CITY BUDGET FACTS

BASED UPON
THE OFFICIAL ESTIMATES OF
THE CITY OF TORONTO

1920

Together with a discussion of

THE PUBLIC SERVICE ENTERPRISES
OF TORONTO

PART II.

The Public Service Enterprises of Toronto

ISSUED BY THE
BUREAU OF MUNICIPAL RESEARCH
189½ CHURCH ST., TORONTO

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Introductory

The number of things which a community may do for itself has greatly increased in recent years. In the not very distant past, protection of persons and property, the maintenance of highways, and charities and corrections, made up almost the whole of the work of a municipal government. Later, elementary and secondary education, although under a separate board, became a regular part of the community's official work. Departments of Public Health, Parks and Recreation were recent additions. Even Street Cleaning and Scavenging is still performed in many communities by private concerns. The Water Supply, Gas Supply and Electric Light Supply are still in the hands of private corporations in many cities and towns.

Toronto, in addition to the ordinary civic departments, is conducting four different business enterprises: the Municipal Water Works, the Civic Car Lines, the Civic Abattoir, and the Canadian National Exhibition. The expenditure on current account alone of these community undertakings in 1919 amounted to $2,906,836. In addition, the Board of Harbor Commissioners and the Board of Commissioners of the Toronto Hydro-Electric System are, in effect, civic bodies managing municipal enterprises. In 1921, the city is to take over the privately-owned street car system.

In essence, the services rendered by these utilities are not less important to the community than those rendered by regular city departments. The modes of paying for these two types of services differ. Taxation defrays the cost of ordinary services; rates, fees, fares and similar methods of direct payment carry the municipally-owned utilities. How the money is spent and how the services are administered are as important in one case as in the other.

In fine, the City of Toronto has adopted a large and courageous programme of public ownership. It is committed to the policy in a very large area of public service. It remains to carry the policy to complete success. No citizen of Toronto can dodge his or her share of the responsibility for success or failure. The best friend of the city and public ownership is he who acknowledges his responsibility, insists on competent administration of all municipally-owned enter-

prises, bears clearly in mind the dangers which lie in their path, and refuses to be silenced by charges of disloyalty raised by interested parties. Courage and frankness are not the commonest of virtues. They are absolutely essential to effective citizenship in our day and generation. Politics, as that much abused word is commonly understood, is exceedingly inhospitable to independence of thought, speech or action. Politics—national, provincial or city hall—must be kept entirely divorced from the operation of municipally-owned public service enterprises. The knowledge and practice of politics in its noble sense, i.e., the science and art of government, cannot be too widely disseminated and cannot be other than advantageous to all corporate undertakings.

Underlying the administration of any and all business enterprises are certain sound business principles. These principles hold, irrespective of the ownership. If little John Smith sells out to big Peter Jones, Peter may place the business on a more secure basis by a better understanding and observance of these principles, but the glamor of his personality will not enable him to abrogate them. He meddles with them at his peril and when the inevitable consequences of such meddling come, he is the one who suffers. When the city goes into commercial business, it operates under the same immutable laws of administrative efficiency. If it ignores them, the results are certain and inescapable; but, inasmuch as the city is not a person but a governing corporative collection of persons, it can pass the loss on to the citizens through its taxing power. But this only prolongs the day of reckoning. There are limits even to the taxing power. *That limit is, on one side, the paying power of the citizens and, on the other, the degree of ease with which citizens can transfer their interests to other communities where the burdens of taxation are not so heavy.* The best safeguard of public ownership is a frank recognition of the fact that a city possesses no magic wand which can reverse administrative principles or change deficits into surpluses by a gesture. There are certain well defined monopolies which, in the nature of things, must be operated by the civic government. There are certain other undertakings partaking of the nature of a monopoly which should be operated by the public if the public can effect the proper machinery for their administration. There are others which may be operated by the public to its own advantage if the public are sufficiently wide awake, disinterested and pertinacious to compel the observance of sound principles of administration.

The Financial Results of Operating the Civic Car Lines

From 1916 to 1920, Inclusive.

Year	Expenditures (Including Debt Charges)	Income	Loss	
			Amount	Per Cent. of Income
1916.....	$343,975.17	$225,031.38	$118,943.79	52.8%
1917.....	432,436.83	275,972.78	156,464.05	56.6%
1918.....	460,082.87	331,724.00	128,358.87	38.7%
1919.....	583,430.93	443,091.00	140,339.93	31.7%
1920 Est'd...	733,763.01	445,000.00	288,763.01	64.9%
TOTAL.....	$2,553,688.81	$1,720,819.16	$832,869.65	47.8%

The Civic Car Lines have been handicapped in their financial management by insufficient fares and by the lack of through connections. The recommendation of the Commissioner of Finance and the Commissioner of Works that fares be increased to an economic charge was not adopted by the civic administration.

The Financial Results of Operating the Civic Abattoir

From 1916 to 1920, Inclusive.

Year	Expenditures (Including Debt Charges)	Income	Loss	
			Amount	
1916	$274,109.08	$240,114.73	$ 33,994.35	
1917	133,810.67	108,700.00	25,110.67	
1918	122,430.43	85,516.00	36,914.43	
1919	137,141.42	132,096.00	5,045.42	
1920 Estimated	161,770.74	130,000.00	31,770.74	
TOTAL	$829,262.34	$696,426.73	$132,835.61	

This undertaking is not a monopoly and is, therefore, extremely difficult to operate under municipal ownership. Only the highest type of business management and *entire* divorce from the civic administration could make the Civic Abattoir permanently self-supporting.

No enterprise should be undertaken by a municipality unless its scope can be confined to the area of the municipality and its immediate vicinity. The element of risk in conducting a business involving operations in distant provinces or countries is too great for the taxpayers to assume. It is doubtful whether the taxpayers of a municipality should be held responsible, legally or morally, for "making good" deficits arising from services rendered outside the city and suburban limits to persons not citizens of the community.

The Financial Results of Operating the Canadian National Exhibition

From 1916 to 1920, Inclusive.

Year	Maintenance and Debt Charges Paid by City Directly	Less Payments from Exhibition Association (Excess of receipts over operating expenses)	Net Amount to be Paid out of City Revenues
1916	$111,266.44	$ 34,613.18	$ 76,653.26
1917	103,835.11	61,465.00	42,370.11
1918	120,074.44	90,598.00	29,476.44
1919	146,921.44	175,007.00	28,085.56*
1920 Estimated	162,741.26	100,000.00	62,741.26
TOTAL	$644,838.69	$461,683.18	$183,155.51

*Excess of receipts over year's operating expenses.

The Canadian National Exhibition is not merely a business venture. It is a huge educational establishment of which the schools and the community in general should make more extensive and intensive use. If the Exhibition can be made to pay, well and good. *It has been done and will be done again.* But if, in spite of excellent management, there should be a deficit, this should be balanced against its unseen educational results. The main thing is to show the deficits when they occur. The public will not begrudge the necessary money, when they are assured of value received. The achievement of the management in running the Exhibition, in 1919, at a profit, which was properly limited to a comparatively small figure, is one which should receive the fullest recognition of the citizens generally.

The Financial Results of Operating the Toronto Water Works

From 1916 to 1920, Inclusive.

Year	Expenditure (Including Debt Charges)	Income	Profit	
			Amount	% of Income
1916.....	$1,737,824.68	$1,784,403.43	$ 46,578.75	2.6%
1917.....	1,749,576.09	2,017,486.00	267,909.91	13.3%
1918.....	1,901,465.75	2,448,081.69	546,615.94	22.3%
1919.....	2,049,698.20	2,616,530.78	566,832.58	21.6%
1920 Est'd...	2,705,133.00	2,840,066.00	134,933.00	4.8%

During the above period the Water Works has shown a yearly profit on its operation. A large portion of its revenue is obtained by way of taxes, through the annual charges made to the Fire Department for "Water for Fire Protection." A full discussion of these charges follows. The question of the advisability of total metering of water services for Toronto and its relation to Water Works operation is also discussed under the heading of "Water Waste."

The Civic Water Works Division is so vitally important to the welfare of the city that a printed annual report on its operations should be issued. Such a report could be so written as to secure the interest and co-operation of the citizens in cutting down costs.

WATER WASTE

Its Effects and Its Prevention

Water Waste*—Its Effects and Its Prevention

General.

Toronto citizens may justly take pride in the quality of the drinking water supplied to them. Can they, however, point with equal pride to their lack of wastefulness in their use of such water? What percentage of the domestic consumers adopt the attitude expressed in the following sentiment: "Oh, let the water run! There's plenty more in the Lake and the amount wasted has no bearing on my water account—I pay on a flat rate."

Is it realized by the majority of Toronto's citizens that every leak not remedied, that every careless waste, adds to the total cost of operation—since it costs the same amount of money to pump, filter and chlorinate water, whether it is used or wasted—and that, in the end, every consumer is penalized?

This short study of water waste has been conducted from the outside and no actual tests have been made of the extent of water waste in Toronto. However, by gathering statistics from other cities where the problem has been given serious study and attention, and comparing Toronto's consumption of water with these cities and with some accepted standards, an idea is gained of just how much might be saved in Toronto if effective steps were taken to prevent water waste.

