

As a basis for determining the amount to be paid for water by takers, when it was not to be measured by meter, the opportunity to waste water was considered to be of the greatest importance. More water being wasted than used, the means of wasting water should govern the rental. This led to a schedule based upon the fixtures connected with the water pipes. Naturally, the well-to-do under this schedule would pay more than the poor in proportion to the amount of water actually used, but a very important point was gained in the inducement offered to those who had many fixtures to put in and maintain at their own expense meters for measuring the water taken by them. The water-takers thus became the advocates of meters, and nearly all the meters on the works, numbering now nearly twenty thousand, or nearly 85 per cent. of all the services, have been applied at the request of the water takers. Possibly one quarter of one per cent. are exceptions, but probably the exceptions are less even than this small number.—J. Herbert Shedd, Consulting Engineer, Providence, R. I., April, 1904.

Here is an extract from the Annual Report of the Superintendent of Water Works of a neighboring City in which the benefits of the meter system are referred to in unmistakable terms of approval. He says: "The results accomplished by the meter system have exceeded all expectations. The waste which has been stopped was greater than anyone had surmised. Stopping this waste has been a hardship to very few, while the benefit reaches every taxpayer in the City. No one is deprived of an abundant supply, but an efficient check is put upon the abuse of the water privilege, which has existed heretofore. Almost every meter which is set, except those put upon new plumbing, detects some leak or waste unknown hitherto, or if known, allowed to continue until the setting of the meter forces repairs. Formerly a polite request to have leaks stopped would, as a rule, receive little attention unless followed by a threat of some penalty. Now, all that is necessary is to state that there is a leak and that the meter is measuring the waste. Further argument or appeal is unnecessary. As the meter system is extended the waste is being reduced, and unless the increase of population is more rapid than in the past the present plant will supply all the water needed for many years to come."—Water and Gas Review, March, 1906.

On February 26 and 27 a National Convention was held in New York City, under the auspices of the Reform Club, to discuss various topics relating to municipal ownership and public franchises. From a paper, entitled "City ownership of water supply, a successful contest for good water," presented at one of the meetings by Mr. Wm. R. Hill, Chief Engineer of the Aqueduct Commission of New York City, the following statistical paragraphs relating to the use of water meters have been taken:

In one hundred cities in the United States, having an aggregate population of 11,000,000, the average consumption of water per day is 1,457,000,000 gallons, equivalent of 132 1-2 gallons per day for each person. In these cities there are 1,531,500 taps or service pipes and 283,554 meters in use; hence 18 1-2 per cent. of these service pipes are metered. In order to show the effect of the use of meters on the quantity of water consumed per person per day, the one hundred cities have been divided into five classes.

In Class A are forty-one cities, of an aggregate population of 6,150,000, having less than 10 per cent of their services metered. Their average consumption of water per capita per day is 162 gallons, and their total consumption of water per day, 996,400,000 gallons. The total number of services is 930,000 and the number of meters 31,000, 3 1-3 per cent. of the

services being metered. In Class B are twenty cities of an aggregate population of 1,461,000 having from 10 to 30 per cent. of their services metered. Their average consumption of water per capita per day is 96 gallons, and their total consumption of water per day, 168,000,000 gallons. The total number of services is 220,714, and the number of meters 78,700, 35.6 per cent. of the services being metered. In Class D are nine cities of an aggregate population of 768,000, having from 50 to 75 per cent. of their services metered. Their average consumption of water per capita per day is 75 gallons, and their total consumption of water per day, 57,600,000 gallons. The total number of services is 110,119 and the number of meters, 68,352, 68 per cent. of the services being metered. In Class E are twelve cities of an aggregate population of 862,000, having from 75 to 100 per cent. of their services metered. Their average consumption of water per capita per day is 58 gallons, and their total consumption of water per day 50,000,000 gallons. The total number of services is 90,600 and the number of meters 83,600, 91.6 per cent. of the services being metered.

Ninety of the above named cities procure their supply of water by pumping, the cost of which is one of the principal items of expense. In Alleghany, Pa., where they have scarcely any meters in use, the consumption per capita is 300 gallons, while in Brockton, Mass., where 83 per cent. of the services are metered, the consumption per capita per day is but 30 gallons. Thus it is apparent that the effect of the use of meters is to greatly reduce the consumption of water, or, more properly, the waste of water.—Engineering Record, March 14th, 1903.

Lawrence, Mass., water consumption statistics, as published in the report of the Water Board for 1902, include some interesting figures on metering. There are 4,886 meters on domestic services and 438 on manufacturing supplies, together equal to 83.4 per cent. of all services, and through them 567,162,000 gallons were supplied to 57,195 persons of the total connected population of 63,318, yielding a revenue of \$90,100. The total unmetered consumption amounted to 683,118,270 gallons, with a revenue of \$14,632, and included water used for fire protection, street sprinkling, flushing and other municipal purposes, and leaks, besides that supplied to takers on the assessment basis. Meters were set in the connections of eighteen business places suspected of extravagance. At the end of twenty-two days it was found that the water used was worth \$3.79 per day more at meter rates than would have been paid on the assessment basis, equivalent to \$1,364 per year additional revenue. When these meters were read three months later, the average consumption had been reduced 33 per cent.—Engineering Record, Sept. 26th, 1903.

