^3)		50.00					
average winter cost per billing period		$59.67					
average seasonal cost per billing period		$94.46					
annual cost		$855.22					
		Scenario #2					
average winter use per billing period (m^3)		40.00					
average seasonal use per billing period (m^3)		40.00					
average winter cost per billing period		$65.66					
average seasonal cost per billing period		$81.02					
annual cost		$849.31					
		Scenario #3					
average winter use per billing period (m^3)		30.00					
average seasonal use per billing period (m^3)		40.00					
average winter cost per billing period		$56.06					
average seasonal cost per billing period		$81.02					
annual cost		$772.51					
		Scenario #4					
average winter use per billing period (m^3)		25.00					
average seasonal use per billing period (m^3)		30.00					
average winter cost per billing period		$51.26					
average seasonal cost per billing period		$67.58					
annual cost		$680.35					
		Budgeted Flat Rates					
actual/projected water and sewer total charge	$698.00	$787.00	$827.00	$868.00	$911.00	$957.00	$1,005.00

APPENDIX D – DIVISION OF WORK

This report was co-authored by Sean Ryan and Jennie Wang. The table below indicates the specific division of work over the course of the project. The sections listed under each name were authored by that person. All sections were written after joint discussions of the topic and were subsequently reviewed and edited by the other partner.

Table D-1. Division of project work

	Sean Ryan	**Jennie Wang**
Participation in regular discussions and meetings, topic selection, solicitation of client and supervisor, and ongoing communications	• Shared responsibility	• Shared responsibility
Proposal	• Sections A,B,C,G	• Sections D,E,F,H
Literature review	• User fees • Elasticity and what it means for water consumption • Equity	• Water metering and pricing—Promising management practices • Rate types • Economic efficiency and marginal cost pricing
Jurisdictional scan	• Alberta • Ontario • New Brunswick • Nova Scotia • Prince Edward Island • Newfoundland and Labrador • Setting rates	• British Columbia • Saskatchewan • Manitoba • Quebec • Implementing new water metering programs
Calculator	• Calculator design and Options	
Reporting	• Conclusion	• Executive summary • Introduction • Background • Methodology • Limitations
Editing and formatting	• Shared responsibility	• Shared responsibility • Reference and document formatting

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