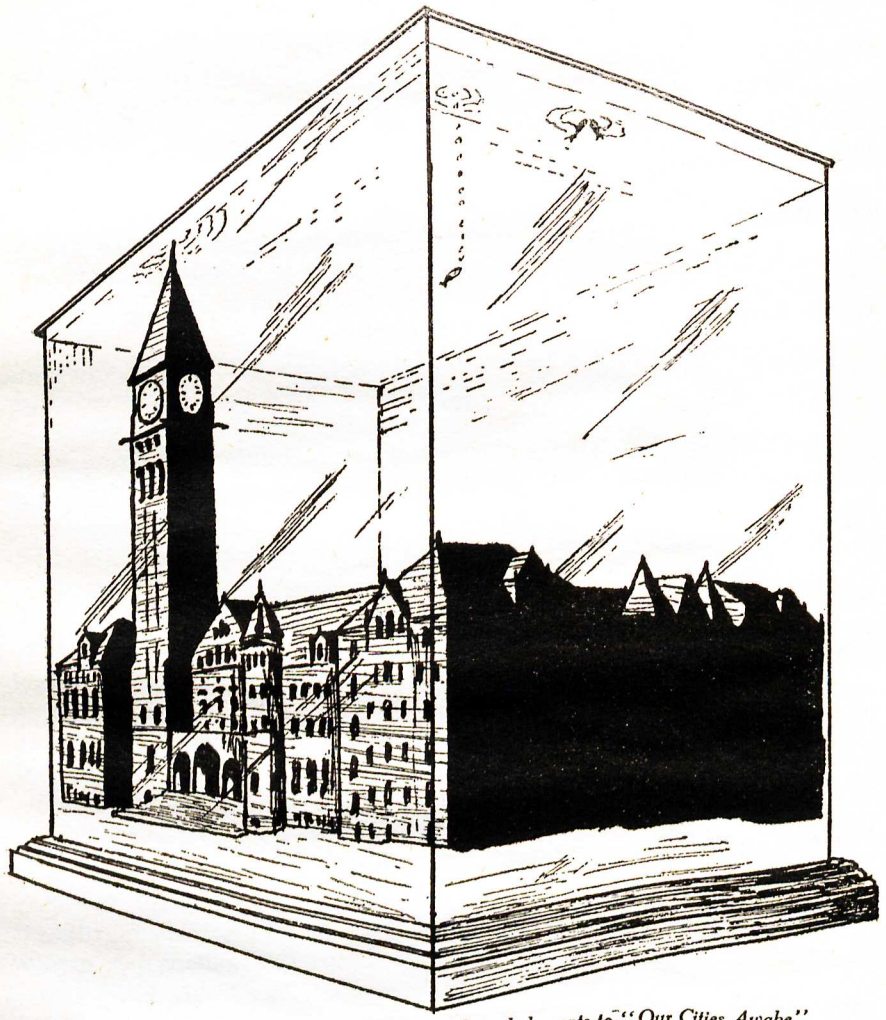
Toronto's Water Consumption.

In 1918, the total consumption of water in Toronto was 22,893,660,000 gallons†. The year's pumpage, had it been confined to a level area equal to Toronto's land area within the city limits (not including the Island) would have covered it to a depth of about 4¼ feet. In 1918, there was an average daily consumption of 62,722,355 gallons. If this latter amount of water were enclosed in a case on the foundations of the City Hall buildings, it would reach to the height of about 123 feet, or a 60-hours' average consumption, in such case, would submerge the building, as shown in the illustration. While Toronto's average daily per capita consumption was but 99.1 gallons in 1911, it gradually rose until in 1918 it amounted to 128 gallons per capita. This is an increase of 29.2% for that period. (See Table I.).

*In this study, "water waste" means not only the water lost through leaky mains, pipes, taps, etc., but also that lost through consumers carelessly using more than their requirements necessitate.

†Wherever gallons are mentioned in this study, Imperial gallons are meant unless U.S. gallons are specifically stated.

TORONTO'S WATER CONSUMPTION



With Acknowledgments to "Our Cities Awake" —Cooke

Every 60 hours—
the people of Toronto, in 1918, consumed a quantity of water sufficient to completely fill a case large enough to enclose the City Hall.

Table I.

How the Per Capita Consumption of Water has Risen in Toronto—1911-1918.

Year	Total Consumption (Gallons)	% of Yearly Increase	Average Daily Consumption of Water (Gallons)	Per Capita Consumption (Gallons)
1911.....	15,377,990,439	.....	42,131,637	99.1
1912.....	17,177,380,000	11.70%	46,930,000	112.4
1913.....	17,530,410,000	2.05%	48,028,000	108
1914.....	18,370,643,457	4.79%	50,305,300	107
1915.....	17,567,290,000	−4.37%	48,100,000	104
1916.....	18,285,870,000	4.09%	49,960,000	108.5
1917.....	20,353,310,000	11.30%	55,762,493	117.7
1918.....	22,893,660,000	12.48%	62,722,355	128
Total Increase 1918 over 1911	7,515,669,561 gallons	48.87%	20,590,718 gallons	28.9 gals. or 29.2%

How Toronto's Consumption of Water Compares with Other Cities.

Table II. sets forth the water consumption of various cities in Canada and the United States in 1917. The following three cities had a larger daily average per capita consumption than Toronto:

Buffalo.....276 Imperial gallons per capita daily
Ottawa.....206.1 " " " " "
Vancouver.....200 " " " " "

According to the 1918 Report of the Water Commissioner of Buffalo, the water consumption there is more than double what it should be and a campaign has been inaugurated, with considerable success, to lessen the consumption. Ottawa has also taken steps in that direction. In Vancouver, where the water is supplied by gravity, the loss occasioned by wastage is apparently not of sufficient importance to cause action to be taken. Hamilton and Detroit have a per capita consumption on about a par with that of Toronto. The other eleven cities mentioned in Table II. have an average daily per capita consumption ranging from 40 to 112.5 gallons.

Some Standards of Water Consumption.

No one absolute standard of the minimum amount of water which should suffice the citizens can be set for all cities. A great deal depends on whether or not a city is of a residential or industrial character and, if the latter, on the class of industry which predominates therein. However, a certain maximum standard of consumption can be arrived

TABLE II—Water Consumption Statistics in Relation to Metering. Canadian and American Cities—1917-18.

City	Population	Total Number of Services Metered	% of Services Metered	% of Consumption Metered	% of Revenue From Metered Services	Total No. of Gals. (Imp.) Consumed Daily	Average Per Capita Daily Consump'n	Did Meters Increase Receipts	Did Meters Reduce Consump'n
Buffalo	495,720	5,000 All Industrial	6.6	31.0	43.4	139,308,333	(Imp. gals.) 276.	More of a constant inspector than revenue producer.	
Cleveland	800,000	99,717	100.0	.....	.....	96,000,000	96.6	No	Yes
Cincinnati	420,000	54,214	71.0	49.55	86.1	46,109,480	110.	.....	Yes
Detroit	808,327	94,630	62.5	54.9	76.8	120,586,674	127.	.....	.....
Edmonton	60,000	.....	80.0	.....	.....	5,500,000	91.	Yes	Yes ¾ of a mill. per day
Hamilton	107,832	Only	large	consumers	metered	13,689,012	127.8	Yes	Yes
Milwaukee	450,000	65,000	99.0	.....	94.43	49,598,674	97.5	Yes	Yes
Minneapolis	366,581	.....	98.0	.....	.....	25,000,000	68.3	.....	Yes
Kansas City	384,750	39,478	80.0	.....	.....	28,333,333	73.3	Yes	Yes
Ottawa	101,549	264	1.06	9.58	.....	20,938,162	206.1	.....	.....
Providence	284,400	30,583	93.0	.....	.....	17,390,451	52.7	Meters installed at commencement of operations 47 y'rs ago	
St. Louis	765,000	8,505	7.2	29.6	39.5	86,963,279	112.5	.....	.....
Seattle	366,445	.....	98.	.....	.....	26,666,000	72.8	Yes	Yes
San Francisco	445,000	.....	75.	.....	.....	33,330,000	66.7	Yes $3,000 per month.	Yes reduced 4 million gals. daily.
Toledo	241,100	38,854	96.8	94.2	89.	16,962,170	71.	Yes	Yes
Winnipeg	183,595	.....	100.	.....	.....	8,000,000	40.	Yes by locating excess.	Yes
Vancouver	102,550	1,777	10.	.....	.....	20,510,000	200.	.....	.....
Toronto	473,820	3,566	3.	31.	.....	55,762,439	117.1	Yes & No It depends upon the purpose for which water is required.	Too small a number ,to make any difference.

at and when a city's average per capita daily consumption passes such maximum it may be considered that water waste is taking place. The following has been set forth by Edward H. Wall, Water Commissioner, St. Louis, as a standard and it is considered by many a liberal one:

For domestic use	34 gallons per capita per day.
For public purposes	10 " " " "
For commercial use	38 " " " "
For unavoidable waste	9 " " " "
	91 gallons