The cost of supplying the extra water required to keep the faucets from freezing is insignificant as compared with the cost of repairing frozen pipes, and while I would not advocate putting plumbing in a house in such a manner that it would be necessary to allow the water to run during cold weather, I cannot criticise very severely the householder who uses a few cents' worth of water to save a plumber's bill of many dollars. and if the water is sold at meter rates such use of the water is certainly legitimate. The quantity of the water used for this purpose is undoubtedly greater than is necessary, and is reduced by the introduction of meters, but the total saving is in most cases an exceedingly small proportion of the yearly consumption.

DISCUSSION.

Mr. Robert J. Thomas—

For a number of years the City of Lowell put on meters as the consumers of water applied for them, and those applying for meters generally

were people who built good houses to live in themselves and were satisfied that they would save money by meters. In other words, the placing of meters was optional. Consequently that didn't affect the consumption of water greatly. But in 1900, several years after driven-well water was introduced, the Water Board applied meters to a thousand services where they believed, from the reports of their inspectors, that water was being wasted. The effect was almost immediate—within the year—a decrease of consumption took place, and ever since this compulsory placing of meters on all new services has carried that same result along with it. The reduction in the consumption of water began in 1900; and the consumption has been working down, so that last year, 1906, it was the lowest for 17 years, due undoubtedly to the enforcement of the meter system and the placing of a thousand meters on the most wasteful services.

The average daily consumption in Lowell last year (1906) was about 5,000,000 gallons, with a population of about 100,000 people. If we had not applied meters our consumption would be nearly three times as much, and if it were, we would have to use Merrimac River water to-day, because the quantity of well water would not be sufficient to supply such extravagant and excessive use of water.

As soon as nearly all consumers used water through meters, the pumpage of water began to decrease. By an examination of the diagram it will be seen that the amount of water pumped in 1890 was about the same as in 1902, or twelve years later, while the number of consumers had increased from 2,650 to 5,147, or had nearly doubled.

Mr. J. C. Gilbert—

Supposing none of us had meters, or suppose, for instance, there were no meters; what would have been the increase in the use of water? Of course the people, if they do not have them, are careless with their water; and although you may catch a man once in a while and tell him that he must be more careful, he doesn't care much about that; but if you finally decide to put on meters, then they will see that you are after them and for a time they will be careful.

We have seen by the tables here that after putting on meters the consumption of water has decreased very quickly. One reason for that is because the people see what is coming, and they know that if they use water they have got to pay for it, and for that reason they are more careful.

Mr. E. M. Peck:—

Metering of the City of Hartford was begun in 1900 and completed in 1903. According to the best information at my command the per capita consumption before general metering was commenced was about 84.6 gallons. Since that time the average per capita consumption by years has been as follows:

1901—75.5; 1902, 77.2; 1903, 74.2; 1904, 66.4; 1905, 62.8; 1906, 64.7.—
by William S. Johnson, Assistant Engineer, Massachusetts State Board of Health, March 13, 1907.

It is here proposed merely to give the experience in this direction of the City of Cleveland, Ohio.

This experience is significant, because—

1. Water meters are being set in Cleveland far more rapidly than has ever been attempted in any City of the world.
2. This is being done under municipal ownership.
3. It is compulsory upon everyone to have a meter, as soon as the Department can set them, but the expense is borne by the Department.

4. Not only has the setting of meters thus far accomplished the results expected, but it has been done in a way to accomplish what the majority of water works and city engineers have hitherto supposed impossible, viz: it has become exceedingly popular with the majority of the water takers.—By Edward W. Bemis, Superintendent of Water Works, Cleveland, O., November, 1903.

The quantity of water wasted in cities can be divided into two principal parts, that wasted up stream, and down stream from the consumers' stopcock. Against the first part there is no remedy, except the good work to be done by the parties in charge of the water supply plant. But against the second part, mostly wasted on the consumers' premises, no remedy yet tried yields satisfactory or lasting results that does not enlist the co-operation of the consumer; and there is but one such method, namely: to give the consumer a direct pecuniary interest in the prevention of waste. How is this to be accomplished? By the simple process of selling water to him by measure.

I have said that selling water for domestic uses by measure will enlist the co-operation of the consumer in the prevention of waste. It does this immediately, yet without need of argument or urging. The mere establishment of an instrument to keep a record of amounts drawn, and the presentation of quarterly bills based on such amounts is all that is needed. The bills convey their own lesson, and it is not possible to convey such a lesson without bills.