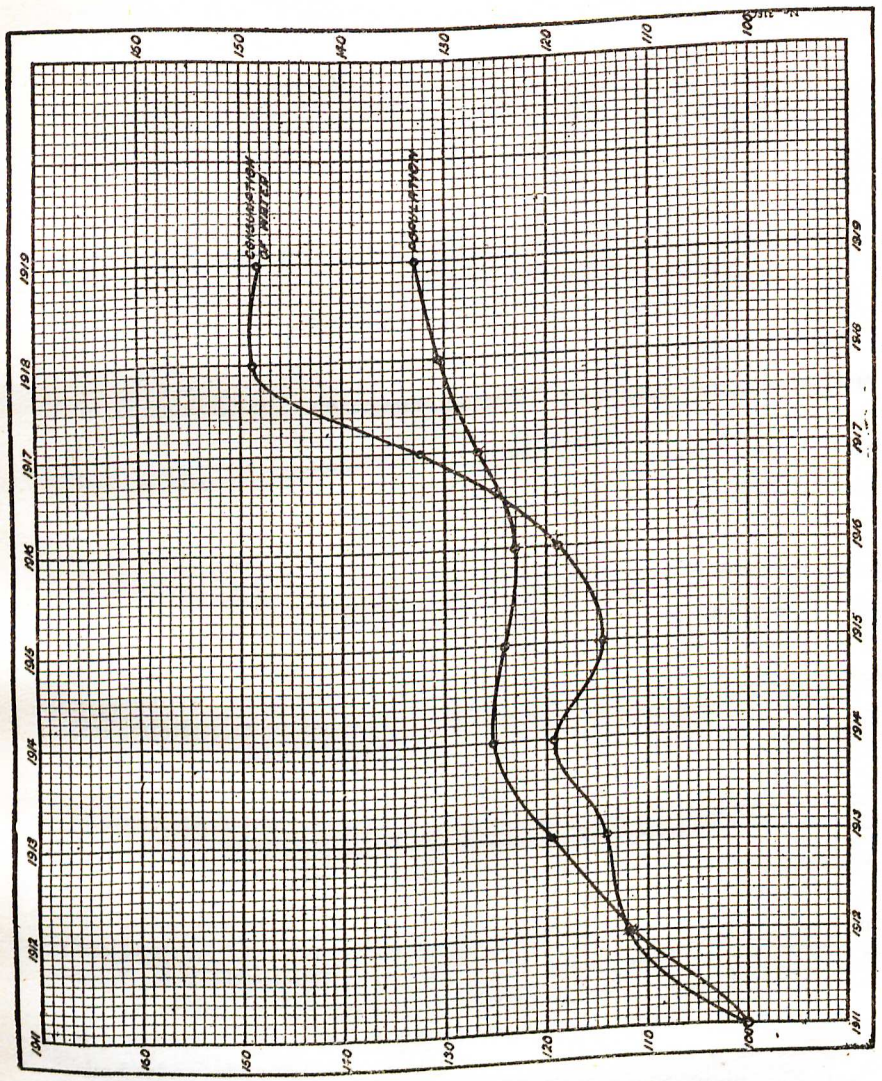
In Table II. the cities having over 80% of metered services have an average per capita daily consumption ranging from 68.3 to 97.5 gallons, with an average for all of about 85 gallons.

In such a large industrial city as Cleveland, Ohio, the average daily per capita consumption was but 96.6 gallons in 1918.

In view of these facts, the Bureau has taken 100 gallons as an average per capita daily consumption which should satisfy all needs in Toronto, and considers that all over that amount is preventable waste.

Toronto's Water Waste in 1918.

If we take the average amount required for a daily per capita supply in Toronto as 100 Imperial gallons, the total amount of water waste per capita in Toronto in 1918 was 28 Imperial gallons, or 5,004,539,820 gallons for the year. This is about two and one-half times the amount of water it took to supply the citizens of Edmonton in 1917, a city with an estimated population of 60,000. On the basis that it cost about 8.37c per 1000 gallons to supply water to the consumers in 1918, this water wastage costs the citizens $418,870. It would not, however, be fair to estimate the loss on this basis. If the existing system can supply the standard amount plus the wastage without requiring any additions, the total cost of pumping per 1000 gallons can scarcely said to have been saved, since it requires almost the same force to operate the plant whether it is working at two-thirds or full capacity, and, irrespective of pumpage, interest on bonds accrues. A saving due to a lessening of wear and tear and upkeep of equipment is made, however, and if a plant is nearing the state where duplication will be necessary in order to give an adequate supply, as is stated to be the case in Toronto, a large proportion of this amount would be a direct saving.



Cumulative Curve Showing the Relation Between the Growth of the City's Population and the Total Water Consumption, since 1910.

NOTE.—Population and water consumption for 1910 taken as 100.

A saving in fuel is also effected. At least 7,500 tons of coal, or their equivalent in electrical energy, were used in pumping the amount of water estimated above as wasted. At a time when the coal and power shortage is creating considerable anxiety in industrial life, this is a serious economic waste.

The Effects of Water Waste.

If no steps are taken to prevent water waste, the following are bound to be some of the results:

1. It creates a never-ending race between the increasing wastage and the building of new plant and purchasing of new equipment to take care of such wastage in addition to legitimate consumption.
2. It increases the cost of each individual's water supply, either through increased rates or by contribution via the tax-rate.
3. It works an injustice by making the careful water consumer share equally the loss created by the less careful consumer. This reason in itself is a sufficient one to require an effort to reduce water wastage to a minimum or to make the careless consumer bear the cost of his carelessness.
4. The excess use of water creates excess sewage which must be taken care of at the sewage disposal plant, and therefore increases the capital and operating costs of sewage disposal.

How Waste can be Prevented.

The waste which goes on in any system may be roughly divided into two sections:

1. The waste due to slippage in the pumps, leaks in the mains, imperfect joints, etc., before the water reaches the consumers' premises;
2. Loss of water on the consumers' premises, due to leaky pipes or plumbing fixtures or water wasted by the consumer through carelessness and shiftlessness.

Most of the physical waste in any system can be stopped if the proper means are taken.

1—*Waste Due to Inefficiency of Plant.*

The waste by reason of the first cause can only be stopped by a systematic and continuous survey of the entire distribution system. If the slippage of pumps is excessive (and 3% is considered the maximum

to be allowed in this respect by most water operators), the valves should at once receive attention. In order to do this, of course, there must be sufficient pumping machinery to allow of shut downs for repairs. Leaks in mains, etc., may be located by Pitometer Surveys, such as were made in Toronto in 1911. The Department has apparatus for making a continuous survey and while, owing to shorthandedness, the greatest possible use has not been made of it, the Bureau understands that in future this will be remedied.

The Pitometer Survey of 1911, according to the City Engineer's Report of that year, showed that "practically 95% of the leakage was in houses, and was due to leaky fixtures, wilful waste or carelessness, and only about 5% in mains and service to stop cocks." It would seem, therefore, that the most important water waste in Toronto is caused by the citizens and not through any carelessness or inefficiency on the part of the Water Works Division.

2—*Waste Due to Consumer.*

There are two methods of stopping the waste on the consumers' premises. The first is by a continuous house-to-house inspection and the second by the universal metering of services. While the advantages of the latter over the former have been frequently set forth and have become generally recognized, it might be well to enumerate a few of such advantages here:

(a) The results obtained by an inspection can only be temporary, since pipes and faucets may be in good condition at the time of the visit and spring a leak five minutes afterwards. Irregular waste is probably not in view when the inspector calls. Meters, on the other hand, are on the job all the time.

(b) Inspectors, no matter how careful, might overlook some leaks. It is impossible for a meter to do so.

(c) Inspectors entering houses on such a mission may create hostility in a country where "every man's home is his castle." A meter does its work unobtrusively, but thoroughly.

(d) An inspector requires rigid enforcement of the penalty in order to do effective work. Meters supply their own penalty.

(e) There are at present 13 inspectors in Toronto who deliver bills, etc., and have a limited time in which to make house-to-house inspections. Under these conditions, it takes from four to five years to make a thorough inspection of the city and much revenue may be lost through oversight on the part of consumers in reporting the number of conveniences on which the present flat rate is based. Meters register such conveniences automatically.

(f) The operation costs of each service are about equal.

The City Engineer of Toronto in his report in 1911 said: "That this waste in houses can only be stopped by the installation of meters is the opinion of all water works men who have given the subject consideration.....No amount of inspection can put a stop to wilful waste."

The Board of Commissioners, Toronto Water Works, in their 1912 Report, said, regarding water waste prevention:

> "The problem of waste prevention by the installation of meters and efficient inspection has not been considered in detail by this Board so far as Toronto is concerned.....It is concluded, however, from the experience of this Board, that the general metering of the domestic supply with a minimum charge for each service would reduce the per capita consumption by approximately one-third and that the cost of installing the meters would be more than compensated for by the reduction in the cost of delivery. Furthermore, the existing plant could be made to supply a third more population than at present."

The Effect of Metering in Other Cities.