A water meter is nothing but an instrument by means of which the annual cost of all the water supplied to all the consumers may be fairly apportioned among them; may be divided so that each one shall pay a fair part of the total. Incidentally, it reduces waste enormously, it makes every one take an interest in keeping at least his own premises in order as regards water waste, and it thus reduces in like proportions the total annual cost of the whole of the water supplied to the whole body of water consumers. And water meters are as much a part of a well-designed and operated system of water works as gas meters are of gas works, or electric meters are of electric works, and they should be treated in their purchase and setting like any other necessary part of the water-works plant.

The characteristics of the average, well-managed system of water works in the United States are then, as it appears to-day, a consumption per tap of not over 400 gallons per day, and a consumption per consumer of less than 60. Even this amount is twice as much as Woonsocket, R. I., consumes, and more than the consumption of 14 cities in the United States, including such cities as Providence, R. I., with nigh 200,000 inhabitants, and Fall River with over 100,000.

If anyone should still argue that prevention of waste is inadvisable, because tending to uncleanliness or to disease, the answer is that no such effects have anywhere followed a prevention of waste. On the contrary, the wasteful are the most uncleanly everywhere, and vice versa. These dreaded effects have not followed in Woonsocket and Fall River, in Utica, or in Providence, for example. More than that, the slightest tendency in this direction of a scrimping of needed water, or of a repression of use, instead of waste, can always be overcome by a fixed or minimum rate for an ample domestic supply, with only the excess paid for by measure.—By Clemens Herschel, M. A., Soc. C. E.

Assuming that the meters can be depended upon to register sixty per cent. of the water pumped, the meter rate upon this basis should average twelve cents per thousand gallons, and should be somewhat less for large consumers and somewhat more for domestic purposes.

Changing radically the system of charging for water invariably results in some uncertainty as to the amount of revenue to be derived from the new schedule, and to prevent the possibility of a deficit which might embarrass the administration, I beg to suggest a rate of sixteen cents per thousand gallons for domestic purposes, and gradually reducing with increased quantities to the present minimum rate of eight cents per thousand gallons for the largest takers. In order to protect the City against serious reduction in revenue, in case the consumption should fall off more than is anticipated, the minimum rates are fixed at three-fourths of the present fixture rates, which will assure the City of a large revenue in any event, and will, at the same time, allow the takers to secure a twenty-five per cent. reduction in their present rates. It is necessary to allow them to save something, otherwise the objection to the change will be very great.

The City is now wasting several times as much water as it uses. The experience of other cities shows that the consumption can be greatly reduced by the adoption of the meter system for the sale of water, and the cost of filtration and pumping can be kept within reasonable limits. I recommend the adoption of the meter system.—Report of the Consulting Engineer, Allen Hazen, C. E.

CONSUMPTION.

It has been assumed in the foregoing that the proposed gravity works shall be capable of delivering at least 75,000,000 gallons per day, inasmuch as the present consumption in the City, during seasons of greatest draft, has nearly reached this amount. Taking the entire estimated population at 300,000 we thus obtain the enormous rate of 250 gallons per head per day, which is practically twice as much as is commonly regarded a very liberal allowance in other large cities. From a recent compilation of the water consumption in 100 American cities of over 30,000 inhabitants, which embraces every large city in the Union, and an aggregate population of about 16,600,000, it is found that the average is 112 gallons per capita, and that if classified according to population, the averages are as follows:

For cities of from	30,000 to 100,000 inhabitants,	105 gallons per head.
“	“ 100,000 to 300,000 inhabitants,	106 gallons per head.
“	“ 300,000 to 600,000 inhabitants,	122 gallons per head.
“	“ 600,000 to 2,000,000 inhabitants,	116 gallons per head.

This statement renders it clearly evident that the large consumption in Pittsburg is highly abnormal; and if the fact that many of the large industrial establishments in the City are provided with independent supplies from the two rivers is taken into account, the conclusion cannot be resisted that much of this excessive use of water from the public mains is due to preventable waste.—Report upon a Gravity Water Supply from Indian Creek, by Emil Kuichling, C. E.

The daily average amount of water pumped in four weeks ending April 26, 1899, was 13,479,088 gallons. During the succeeding year 618 meters were installed and in the four weeks ending April 24, 1900, the daily average of water pumped was 11,858,802 gallons—a decrease of 1,620,826 gallons per day. During the past year 910 meters have been set, making the total number now in use 2,103. During the four weeks ending April 25, 1901, the daily average of water pumped was 9,724,550 gallons, or 2,134,252 gallons less than last year and 3,754,836 less than the corresponding four weeks in 1899.

If the setting of meters can be resumed and continued it will soon be practicable to do all the pumping with one pump, except in times of extraordinary consumption of water. Even now the Norberg pump could supply the demand if it were connected with the High Service, and the Holly pump could be held in reserve. Thus it will be seen that if the Board can continue to buy and set meters there will be no necessity for buying an additional pump in the immediate future.—Report of Board of Public Works, Grand Rapids, Mich.

METERS GENERALLY.