A reference to Table II. shows that where the percentage of metered services is high, the per capita daily average consumption is relatively low, and in no case where such percentage is 80% or over does the said consumption reach 100 gallons. Take, for instance, Cleveland and Detroit with practically the same population and both large industrial centres. Cleveland, 100% metered, had an average per capita daily consumption of 96.6 gallons. Detroit, with 62.5% of services metered, had an average daily per capita consumption of 127 gallons. Take also the cases of Seattle and Vancouver—both supplying water under similar conditions by the gravity method—Seattle, 98% metered, had an average daily per capita consumption of 72.8 gallons, while Vancouver, 10% metered, had an average daily per capita consumption of 200 gallons. Winnipeg, 100% metered, had an average daily per capita consumption of 40 gallons, while Ottawa, 1.09% metered, had a daily average per capita consumption of 206.1 gallons. This latter, however, is scarcely a fair comparison, since Winnipeg restricted, at least previous to the completion of the present source of supply, the use of water by its method of levying water rates.

The experience of the cities in Massachusetts State, supplied by the Metropolitan Water Works, is illustrative of the effect of metering on the average daily per capita consumption of water. In 1907, the Massachusetts Legislature passed an Act which provided that after January 1st, 1908, all cities and towns which derived their source of supply from the Metropolitan Water Works should equip all new service pipes with water meters and should also equip annually with meters 5% of the services that were unmetered on December 31st, 1907. The effect of the Act is shown in the following table:

City	Percent of Services Metered		Average Daily per Capita Consumption Gallons (U.S.)	
	1907	1916	1907	1916
Arlington	33.6%	100.0%	91	59
Belmont	100.0%	100.0%	68	52
Boston	5.5%	53.2%	153	105
Chelsea	14.6%	99.7%	97	68
Everett	2.0%	50.0%	82	74
Lexington	2.1%	92.0%	69	69
Malden	93.6%	95.5%	46	49
Medford	10.5%	100.0%	102	46
Melrose	3.9%	100.0%	117	45
Milton	100.0%	100.0%	46	42
Nahant	17.2%	64.1%	130	110
Quincy	14.2%	88.6%	100	59
Revere	4.8%	70.8%	82	59
Somerville	24.6%	69.2%	90	69
Stoneham	1.9%	98.5%	91	58
Swampscott	37.8%	100.0%	85	59
Watertown	98.3%	100.0%	67	65
Winthrop	2.3%	100.0%	105	53
Average for District	14.7%	66.8%	130	89

That is, during this period the percentage of services metered in the district rose from 14.7% to 66.8%, while the average daily per capita consumption fell from 130 to 89 gallons (American).

Recently, also, Mr. W. R. Hill, Consulting Engineer of Albany, N.Y., set out to find the effect of meters upon the consumption of water. A questionnaire was sent out to nearly 100 cities, 68 of which returned the questionnaire filled in. In order to make a reliable comparison of the influence of the use of meters, the 68 cities were divided into groups, in accordance with the quantity of water consumed per capita

per day. Putting the cities into groups combined all the local circumstances which effected the consumption of water and made the conditions more general. The result is shown below:

TABLE III.

Effect of Metering on Water Consumption in 68 American Cities, as Set Out by W. R. Hill, Albany, N.Y.

Group	No. of Cities	Population	Daily Consumption—Gals. (U. S.)			No. of		% of Service Metered
			Total Amount in Millions	Per Capita Range	Average	Services	Meters	
1	4	379,198	18.6	45— 55	49	43,502	41,109	94
2	8	1,307,341	85.88	56— 70	66	193,057	173,410	89
3	8	926,252	71.23	71— 80	77	149,781	122,165	81
4	13	1,096,729	97.03	81— 95	88	170,882	128,571	75
5	7	1,083,068	112.33	96—110	104	180,039	125,271	69
6	7	1,408,465	159.74	111—120	113	238,291	144,497	60
7	8	1,588,716	203.72	121—130	128	271,327	64,266	24
8	9	1,491,518	206.49	131—150	138	291,517	55,450	19
9	4	1,993,951	351.66	151—200	176	432,583	76,100	17
	68	11,275,238	1,306.68	45—200	116	1,970,979	930,839	47

Note the uniformity of the decrease in per capita consumption with the increase in services metered.

Opinions on Metering as Expressed by the Heads of Some of the Larger Water Works Systems in America:

J. T. Morton, Commissioner of Water, Cleveland, Ohio, which is 100% metered, says:

> "In the first place, the pumping and distribution of water for Cleveland is almost identical with the problem you have in Toronto. We are both located in close proximity to the Lake. It was hard to convince the people of Cleveland that with water so handy they should be prevented from using all they cared to. The facts were that, in 1901, the year that Cleveland decided to install the meters, the per capita consumption was 194* (U. S.) gallons per day. In 1910 when the city had been fully metered, the per

*One Imperial gallon equals 1.2 U. S. gallons, so amount used would be 162 and 90 Imperial gallons respectively, and a saving of 72 Imperial gallons per day per capita.

capita consumption was reduced to 108 (U.S.) gallons daily. This means a saving of 86 (U.S.) gallons per day for each inhabitant of the city. In other words, practically 45% of the water pumped at the pumping station had been wasted. If that percentage still maintained in the City of Cleveland and we have every reason to suppose it would, without the use of meters, it would mean an additional cost to us for operating of $350.00 per day at the present price of power, and would require an additional capital expenditure of about $9,000,000. So you see there are two wastes: one a waste in operation, and the other, a waste in unnecessary addition to the plant.

We heartily recommend the use of meters, which we know will do away with this unnecessary waste."

Geo. C. Andrews, Water Commissioner of Buffalo, N.Y., says:

"Theoretically, the proper way to sell water is by measure, the same as gas, electricity or any other commodity which costs money to produce or distribute. Practically, it is hard to introduce the use of meters in some localities.....The universal metering of Buffalo has been prevented by two considerations:

1. Popular prejudice against meters, on the ground that they increase water bills;
2. That the universal use of meters on the old meter rate would have resulted in a decided decrease in the receipts of the department.

.....In my opinion a meter on a house service serves more the purpose of a constant inspector than that of a revenue producer. Were it possible to make a daily inspection of every service, meters would be unnecessary for the ordinary dwelling, but the meter will do the same work at a much lower cost."

H. H. Frost, Superintendent, Akron Water Works, says:

"I am decidedly in favor of having all water services metered for the following reasons:

Everybody is put on the same basis as regards the payment of service rendered. In other words, a man pays for what he receives. On a flat rate basis a careful man is forced to pay for what another consumer may waste.

By using this means (water meters) for conserving water, it enables one in a great many cases to put off further additions and extensions to supply pumping, filtering and distributing capacities.

During 1918 our consumers increased 11%, while our consumption increased only 6%, due to the fact that we set 5,500 meters in 1918."

H. P. Bohmann, Supt. of Water Works, Milwaukee, says:

"The general introduction of water meters in the City of Milwaukee started a little over three years ago.....If it were optional with the consumer, I feel that it would be very difficult to find a single consumer who would care to go back to the annual unmetered rates.

.....There is no necessity for anyone to skimp in the liberal use of water as long as the plumbing is kept in good condition, and there is no wilful wastage of large volumes of water. Many commodities which were formerly sold by the month or week, such as ice, are now sold by a unit of measure. Why not water? Under metered service each consumer pays his proper share, as shown by the meter. It is clearly a business proposition."

Edward E. Wall, Water Commissioner, St. Louis, says:

"In my opinion there is no longer any rational ground for argument, about the wisdom of measuring water supplied to consumers. It is the only equitable method by which the transaction between the water works and the consumer can be carried out. All other methods are bound to result in injustice to both parties in individual cases."

The Arguments Against Meters

The arguments usually used against metering are as follows:

1. That water charges to consumers are increased;
2. That consumers are apt to restrict the use of water over what is really required in order to keep their water rates low;
3. That the cost of installation and upkeep of meters is greater than the policy of keeping the domestic consumers on a flat rate, and taking care of increased consumption by frequent additions to the Water Works plant.

While the examples and experiences given above refute these objections, it is probably worth while to examine them in more detail.

1. The first objection may have some justification in individual cases, but such cases depend altogether on the policy in connection with the installation of meters and the fixing of water rates under the meter system, and, in some instances, on the habits of individual consumers. The fact that meters have been installed will not increase costs of water works operation, in fact a saving will be made. Therefore, average consumers will not be required to pay more. Careless consumers, however, will pay in proportion to their carelessness, while careful consumers will be rewarded and pay only for what they *use*.

2. The second objection has been found to be without foundation by those cities which have tried universal metering. Water is supplied at such reasonable rates that no legitimate use of the same is restricted. The adoption of a minimum rate, such as gas and electrical companies use, takes care that no one skimps the use of water to such a degree that sanitation is endangered.

The Board of Commissioners, Toronto Water Works, in their 1912 Report stated: "The argument that meters restrict the use of water has proven fallacious from experience and may be dismissed."

3. The real argument then is that the capital outlay required to purchase meters and that their annual maintenance charges are greater than the saving that would be made from their installation. On page 9 of the 1912 Report of the Board of Commissioners, Toronto Water Works, this question was dealt with in some detail and the conclusion was: "The general adoption of meters in the city of Toronto would probably result in a saving of $200,000 per annum."

While the cost of meters and their maintenance have both increased since that time, on the other hand, costs of operation of Water Works Plant, as well as costs of material for additions to plant and the average daily per capita consumption, have also increased. Thus there is no reason to believe that the annual saving to the city, due to unniversal installation of meters, would be any less now than in 1912.

The Detroit Board of Commissioners in their report for 1918, in this connection, figured out that on a basis of actual pumping costs, and on account of the saving in interest and sinking funds on construction work made unnecessary through reduced consumption due to meters

set since 1912 (about 65,000 in number, or 62.5% of total services), an annual saving of at least $122,000 was effected. This estimate was made in a very conservative manner and would appear to substantiate the above figure of $200,000 for Toronto if total metering of services was enforced.

Conclusion

The Bureau recommends that in order to prevent the present wastage of water, universal metering of water service be adopted by the City of Toronto and that in carrying out the policy the following points be considered:

1. That a date be set by which time the policy will have been completely carried into effect.
2. That the city be divided into districts and each district completely metered before another is begun.
3. That notice be given the consumer of intention to install meters at least one month before such installation, so that plumbing can be inspected and repairs made before meters are installed. This would forestall any prejudice which might be engendered on the part of the consumer, on account of these defects causing high water bills as soon as the meter was installed.
4. That all meters be owned by the city and installed and maintained free of direct expense to consumers.
5. That no free water be furnished under any circumstances to any individual, corporation or municipal department.
6. That a minimum charge be made, which should be high enough to encourage the use of all the water which health and comfort call for, and that meter rates should be based on a fair cost of service and the effort should be made to so adjust them that each consumer, *large or small,* shall pay his fair proportion of that cost and no more.

   Failure to establish proper meter rates may either operate to defeat the purpose of the meter as a means of checking waste, or may reduce the revenue from the water works system below a fair amount, or both.

The effects of metering, as well as the total capacity of the existing filtration plant, should be taken into consideration when deciding when the proposed duplicate pumping station should be built, and where it should be located.

WATER FOR FIRE PROTECTION

Its Cost

Water for Fire Protection—Its Cost

General.

What proportion of the total cost of supplying water in any municipality is justly chargeable to "Fire Protection"? This is a question which has been much discussed in recent years, both in Canada and the United States. The amounts charged in Toronto by the Water Works Division to the Fire Department, for "water for fire protection," since the year 1915, have been such as to cause considerable comment.

With a view to throwing some light on the equity of such charges, the Bureau collected information in this connection from a number of the cities on this continent and the replies received are tabulated herein. Authorities on this point are also quoted, and the method in vogue in Toronto is explained in order that the citizens may form their own conclusions regarding the fairness of the amounts now charged in Toronto. No attempt has been made to treat the subject from a technical point of view. The information given in the tables is for the years 1917-18, since uniformity was desired and this was the latest material available in a considerable number of cities.

The Services Performed by a Water Works System.

In a sense, the Water Works of any city may be said to have been constructed for three purposes:

1—To provide water for drinking, manufacturing and other private uses;

2—To furnish water for public use on streets and for sewers, public buildings, etc.;

3—To provide water for fire protection.

The first and second purposes may be classed together as there is little difference between the services performed, and the amount of water required for such services can be calculated with a fair degree of accuracy. The third service performed, namely, providing water for fire protection, however, is on a different plane and, while the quantity of water used during the whole year may be small, the cost of being constantly prepared to supply large quantities for this purpose may be exceedingly large in proportion to the total cost of operation. The problem is to decide the relation of this cost to the total cost of operation.

Some Standards for Judging the Relation of the Cost of Providing Water for Fire Protection to That of Cost of Water Works System.

The standards for judging the cost of supplying water for fire protection are many and varied. Most authorities, however, are agreed on the point that *the population and size of the community to be served are extremely important factors in working out this amount.* This has been well stated in an article in the "American City," by H. M. Blomquist, Principal Assistant Engineer, Bureau of Water, St. Paul, Minn.:

> "In a large city the requirements for fire protection do not play as great a part relatively in the design of a system as they do in a small city, except in certain details, such as fire hydrants, the size of mains and to some extent the capacity of the pumping equipment, because in a large city the requirements for private and public use are usually very large and constitute the greater portion of the total capacity that must be provided. In smaller cities, except the source of supply, as far as construction is concerned, the fire protection requirements determine nearly all the important features, and include the pressure, the size of the storage reservoir, the size of mains, and the pumping plant. These portions of the plant could be made much smaller and much less expensive were it not for the fire protection requirements."

The National Board of Fire Underwriters of the United States have worked out an estimate of the percentage of the entire cost of the Water Works plant chargeable to fire protection, on the basis of population, as follows:

In a municipality of 10,000 population	60%
In a municipality of 50,000 population	32%
Larger cities, over 100,000	10 to 20%
In a municipality of 300,000 population	13%

Messrs. Metcalfe, Kuichling & Hawley, in their paper on "Reasonable Return for Fire Hydrant Service" (American Water Works Proceedings, 1911, page 66) estimate the proportion on this basis:

Community with population less than 5,000	60 to 80%
Community with population of 100,000	20 to 30%
In a municipality of 100,000 population	23%

The following is quoted from the article referred to above:

"The investigation of the cost of furnishing fire protection to a section of Greater New York for a population of about 400,000 people, using an average daily supply of 38,000,000 (U.S.) gallons of water served by a private water company, showed that only *3 per cent.* of the total investment and *15 per cent.* of the operating expenses were attributable to fire protection, but with allowance for depreciation and interest on investment, the cost of fire protection was found to be approximately *21 per cent. of the total cost of furnishing water by this company.*"

In his paper, Mr. Blomquist concludes:

The approximate cost of fire protection consists of the following items:

1. The interest on the additional investment necessary in the water work plant, by reason of the increased amount of construction required to supply water for fire protection purposes;
2. The maintenance of this portion of the plant;
3. A certain amount of the attendant and inspection charges necessary in order to have the plant ready for operation at all times, day or night, which otherwise would not be necessary, especially if sufficient storage is provided for ordinary consumption.

How the Charges Made by the Water Works of Toronto for Water for Fire Protection Compare With the Above Estimates.

Up to and including the year 1911, the charges of the Water Works to the Fire Department for water for fire protection in Toronto were made on the basis of a flat charge of $15.00 per hydrant per annum. In 1912 this charge was increased to $30.00 per hydrant per annum, and continued on this basis until 1915 when a new plant for proportioning these charges was put into operation. This plan, which will be explained in detail later in this report, greatly increased these charges. Table I. below shows the total cost of operation of the Water Works of Toronto, 1910-1920, including Debt Charges (but not operation or debt charges on account of the High Pressure System), and the relation of such operation cost, on a percentage basis, to the charges to the Fire Department for water for fire protection.

Table I.

The Relation of the Charges for Water for Fire Protection to the Cost of Operation of the Water Works.—1910-1920.

Year	Population	Amount charged by W.W. Dept. to Fire Dept. for Water for Fire Protection*	Total cost of Operation of Water Wks. (Including Debt Charges)*	Percentage of W.W. Operat'g Costs Charged to Fire Dept.
1910.....	341,991	$ 65,175.00	$ 736,552.00	8.8%
1911.....	374,667	71,925.00	778,592.00	9.2%
1912.....	417,250	157,950.00	1,101,356.00	14.3%
1913.....	445,575	176,460.00	1,227,060.00	14.4%
1914.....	470,144	183,210.00	1,524,130.00	12.02%
1915.....	463,705	498,505.00	1,318,092.00	37.8%
1916.....	460,526	620,672.00	1,737,825.00	35.7%
1917.....	473,829	734,209.00	1,749,576.00	41.9%
1918.....	489,681	697,690.00	1,901,466.00	36.7%
1919.....	499,273	712,756.00	2,049,698.00	34.8%
1920 Est'd.	515,000	826,133.00	2,705,133.00	30.5%

*Operation Costs and Debt Charges on account of High Pressure System have been excluded in these calculations.

It will be seen from this table that, in 1910, when the charges to the Fire Department were on the basis of $15.00 per hydrant per annum, the percentage of such charge to the total cost of operation was 8.8%. This was increased to 14.4% when such charges were raised in 1912, and to about 38% of the total in 1915, when the charge for water for fire protection was made up on the new basis. It will be noticed that the highest percentage was in 1917 (41.9%), but that it has steadily declined until at present the percentage is lower than at any time since 1914. It will also be noticed that all of these percentages since 1914 are greater than those given as a result of the New York investigation, where the water was furnished by a private company and where the population was smaller than the one supplied in these years in Toronto. The average daily consumption in Toronto for each year since 1915 has been:

1915 .....48,100,000 Imperial gallons
1916 .....49,960,000 Imperial gallons
1917 .....55,769,493 Imperial gallons
1918 .....62,722,355 Imperial gallons

The smallest of these amounts is about 50% greater than the amount supplied by the New York Company investigated.

How the Amount at Present Charged in Toronto for Water for Fire Protection is Arrived at.

As already stated, previous to 1915, the charges for water for fire protection were made up on a flat charge per hydrant per annum. In 1914, however, a Special Committee of Council for the Revision of Water Rates was appointed. In the report of this Committee the question of the amount which should be paid for water for fire protection was discussed and a change in the existing policy recommended. This recommendation was based on a suggestion of Alderman F. S. Spence and was concurred in by the present Commissioner of Works and the then City Treasurer. It was adopted by the City Council in March, 1915 and went into effect that year. The plan can best be explained by the following extracts from the Committee's Report:

"There has been much discussion as to a rational plan of dividing the cost of water service between the fire service and the general consumers.