In view of all the evidence existing on the subject, the conclusion seems inevitable that the wastage of water wrongs and injures the community collectively, and the individual to a far greater extent than it does the water works department, for one reason among others, that the honest, prudent, careful consumers who use all they need and waste little or none, are the ones most injured, because they are obliged to bear, and unjustly too, their share of the amount of money representing the value of the water wasted, and it is literally and actually money thrown away. The fact that water is ready at the faucet to be used or to be wasted means that many thousands of dollars have been invested in water works to make it possible to deliver it there, and that annually many more thousands—all of which comes from the pockets of the taxpayer—must be expended to maintain the works, and supply the water under pressure at all times. On this account alone the City should exercise its police powers to reduce waste of water to a minimum for its own good and that of the taxpayers. The evils due to wasting water and the proper remedies therefor constitute the hardest problem coming before municipal and company water works managers.

Where the character and intelligence of the community enables it to cooperate with the management, the result is comparatively easy. Where it is otherwise positive measures must be used. In both cases the result is the use of meters to a greater or less extent. Water costs money, as also do meat, flour, potatoes, fuel and the like, and if it is just to the seller and not unjust to the buyer for any one of these commodities to be measured or weighed to determine its equivalent in money, then it is alike fair that every one of them or all, may be measured or weighed to determine its equivalent in money, and it is as senseless and foolish that a grocer should accept \$25 a month for all the groceries a family take home to use, waste and distribute among its neighbors as to accept \$8 for the water one family may use, waste and distribute during one year. There is actually no difference in effect. That water has been sold in this manner is due to the fact that its sale commenced a long time ago when there were no reliable meters for measuring its continuous or intermittent flow and of recording such accurately. Many forms of water meters do this accurately, and only two reasons now remain where clear water is supplied where all water services are not supplied with them. One is that the management find it inexpedient, or not advisable, to meter small consumers who do not waste much water, believing that where water is abundant the extra loss of money is nearly off-set, or is inconsiderable because the installation, care of and the reading of the meters adds somewhat to the operating expenses. The other is that the consumers are generally entirely misinformed of the true function of and service rendered by the meter, and their prejudices and their influence in the aggregate are such as to prevent their use. Their prejudices prompt them to feel

that the use of the meter deprives them of their privilege of using all the water they need and tends to make it more expensive. Nothing could be further from the truth and from actual experience. It does tend to check him if he has been wasting and makes his bills larger if he continues to waste, just as his brother butcher makes him pay more money if he carries away or wastes more meat, but his bills are nearly uniform if he always uses only what his needs require. Each 1,000 gallons of water costs a certain amount of money, depending entirely upon local conditions. When it is taken from the faucet why should not one pay a reasonable price for it, and why should one expect to take 2,000 gallons and pay for only 1,000 gallons if he be fair and honest? If one thinks, one must appreciate that his neighbor must help pay the cost of the extra 1,000 gallons, or that he must help pay for his neighbor's 1,000 gallons wasted. The City has the power to regulate the rates charged for water, and does, so the charge to him is fair. The consumer regulates the volume he uses or wastes, or both; hence it is fair that he pay for all. The use of a meter is the best method known for determining this volume, then why is it not fair to use a meter? If it is unfair to insist that a meter be used, or is wrong in any sense, then it is equally unfair and wrong that the dealer use the yard stick, the scales and the measure. This conclusion is legitimate and there is no fair escape from it. The man who is opposed to using a meter says he fears it will cheat him. If he uses one of a reliable make he will find it accurate to within one per cent., and this error is against the Company. The contract gives him a method of determining from time to time if it is accurate. To object to the use of a meter is substantially to prefer the methods of antiquity and to oppose modern methods which years of study and experiment have developed, and which indicate an advance in civilization and intelligence. The average water taker has a feeling of great prejudice against the use of a meter, which is founded wholly upon a misunderstanding of the actual facts involved, because he has never fairly enquired into or been properly informed concerning them. If he uses only the water he needs and has paid for, and doesn't supply his neighbors, thus enabling him to beat and rob a company, and if he does not throw away property—the water—which has cost money, he ordinarily will never be bothered by a meter, but if he permits any of these or other depredations, he deserves worse fate than to be compelled to use a meter; he should be denied the privilege of using water from the mains, because he actually takes without right, leave or license, the money of his fellow citizens, and tends by his acts to increase the danger of fire loss of his neighbor's property. If he is compelled to pay for what he wastes he will stop wasting.

Competent authorities hold that there can be no such thing as free water when it is delivered through pipes as in a city's water works. Someone must pay for the cost of delivering each and every gallon, and if someone has free water, it must follow that some user pays more than he ought, or else the plant will be run at a loss. It is somewhat difficult to understand why those who use water and pay for it should be asked not only to pay for what they use themselves, but in addition to furnish the water used in parks, schools and hospitals. Or that they should be required to keep the watering troughs filled and overflowing for the benefit of thirsty horses, fountains playing, sewer flushing or fire purposes, and the other uses for which it is expected the City will have free water.