In days gone by when water was usually supplied by companies instead of by a municipally-operated service, the tendency was to make a big amount look as small as possible, and it was easier for private companies to obtain contracts by offers that bore heavily on the small consumer, and cut proportionately the public charges that by themselves would have looked very large. This object was also aided by making the fire protection charge not one large sum, but setting it out in smaller amounts charged to separate hydrants. This was probably the origin of the hydrant plan of paying for fire protection, the absurdity of which will be manifest to any one who gives it a little attention.

Probably the method that is at once the simplest and fairest may be described as follows:

1. Take the full cost necessary for the construction of a water works system sufficient to supply the community with all services demanded, other than the special service of fire protection;
2. Take, similarly, the construction cost of a system sufficient to provide that community with fire protection of the effectiveness which it at present enjoys;
3. Add these two amounts together, obtaining a sum which, of course, will be very much in excess of the actual construction cost of the existing system, which cost is also carefully ascertained;
4. Then divide the actual cost of the existing system in the same proportion as the aggregate cost of the separate systems before mentioned would be divided between the general supply cost

and the fire protection. The result will be *the proportion of the construction cost fairly chargeable to each of the existing services.*

On a similar basis of equitable apportionment, the operating cost ought to be distributed, after charging independently to the general service such matters as filtration, which is not necessary for fire purposes, and charging to the fire service the high pressure expenditure which is not necessary for domestic purposes."

While this theory was accepted and presumably put into operation, it was found that in its practical application some modifications were necessary. The present method of arriving at the charges for water for fire protection is as follows: The cost of the existing combined water works system is analyzed according to the various elements of its make-up, such as water mains, pumping machinery, filtration plant, etc. These separate costs are divided into two parts according to the proportion which it is believed is necessitated by the requirements of the domestic service on the one hand, and the fire protection service, on the other. These various proportions are then added and the percentage each total is of the entire cost is worked out. The yearly cost of operation (including Debt Charges) is then divided on the basis of these percentages. This computation is made annually and does not take into consideration the High Pressure System, the operation cost of which is charged directly to the Fire Department. As an example of this method: If we call A, B, C, D, and E, the various elements of the existing plant, with a value of $3,000,000, $6,000,000, $4,000,000 $2,000,000 and $1,000,000, respectively, making a total value of $16,000,000, these separate costs might be proportioned in the following manner:

	Total Value	Proportion Necessitated by Domestic Service	Proportion Necessitated for Fire Protection
A.....	$3,000,000	$2,000,000	$1,000,000
B.....	6,000,000	3,000,000	3,000,000
C.....	4,000,000	2,500,000	1,500,000
D.....	2,000,000	2,000,000	.....
E.....	1,000,000	.....	1,000,000
	$16,000,000 100%	$9,500,000 60%	$6,500,000 40%

In this example, therefore, $9,500,000 or 60% of the total cost of the system is necessitated by the requirements of the domestic service and $6,500,000 or 40% by fire protection service. The total annual cost of operation, including debt charges, would then be divided in the proportion of 60:40, and the 40% would be charged to the Fire Department.

Toronto's Method of Distributing Charges for Water for Fire Protection Among the Citizens.

When the method of arriving at the amount to be charged for water for fire protection had been decided upon, in Toronto, the question arose as to the most equitable way of distributing such charges. The method described below, which was adopted and which is now in use, is fixed, the Commissioner of Works contends, on the proportion of value of such service to the respective property owners. To illustrate: If A owns fifty thousand dollars worth of property in Toronto, he enjoys fire protection on that amount. Further, he has the advantage of lower insurance rates (for which this service is responsible) on fifty thousand dollars worth of property. B owns twenty-five thousand dollars worth and C ten thousand dollars worth, and so on. It is evident that fire protection is of more value to A than to B, and again B enjoys greater protection than C, and so on, the value of this service to property owners varying according to their respective holdings.

The Assessment Department maintains machinery for determining the value of every citizen's holdings in Toronto. The respective amounts are ascertained and recorded on the assessment rolls for taxation purposes. Based on these figures, a tax-rate is struck which will net the city an amount sufficient to meet the needs of the various city services, less the amount raised by other channels of revenue, such as license fees, water rates, etc. Among the services paid for out of the general tax-rate is the fire protection service. In this, the part played by the Water Works Division is included. Thus, the expense of maintaining that service is met by the citizens at large in direct proportion to value received.

The High Pressure Fire Protection System and Its Relation to the Water Works.

In the calculation of the charges for water to the Fire Department in Table I. no account has been taken of the expenditure in connection with the High Pressure Fire Protection System in Toronto. This is a service installed for fire protection purposes only. The area served by the system covers three hundred acres extending from John Street, easterly to Jarvis Street, and from the water front to Queen Street, with a line up Terauley Street to Albert Street. A line also extends up Victoria Street to Shuter Street, from Queen, and westerly on Shuter to Yonge Street. The length of the mains laid amounts to 45,241 feet on which are located 146 hydrants. The Pump House for the system is situated at the foot of John Street, being an annex of the City Water

Works main pumping station. In the pumping station are installed two 1,000 horse-power Westinghouse-Parsons horizontal steam turbines, directly connected with two 2-stage five-million gallon turbine pumps.

The maximum pressure possible on the mains for fire purposes is 300 lbs. to the square inch and the normal pressure can be raised to this maximum in less than a minute.

The cost of installing the High Pressure System was approximately $784,000 which was charged to the city at large and not to the property directly benefited.

The costs of operation of the High Pressure Fire Protection System and the Debt Charges thereon since 1915 have been as follows:

Year	Operation High Pressure Fire Protection System	Debt Charges High Pressure System	Total Annual Cost of High Pressure System
1915.....	12,368.00	$24,478.00	$36,846.00
1916.....	12,000.00	24,478.00	36,478.00
1917.....	12,625.00	24,478.00	37,103.00
1918.....	12,284.00	29,331.00	41,615.00
1919.....	15,957.00	29,281.00	45,238.00
1920 Estimated.	19,051.00	24,131.00	43,182.00

The Debenture Debt due to the installation of the High Pressure System is not included in the Water Works Debenture Debt and the debt charges thereon are, therefore, not included in the cost of Water Works operation, but are paid by general taxation. The operation costs, while nominally in connection with the Water Works Division, are now also charged directly to the Fire Department, and paid by general taxation.

It would seem reasonable that the installation of a High Pressure Fire Protection System should lesssen, to some degree, the proportion of the other charges made for water for fire protection—not alone because the operation and maintenance of the high pressure system is charged directly to fire protection, but also because its installation protects the districts where conflagrations would be the most dangerous and hard to control, and therefore lessens the proportion of the general Water Works Plant required for Fire Protection Services.

The equipment necessary to take care of the requirements of the ordinary water supply for domestic and industrial services in a community having the large average daily consumption of Toronto—in 1918 this was 62,722,355 Imperial gallons—should be sufficient to cope

with the majority of fires in sections of the city other than special districts, such as those protected by the High Pressure System. In Toronto, however, the charges for water for fire protection are much greater than any other city mentioned below having a High Pressure System.

Of the sixteen cities, other than Toronto, which supplied information to the Bureau *re* High Pressure Systems, ten stated that they had a High Pressure or Auxiliary System. Of these, only five made any charges for water for fire protection, other than cost of operation of the High Pressure System, as follows:

Buffalo.....	$90,000—Based on a hydrant charge.
Providence.....	20,000—For Water used.
San Francisco (private).....	140,000—$30.00 per hydrant.
Winnipeg.....	70,650—$30.00 per hydrant.
Milwaukee.....	18,655—$5.00 per hydrant.
TORONTO.....	734,209

In Cleveland, Cincinnati, Detroit, Ottawa and Toledo, no charges are made.

Three out of six of the cities not having High Pressure Systems made charges to the Fire Department for water for fire protection, as follows:

Edmonton.....	$39,850—$50.00 per hydrant.
Hamilton.....	20,000—For Water used.
Seattle (gravity system).....	114,625—$12.00 per hydrant.

Kansas City, St. Louis and Vancouver report that no charges are made.

Other Cities and Their Charges for Water for Fire Protection.

While the fact that other cities on the continent may differ from Toronto in their method of arriving at the proper charges for water for fire protection does not, in any sense, indicate that the system in vogue here is an inequitable one, nevertheless, it is interesting to note what such charges are in other large Canadian and American cities, and the basis on which they are calculated.

Table II.—in two sections—sets out this information for seventeen cities, including Toronto. While so many elements enter into the cost of supplying water to the consumer, such as source of supply, method of distribution (i.e. pumping or gravity), treatment given, fuel costs, etc., that it is impossible to make an absolute comparison of water rates in one city with those in another, or to say definitely that any special factor has been the dominating influence in setting such price, nevertheless such comparison is interesting and illuminating.