The waste of water in most unmetered and in many partially metered cities is estimated by competent authorities to be sixty per cent. of the pumpage, in other words, but forty of each hundred gallons of water is

actually put to some good use and paid for. Of course, is it possible to control this waste of water, and there are two ways of doing it. The first is by rigid rules absolutely enforced and through frequent inspection; the other method, the more sensible plan, of asking each consumer to pay for the water he uses or wastes. The first remedy—frequent inspection—has always been unsatisfactory, and, to be of value, must of necessity be expensive, while it is very annoying to the average household. The frequent visits of the inspector are not liked, and soon he becomes a disagreeable nuisance and plans are laid to outwit him. The opinion of a well-known engineer and superintendent of water works on this point, as expressed in one of his last annual reports, is worth quoting. He says: "Inspectors do a great deal of good in ordinary weather, but it would take an army of inspectors to stop waste during a cold snap. After the waste is discovered notice must be sent and a reasonable time given before taking action. In the meantime, the weather moderates and the culprits stop the waste, not because of the warning, but because they think it is no longer necessary. No one would expect a dealer in any other liquid except water to be willing to furnish all the supply wanted, and allow the consumer to help himself at a fixed rate for the year, unless the dealer based that rate on the value of his entire outfit. Yet the water and other liquids have a definite value, and the value can be ascertained by the simple process of measuring.

ABRIDGED REPORT MASSACHUSETTS WATER COMMISSION.

To the Honorable the Senate and House of Representatives of the Commonwealth of Massachusetts in General Court Assembled:

The water supplied by the Metropolitan Water Works is taken and used for:

- (1) Domestic purposes.
- (2) Manufacturing, mechanical and trade purposes.
- (3) Public purposes.

A careful and extended study has been made of the actual consumption of water as required for all these uses in the District, and the conclusion has been reached that the amount actually required and consumed for all necessary and legitimate uses does not exceed 60 gallons per inhabitant per day. Inasmuch as the daily amount actually supplied to the district was at the rate of 119 gallons per inhabitant, it would follow that about one-half of the entire supply was lost by waste or leakage, or was unnecessarily or improperly consumed. The investigations made conclusively indicate that there is, as a matter of fact, such loss and unnecessary use.

There are chiefly two causes of this loss and unnecessary waste.

A large amount of water is lost by leaks from broken main and service pipes which form the supply system of each city and town, and by the existence of defective joints connecting the separate pipes.

A still larger loss of the water supplied is suffered on the premises of the individual water takers. Leakages arising from defective plumbing and improper fixtures are permitted to exist, by which there is a constant escape of water; continuous streams are purposely allowed to run during the winter, to prevent the pipes from freezing; and during the hot weather much water is allowed to run, in order to obtain water for drinking.

It is doubtful whether such inspection and enforcement can be uniformly secured, unless both the municipality and the individual water

taker are made to become pecuniarily interested in the result. The measurement of water supplied has been found not only the best means for the detection of waste, but also, when made an element in the fixing of water rates, an efficient means of prevention.

The experience of cities and towns outside of this district has invariably been that the introduction of the element of measurement to water-takers has been attended by a decreased and more normal consumption. A like result has been demonstrated by the experience of four municipalities within the District. In the towns of Belmont and Milton all the services are metered, in the town of Watertown 89.5 per cent. of the services are metered, and in the City of Malden 63.4 per cent. of the services the other municipalities of the District the metered services constitute only from .5 to 9.3 per cent. of the entire number. The rate of consumption in the above-named four municipalities was for the period observed not only low, being 47, 44, 49 and 47 gallons per inhabitant, as against an average per capita consumption of 116 gallons in the remainder of the district, but notably uniform.

The investigations demonstrate that it is within the power of the municipalities largely to check the unnecessary use and waste of water.

It is also shown that the payment of meter rates does not bear hard upon any class of water takers.

The Board has in its annual reports repeatedly called attention to the necessity of taking measures for reducing the unnecessary consumption of water, and the desirability of making the amount of consumption an element, not only in fixing the amount of assessment to be imposed upon each municipality, but also in fixing the water rates of each individual water taker, so that each municipality and each individual taker should have a direct pecuniary interest in checking waste and excessive use.

The Board has hitherto urged that the great unnecessary consumption of water is not only causing larger annual expenditure for maintenance and operation, but is hastening the time when great expenditures must be incurred for new source of supply, new plumbing facilities, new aqueducts, new reservoirs, new mains and all other equipment. Such unnecessary consumption is also hastening the time when corresponding expenditures must be incurred for new works for the disposal of sewage.

It is estimated that, if the present rate of consumption is unchecked, the present sources of water supply will become inadequate within the period of ten years; so that, in a comparatively few years after the works now in progress are completed, construction of additional works will have to be provided for. If, on the other hand, unnecessary consumption is prevented, as is believed possible, such additional construction may be deferred for considerably more than twenty years.

It is safe to assume that where the consumption per capita is more than 50 gallons per day the excess is wasted.

In the towns of Belmont and Milton every service pipe is metered: in Watertown, 89.5 per cent.; and in Malden, 63.4 per cent.

The average daily quantity of water used for domestic purposes, as measured by meters in each of these municipalities during the years 1901 and 1902 was as follows:

CITY OR TOWN.	Number of Consumers.		Gallons per day.		Gallons per day per Consumer.	
	1901.	1902.	1901.	1902.	1901.	1902.
Belmont.....	3,600	3,900	63,760	66,630	17.7	17.1
Malden.....	21,100	22,550	414,030	450,160	19.6	20.0
Milton.....	6,850	7,450	115,000	143,500	16.8	19.3
Watertown.....	9,650	10,250	147,200	152,900	15.3	14.8
	41,200	44,150	739,990	813,190	18.0	18.4

The above quantities include water used for stables supplied in connection with dwellings and that used for lawn sprinkling, as well as that used strictly for household purposes.

The experience in other cities and towns where meters are in general use on domestic services corroborates the results obtained in the Metropolitan District.

CITY OR TOWN.	Estimated number of consumers.	Per cent. of services metered.	Total daily average metered consumption (gallons).	Gallons per Consumer per day		
				Domestic.	Manufacturing.	Totals
Brockton.....	37,800	90.0	822,670	13.2	6.5	21.8
Fall River.....	107,650	96.0	2,607,100	15.5	5.2	22.2
Newton.....	35,400	86.0	1,202,740	23.1	4.6	34.0
Ware.....	7,690	100.0	203,430	25.4	1.1	26.5
Woonsocket, R. I..	34,474	86.7	762,380	11.6	10.5	22.1
Wellesley.....	5,147	100.0	132,540	25.6	.1	25.7
Worcester.....	119,330	94.5	4,331,030	16.1	17.8	36.3
Yonkers, N Y.....	51,000	98.7	2,413,380	19.7	22.0	42.7
	398,491		12,475,270	16.7		

The statement sometimes made that the greatest use or waste of water is to be found in the cheapest class of houses is not substantiated by the results obtained where water is supplied by meter. On the contrary, experience seems to indicate that the per capita use of water for domestic purposes increases with the value of the property supplied.

Domestic consumption per capita in Newton, Fall River, Worcester, and London, Eng. as determined by meter measurement:

Domestic Consumption per capita in Newton, Fall River, Worcester and London, Eng., as determined by Meter measurement.

CITY OR TOWN.	Number of Houses.	Number of Families.	Number of Persons.	Consumption (Gallons.)		REMARKS.
				Per Family	Per Capita.	
Newton.....	490	490	2,450	132.5	26.5	All houses supplied with modern plumbing.
Newton.....		619	3,005		6.6	These families have but one faucet each.
Newton.....		278	1,390	34.5	6.9	These families have but one faucet each.
Fall River ..	28	34	170	127.5	25.5	The most expensive houses in the City.
Fall River ..	64	148	740	42.0	8.4	Average class of houses generally having bath and water closet.
Worcester ..		81	327	80.0	19.9	Woodland St., best class of houses.
Worcester ..		37	187	118.1	23.4	Ceder St., best class of houses.
Worcester ..		93	447	95.0	19.8	Elm St., houses of moderate cost.
Worcester ..		245	1,104	55.1	12.2	Southbridge St., cheaper houses.
Worcester ..		229	809	55.0	15.6	Austin St., cheaper houses.
London, Eng	1,169		8,183		25.5	Houses renting from \$250 to \$600, each have bath and two water closets.
London, Eng	727		5,089		18.6	Middle class, average rental \$200.

Careful estimates of the quantity of water used for mechanical purposes, which is not metered, indicate that the amount is not more than 5 gallons per capita in other cities and towns in the District, with an average of about 4 gallons for the whole District. This quantity, added to the quantity supplied through meters, gives about 23.5 gallons per capita per day required at the present time for manufacturing, mechanical and trade purposes in the Metropolitan Water District.

The following table gives the total metered consumption in 1902 in several of the largest cities of the United States, where very little or none of the water supplied for domestic use is metered:

CITIES.	Number of meters.	Daily average metered consumption (gallons).	Per cent. of services metered.	Gallons per capita.	Gallons per metered service per day.
Boston	5,381	17,521,400	6.03	29.90	3,393
St. Louis, Mo.	4,635	15,149,000	6.41	23.30	3,495
Baltimore, Md.	2,182	13,226,000	2.17	25.20	6,061
Buffalo, N. Y.	1,375	16,501,800	2.04	46.00	12,000
Pittsburg, Pa.	394	4,279,000	1.09	16.40	10,860
Detroit, Mich.	5,847	14,970,800	9.24	42.70	2,543
Chicago, Ill.	7,075	41,096,000	2.18	18.30	5,809
Philadelphia	1,510	16,430,400	.59	12.20	10,881

Quantity Actually Needed For All Purposes.