TABLE II—Part I—Water Works Operation in Other Cities Compared with Toronto for Year 1917-18 in Relation to Charges Made for Water for Fire Protection,

City	Population	By Whom Owned	Water Works System		High Pressure Fire Protection System		Charges For Water For Fire Protection		
			Source of Water Supply	Supply Operations	Is one in Operation ?	By which department are costs borne?	Are any made to Fire Dept	On what basis made	Total amount of same
Buffalo	495,720	City	Lake Erie	Water pumped	Separate mains with fire tug supply system.	Fire Dept.	Yes	Hydrant chg.	$ 90,000
Cleveland	800,000	City	Lake Erie	" "	Yes	Fire Dept.	No.		
Cincinnati	420,000	City	Ohio River	Pumped and filtered..	Yes		No.		
Detroit	808,327	City	Detroit River	Pumped	Yes Fire tug supply system.	Fire Dept.	No		
Edmonton	60,000	City	Saskatchewan River	Pumped and filtered	No		Yes	$50 per hydrant	$ 39,850
Hamilton	107,832	City	Lake Ontario	Pumped	No		Yes	Lump sum charge	$ 20,000
Milwaukee	450,000	City	Lake Michigan	Pumped	Independent Fire Boat System	Fire Dept.	Yes	$5 hydrant rental	$ 18,655
Kansas City	384,750	City	Mississippi River	Pumped	No		No		
Ottawa	101,549	City	Ottawa River	High Lift Pump with gravity	Yes		No		
Providence	284,400	City	Pawtucket River	Pumped and filtered	Yes		Yes	For water used	$ 20,000
St. Louis	765,000	City	Mississippi River	Pumped and filtered	No		No		
Seattle	366,445	City	Lake Washington	Gravity—⅛ pumped	No		Yes	About $12 per hydrant	$ 114,625
San Francisco	445,000	Pte. Co'y		Gravity—½ pumped.	Yes	City at large	Yes	$30 per hydrant	$ 140,000
Toledo	241,100	City	Maumee River	Pumped and filtered	Yes	98% by property benefitted; 2% by city at large	No		
Winnipeg	183,595	City	Artesian Wells system	Pumped	Yes	Prop. benefitted	Yes	$30 per hydrant	$ 70,650
Vancouver	102,550	City	Capilano and Seymour Creeks	Gravity System	No		No		
Toronto	473,829	City	Lake Ontario	Pumped and filtered	Yes	Fire Dept.	Yes	(See Copy)	$ 734,209

TABLE II—Part 2—Water Works Operation in Other Cities Compared with Toronto for year 1917-18. Cost of Supplying Water, Water Rates and Financial Results of Operation.

City	Average Cost of Supplying Water to Consumer per 1,000 gallons (Imperial) See note K	Flat Rate, Eight-Room House With Average Conveniences.	Meter Rates per 1,000 Gallons (Imperial)	Financial Result of Operations Surplus—S. Deficit—D.
Buffalo	3.026c	$10. per annum (average)	4.8c	$54,841 S.
Cleveland	5.137c	None	6.41c	337,807 S.
Cincinnati	9.345c (7.976c in 1917)		16.03c	432,727 S.
Detroit	1.541c	$6.32 (Average)	Minimum charge $1 per quarter. From 8c to 5.6c	1,300,694 S.
Edmonton	18c			38,190 S.
Hamilton	5.202c	$10.60 based on assessed value of $5,000 house.	10c ordinary: 7½c manufacturers	206,954 S.
Milwaukee	2.788c	None	7.2c*	563,977 S.
Kansas City	7.324c †	$11.25 per annum	Minimum charge, 50c per month; Maximum, 29.93c; average, 16.82c; large consumers, 4.8c.	350,000 S.
Ottawa	4.88c	$14.00 per annum. Based on assessed value, $5,000 property	8c up to 2,000,000 gallons per year: 6c if greater than 2,000,000 per year.	14,959 S.
Providence	6.361c	$20.00 per annum	Up to 100,000 cu. ft. per quarter .....24c 100,000 to 250,000.....18c 250,000 to 400,000.....14c Over 400,000.....12c	337,829 S.
St. Louis	5.065c	$11.50 per year	1st 3,000 cu. ft. in 6 mos.....24c Graduating scale, 100,000 cu. ft. in 6 mos ....14.4c Manufacturers..... 8c	958,659 S.
Seattle	8.221c	$20.40 per year (98% metered)	Minimum charge, 50c; Maximum rate, 9.6c; Manufacturers rate.....6.4c	298,000 S.
San Francisco			Minimum bill $1.80 per month. Graduating scale. (Max. 46.07c. av. 33.17c; Min. 22.11c)	
Toledo	5.798c	96% metered	$6.40 min. charge per annum. Max., 12.8c; av. 9.6c; min. 6.4c.	88,297 S.
Winnipeg	23.63c	$12.60 per yr. There is frontage tax on water mains of 4c per foot	23c per thousand; over 200,000 per quarter, 16c.	12,000 S.
Vancouver	5.32c	$12.00 per year	Max. rate 25.7c: av. 19.2c; min. 11.2c	32,300 S.
Toronto	8.59c	$14.20 per year	13.¾c per 1,000 gallons	267,910 S.

Note—*Meter furnished by consumer. †Does not include depreciation. kUnless noted includes Operation, Maintenance, Interest on Bonded Indebtedness and Depreciation or Sinking Fund charges in lieu thereof.

In order to show the conditions under which each city supplies water, the source of supply is given, the method, whether pumping or gravity, and the purification process other than chlorination which is now practised in all the cities listed. The costs of supplying water per 1000 gallons (Imperial) and the other financial statistics are included in order to show whether or not charges for water for fire protection, as arrived at by each city, have any effect on the financial results of operation. It is interesting to note that during the periods mentioned, i.e. 1917-1918, not one of the water works systems referred to in the table, operated at a deficit. The water rates charged in the various cities are shown, in order to indicate any tendency the basis of charges of each city for water for fire protection might have had in influencing the charges to private consumers. Some of these rates are compared in detail with Toronto in Table III.

Table III.

Detailed Comparison of Flat Rates in Various Cities for the Year 1918

	Toronto	Detroit	Kansas City	Providence	St. Louis	Seattle	Vancouver
Basic Rate.....	$2.00lowest rate, with 65c. per room for houses with 5 rooms or over	$6.00 per family	1 room $3.00; 50c. extra for each add'l room	.....	$2.00 for 3 rooms; 75c. each room thereafter	$7.80	$12.00 includes dwelling house with Bath and Toilet; no charge for extra Bath Toilet
ADDITIONAL							
Bath.....	1.25	1.20	3.50	5.00	2.00	2.40	
Toilet.....	2.00	2.00	3.50	5.00	3.00	2.40	
Laundry Tubs (each)	1.25	....	....	3.00	....	....	
Basins (each).....	1.25	.50	....	2.00 each add'l 1.00	....	....	
Taps.....	....	....	....	6.00 for 1st each add'l not rated 2.00	....	....	
Lawn Sprinkling....	1.25, 1,000 sq. ft. 50c. Per 1000 thereafter	1.40, 30 ft. or less frontage	15c. per ft. frontage		1.00 25 ft., 14c. each ft. thereafter	....	
Steam or Hot Water Heating.....	....	....	4.00	5.00	....	....	

As already shown, of the 16 cities (exclusive of Toronto) listed in Table II. 8 made *no charge* whatever for water for fire protection. Of these eight, five were equipped with High Pressure or Auxiliary Systems (operated at the expense of the Fire Department). Five of these cities each had a population of over 300,000. In two of these cities the water rates were higher than in Toronto, in two others they were about the same, and in the other four they were lower than those in Toronto, but

in these four latter instances the water supplied was not filtered. In seven of these cities the cost of supplying water to the consumer was less than in Toronto. In none, where water was supplied free to the Fire Department, was there a deficit in operation.

Of the eight cities (excluding Toronto) which *made charges* for water for fire protection, five were equipped with a High Pressure or Auxiliary Fire Protection System. Four were over 300,000 population. One was owned by a private water company. Of these eight cities, two charged a flat $20,000 for water used, while the remainder were on the basis of hydrant rental, ranging from $5.00 to $50.00 per hydrant per annum. In the eight cities where charges were made, the percentage of the charge to the total cost of operation ranged from 3.69% to 12.05% and in none were equal to the charge made in Toronto, where the charges in 1917 were 41.9%. (See Table IV.) None of these systems operated at a deficit.

Table IV.

Showing the Relation of the Charges for Water for Fire Protection to the Total Cost of Operation in Various Cities in 1917

City	Amount of Charges to Fire Dept., for water for fire prot'n	Total cost of operation of Water Works, not including high pressure system	Percentage of charges for water for fire protection of total cost	Amount based on hydrant charge
Buffalo.....	$90,000.00	$1,538,362.00	5.85	$15.00
Edmonton...	39,850.00	330,678.40	12.05	50.00
Hamilton....	20,000.00	259,889.00	7.70	?
Milwaukee...	18,655.00	504,622.00	3.69	5.00
Providence...	20,000.00	370,613.00	5.39	8.00
Seattle.....	75,000.00	798,778.00	9.40	12.00
San Francisco	140,000.00	.....	.....	30.00
Winnipeg....	70,650.00	704,941.00	10.02	30.00
Toronto.....	734,209.00	1,749,576.00	41.9	114.00

Increase in Water Rates and Charges in Toronto, 1908-1920.