From the preceding statements the total quantity actually required for legitimate use in the Metropolitan Water District at the present time is shown to be less than 60 gallons per inhabitant per day, divided as follows:

	Gallons.
Domestic use	25.0
Manufacturing, mechanical and trade use.....	23.5
Public use	7.0
	55.5

It will be noticed that both the daily per capita and night rates of consumption vary widely in different districts, even where the takers are of the same general class. Where the rate for twenty-four hours is large, the night rate is in almost every case excessive. It is also noticeable that the lowest rates of consumption are to be found in those districts where water meters are in general use. Take, for example, the rates of consumption during the night in Milton, Watertown, Belmont and Malden, as compared with those in Medford, Melrose, Winthrop and the high-service districts of Brighton and Chelsea. The population of each of these groups is about 60,000. They are districts in which the manufacturing use is very small, and there appears to be no good reason why the legitimate use of water between the hours of 1 and 4 a. m. should not be very small in every case. In the first group the rate varies from 13.4 to 25.5 gallons per capita, with an average of 18 gallons; while in the second group it varies from 43 to 71.4 gallons, with an average of 58.3 gallons. The difference between 18 and 58 gallons is unquestionably preventable waste.

Waste From Pipes and Fixtures on Premises of Water Takers.

Waste from pipes or fixtures on premises of water takers is due either to defective plumbing or to permitting the water to run from open fixtures, either negligently or wilfully. Where the amount paid for water is not dependent upon the quantity of water used, the average water taker pays little attention to the condition of the plumbing on his premises; and, so long as the leaking fixtures cause no damage to his property, they are seldom repaired unless discovered by inspectors of the Water Department.

Few people realize that sufficient water will flow in twenty-four hours through an orifice of no greater diameter than an ordinary lead pencil under the average pressure which exists in the pipes throughout the Metropolitan District, to furnish an ample domestic supply for 360 persons; and that in the same time more water will leak through an orifice the size of an ordinary pin than would be used by a fairly economical family of five persons. It is the continual running of thousands of little streams which causes the greater part of waste on the premises of the water takers.

Wilful Waste.

During the winter season large quantities of water are drawn from the pipes by water takers for the purpose of preventing the freezing of water in the house piping; and throughout the year faucets and water-closet

fixtures are left or fastened open by water takers for the purpose of flushing water-closets and drain pipes, or in order that the water at the faucet may be constantly kept cool.

In the cities where meters are in general use waste of this character does not occur to any great extent, as each property owner is pecuniarily interested so as to arrange the plumbing in his buildings that it does not become necessary to allow water to run in order to prevent it from freezing.

It is the practice of some water takers to allow water to run continuously from water-closets, for the purpose of cleansing house drains; others permit the water to run from the kitchen faucet, in order that the water may not become warm in the pipes, and some even use a constant stream of water, instead of ice, for the purpose of preserving food. Some water is wasted by each of these methods, but they are sources of waste which are not easily detected by house-to-house inspection, and no attempt has been made to determine the exact amount wasted from these causes.

EFFECT OF USING METERS.

The most certain means of detecting waste, and the most effectual means of preventing the extravagant use and waste of water is that of measuring the water supplied to each municipality, district or individual water taker, and obliging each municipality and individual to pay for water in proportion to the quantity used. Where meters are in use, each water taker finds it to be for his interest to see that the plumbing fixtures which he uses are of the best quality and that they are kept in repair; that the pipes in his buildings are so located that they will not freeze during cold weather, and that his family or employees are not wasteful in the use of water. The introduction of meters upon all old works has always been followed by a reduction in the quantity of water used; and in cities and towns where they have been introduced when the works were built, the per capita consumption is universally very low. The effect of the use of meters is well illustrated by a comparison between the per capita consumption of water in cities and towns where meters are in general use with that in those where water is paid for at schedule rates.

In the City of Milwaukee there has been a gradual reduction in the quantity of water used with the increase in the use of meters. In 1880, with no meters in use, 1,750 gallons were drawn from each tap; in 1890, with about one-third of the taps metered, the quantity drawn from each was only 1,250 gallons; and in 1902, with 72 per cent metered, the quantity used per tap was only 550 gallons.

During the past two years the Water Department in the City of Cleveland has been engaged in placing meters upon service pipes. At the end of the year 1902, 11,099 meters were in use on 56,816 services; and the daily average consumption for the year was 69,964,740 gallons. At the close of the year 1903 the number of meters had been increased to 25,193; and the daily average consumption for the year was 62,012,000 gallons. As a result of this work, the daily average consumption for the year 1903 was about 8,000,000 gallons per day less than in 1902, and the greater part of this reduction was no doubt due to the meters set during the previous year.

EFFECT OF METERS UPON THE POOR.

The fear has been sometimes expressed, by those who have not given the subject careful study, that the use of water meters will have the effect

of reducing the use of water by the poorer class of takers below an amount necessary for health. The experience in the cities and towns using meters does not indicate that there need be any fear of such a result.—Report Metropolitan Water and Sewerage Board.

Note.—As a result of this report a statute was passed in Massachusetts requiring all cities and towns in the State to meter not less than five per cent. of all services annually.