In Table V. the basis of the charges for water for fire protection in Toronto, the total of such charges, the result of the operation of the Water Works and the times when general water rates were increased are set forth for the period 1909-1920.

Table V.
Toronto's Charges for Water for Fire Protection—1908-1920

Year	Basis of charge	Amount of charge	Financial result of operation of Water Works Surplus—S Deficit—D	Remarks
1908.....	$15 per hydrant per annum	$53,910	$ 8,615—d	
1909.....	"	59,805	52,294—s	Water Rates Increased, see Table VI for details.
1910.....	"	65,175	14,976—s	
1911.....	"	71,925	44,045—s	
1912.....	$30 per hydrant per annum	157,950	120,803—d	Water Rates Increased, see Table VI for details.
1913.....	"	176,460	146,567—d	
1914.....	"	183,210	343,033—d	
1915.....	See copy	498,505	257,659—s	
1916.....	"	620,672	46,579—s	
1917.....	"	734,209	267,910—s	Water Rates Increased, see Table VI for details.
1918	"	697,690	546,616—s	Water Rates Increased, see TableVI for details.
1919.....	"	712,756	566,833—s	
1920 (Est.).	"	826,133	134,933—s	

In 1908, when $15.00 per hydrant per annum was charged for water for fire protection, the result of operation was a deficit of $8,615. Water rates were then on the same basis as in 1904. In 1909 the water rates were increased as per Table VI. Hydrant charges remained constant and there was a surplus on operation of $52,294.

In 1912, hydrant charges were doubled to $30.00 per annum and water rates increased (see Table VI.), but in spite of this there was a deficit on operation of $120,893.

Up to and including 1914 no change was made in either charge and the deficit in that year, on operation, was $343,033.

In 1915, although no change was made in the ordinary water rates, the new basis of charging the Fire Department for water for fire protection was worked out, raising such charges from $185,225 per annum to $537,351 per annum, and there was a surplus on operation that year of $257,659.

In 1916, this surplus had again dwindled and the rates were partially raised in 1917 and completely raised to their present scale in 1918.

Table VI.

Showing Increase in Water Rates in Toronto—1904-1920.

Flat Rates	1904	1909	1912	1917	1918
Room Charge (8 Rooms).....	$3.25*	$4.00	$4.00	$4.00	$5.20
Basins;—Wash, Sink, Laundry..	50c. ea.—1.50	50c. ea.—1.50	1.00ea—3.00	100ea—300	125ea.—3.75
Bath.....	1.25	1.25	1.25	1.25	1.25
Water Closet.....	1.25	1.25	1.50	1.50	2.00
Lawn Sprinkling, 2,000 sq. ft....	1.25	1.25	1.25	1.25	2.00
Total.....	$8.50	$9.25	$11.00	$11.00	$14.20

Total Increase 67%.

Meter Rates					
General Manufacturers, per 1,000 gals.....	.06¼c.	.06¼c.	10c. per 1,000 gals. for 1st one million supplied by meter in any yr. 7½c. per 1,000 after.	.11c.	.13¾c.
Brewers and Soft Drink Manufacturers, per 1,000 gals.....	.08¾c.	.08¾c.		No meter rate shall be less than $1.25 net per quarter year.	No meter rate shall be less than $2.00 net per quarter year.
Swimming Baths, per 1,000 gals..	.12½c.	.12½c.			
Distillers, lifts, etc. (domestic)...	.15c.	.15c.			
Outside City Limits.....	.30c.	.30c.	30c. per 1,000 gals.	.30c.	.37½c. No meter rate less than $4 net per quarter year.

Increase in meter rate to general manufacturers, from 1904 to 1918—112%.

*In 1904 this rate was based on a combination of the number of rooms in the house and also the number of occupants.

Conclusion

From a comparison of the charges made for water for fire protection in Toronto with those of other cities, and with recognized standards in vogue on this continent, it would appear that the equity of the present charges to the Fire Department is open to question.

The Bureau is not in a position to arrive at the scientific accuracy of the percentage now in use in Toronto in this connection, but it believes that *the general method used is a fair one, so far as the distribution of the debt charges on the existing investment is concerned.* The Bureau, however, is inclined to the belief that these same percentages should not be applied to operation charges, but that a differentiation should be made. The Bureau suggests that this portion of the charge be made up as follows:

a—A charge for water used at the prevailing metered rate;
b—A charge for salaries and wages of those employees actually necessitated by the fact that the Water Works must be prepared to supply water for fire protection at all times;
c—A charge for the upkeep of any extra pumps and machinery kept running for this purpose;
d—A charge for the upkeep and maintenance of fire hydrants.

Estimating the proportion of the capital outlay of the present Water Works System due to the necessity of supplying water for fire protection at 30%, which is much greater than many authorities suggest, and following the other methods suggested by the Bureau, the charges for water for fire protection in 1917 might fairly be estimated at:

30% of Debt Charges (Interest and Sinking Fund) of entire system	$275,098.00
16,628,250* gals. of water used by Fire Dept., at 13¾c. per 1000 gals.	2,286.00
Hydrants Upkeep, etc.	x64,000.00
Extra Labor and Operation of Machinery Necessitated by Such Cause	x100,000.00
	x$441,384.00

This is about 60% of the charge actually made in 1917.

*See section "An Estimate of the Toronto Fire Department's Consumption of Water, 1917."
xEstimated.

The Bureau thinks it is important that the charges made for water for fire protection, which are paid through the tax-rate, should not be any higher than the actual case demands, for the following reasons:

1. It might permit of the actual operation of the water works at a deficit without the knowledge of the citizens, and unjustly place part of the water-users' load upon the taxpayer.
2. It would give properties exempt from taxation not only their fire protection free, but also their water supply at less than cost.
3. The opportunity for hiding deficits in the general taxes might make not only for careless or mediocre management, but also operate against the policy of public ownership.
4. It aggravates the grievance of the man with the strictly fire-proof building, where the danger of fire is almost nil, who, in any case, pays a larger proportion of the tax levy than the man who has a less valuable building not of fire-proof construction.

At the same time, *charges to the Fire Department for water services, should not be lower than actual cost.* Otherwise the taxpayer is paying part of the legitimate charges on the water-users. It may and, of course, will be urged that these are the same people. This is not true, except in a superficial sense, as citizens vary in relative importance as taxpayers and water-users. This argument is two-edged, and may lead, on the one hand, to operating publicly-owned utilities at a deficit, thus increasing the tax-rate, and, on the other, to using public utilities to reduce the tax-rate. Both are fundamentally dishonest and strike at the very foundation of public ownership.

***An Estimate of the Toronto Fire Department's Consumption of Water, 1917.**

The Bureau's attempt to find out just how much water is used for fire purposes was not entirely successful, for the reason that at present there is no accurate record of the quantity consumed for this purpose. To get a figure which might safely be accepted as the maximum amount used, fire records for 1917 were carefully analyzed with the following results:

During the year 1917, the Fire Department reported a total of 818 fires.

Of the total number of actual fires (818) reported for 1917, 477, or 58%, were extinguished by chemicals alone, no hydrant connections being made.

Out of the 341 fires extinguished by water, 9 were cases where the High Pressure System was brought into operation. For the remaining 332 fires, 703 hydrant connections were made.

As nearly as can be ascertained from the records of the Fire Department, these 703 connections resulted in 705¼ hydrant hours. Of this number, 49 were engine hours. Assuming that each engine pumped at maximum capacity the total amount of water pumped in the 49 hours was as follows:

Engine Number	Max. Capacity in Gals. per Minute	Minutes Worked	Max. Gallons Pumped
2	1,000	285	285,000
3	600	60	36,000
4	1,100	930	1,023,000
6	1,200	90	108,000
8	750	645	483,750
9	750	585	438,750
10	750	345	258,750
		2,940 minutes (49 hours)	2,633,250 gals.

Of the total of 705¼ hydrant hours, deducting 49 engine hours accounted for above, 656¼ was the total number of hydrant hours of normal pressure—120 gallons per minute.

The total water consumed by the Fire Department in this connection, therefore, with normal pressure was: 656¼ x 60 x 120—4,725,000 gallons.

The maximum capacity of the High Pressure System is 10,000,000 gal. per 24 hours. The system was operated for a total of 22¼ hours during the year 1917. Assuming that it worked at maximum capacity all of this time, the quantity of water pumped was:

$$\frac{10{,}000{,}000}{24} \times 22.25 — 9{,}270{,}000 \text{ gallons}$$

The total maximum amount of water consumed by the Fire Department might, therefore. safely be accepted as:

A—Total pumped by Engines	2,633,250
B—Total pumped by High Pressure	9,270,000
C—Total consumption under normal hydrant capacity	4,725,000
	16,628,250 gals.

This total estimated, as described above, is .0008% or about 1/12 of 1% of the total quantity pumped by the Water Works Department, 20,353,310,000 gallons.

In Detroit, where the water consumed by the Fire Department is all metered, the amount is 1/17 of 1% of the total pumpage. In Milwaukee, the amount used for fire protection is placed at 1/13 of 1%. In Akron, Ohio, the amount does not exceed 1/15 of 1%. These figures would tend to substantiate the adequacy of the amount estimated for Toronto.