Under these conditions the volume of water pumped always increases faster than the population, and is only limited by the fact that after a time the cost of securing and distributing the water becomes so great as to make rational measures imperative.

Natural gas was formerly sold in Pittsburg at a fixture rate, the amount charged for heating a house depending upon its size, etc. The practice has, however, been given up, and all gas is now sold by meter. The temptations to abuse the privilege of using water supplied at a fixture rate are quite as great as they are in the case of gas. In fact, the opportunities are better, because gas cannot be discharged unburned into a house without making it uninhabitable, and if an excessive quantity of gas is burned, the house becomes too warm for comfort. There is thus a certain physical limit upon the amount of gas which can be used in a house. With water, however, this is not so. Faucets can be left open and leaks allowed to remain unrepaired, and the water allowed to flow to the sewers in absolutely unlimited quantities without benefiting anyone. It has been found by careful and extended observation in both American and European cities that in the best class of modern houses an abundant supply of water for domestic purposes does not exceed from twenty to forty gallons per capita daily. Only in the very largest places, where many servants are kept, and much water is used for lawn sprinkling, do the quantities become as high as fifty or sixty gallons per capita daily.

As an average for American conditions, thirty gallons may be taken as a liberal allowance for all the water which can be used. The population now supplied with water from the Pittsburg works is about 220,000. The quantity of water required to supply the needs of this population at thirty gallons per capita daily is 6,600,000 gallons.

Various ways have been suggested for preventing the waste of water. One of these ways has been very much more successful than any other. This is the method which has been universally adopted for the sale of gas, namely, the use of meters. Under this system the water supplied to each consumer is measured and payment demanded according to the amount used.

There is often a prejudice against the use of meters, which arises from the thought that people will be limited in the use of water, and cannot use as much as they desire without making excessive payments for it. There is also the feeling that if the consumption of water in the city should be reduced to one-half or one-fourth of the present consumption, each person would have to get along with one-half or one-fourth as much water as is now used. As a matter of fact, this idea does not present even remotely the truth. A majority of people are reasonably careful in the use of water and do not waste excessive amounts. A majority of the families in Pittsburg probably use at the present time less than the amount of water mentioned in the above estimate. It is the minority of people who, by carelessness or wilful waste, discharge water into the sewers in large quantities, and increase enormously the amount of water which must be provided, and consequently the cost of water to all the people.

At the present time the loss inflicted by the careless or wasteful people

is borne by the whole City. If a meter is put on every service, the people who waste water will have to pay for it, and others will be relieved from the burden, and the cost of water to them will be materially reduced. The cost to the people who are now wasting water will also be reduced, if they are willing to learn by experience, as nearly all of them will, that they cannot waste water without paying for it.

The cost of installing a meter system is considerable, but it is very much less than the cost of installing the pumps, filters, reservoirs and larger mains that will be necessary in case unrestricted waste is allowed to continue. The meter system also results in a saving in water rates to all people except those who under previous conditions are fraudulently or through carelessness securing quantities of water largely in excess of those to which they are entitled. I therefore most earnestly recommend that the City of Pittsburg adopt forthwith the meter system, and I would make the following suggestions in regard to it:—

- (1). That the City should own and set all meters and assume all care of them.
- (2). That the Superintendent should have the right to meter any service at his discretion.
- (3). That all services should be metered commencing with the largest and those where unusual waste of water is thought likely to exist.
- (4). That wherever a service is metered all water shall be paid for at meter rates, excepting that the sum charged shall not be less than three-fourths of the present fixture rates, and this sum shall be collected in all cases where less than a corresponding amount of water is used.
- (5). That all schools, hospitals, and public institutions now supplied with water free, or at a nominal charge, shall be metered that the amount of water actually required by each shall be estimated by the Superintendent and notice thereof sent to the respective institutions; and that in case water is drawn by any of them in excess of the amount thus allowed, the excess shall be paid for at the regular meter rates. In case of another City department, the excess shall be paid out of the appropriation of that department.

CITIES WHICH HAVE ADOPTED THE METER SYSTEM.

The meter system has been adopted and applied to all consumers by a number of European cities, notably in Berlin, and by a few American cities, namely, Atlanta, Yonkers and Madison. It has been adopted and applied to all services except the smaller domestic services by a much larger number of American cities, — Milwaukee, Providence, Syracuse, Worcester, Fall River, Hoboken, Lawrence, Manchester, Utica, Brockton and Pawtucket have adopted in this way, and having more than half of their services metered. In addition to the above, New York, San Francisco, Kansas City, Lowell, Nashville, Toledo, Dayton, Des Moines, Peoria, Springfield, Quincy, Bay City, and Taunton have metered more than a quarter of their services, and nearly all cities which have started upon the introduction of the meter system are extending its use as circumstances permit.

EQUITABLE BASIS FOR METER RATES.

The amount of money now obtained from the sale of water is about \$740,000 per annum.

It is found, however, that it is impossible to operate a water works system so that all of the water will be accounted for. In the best German practice, with all the services metered, sometimes as much as 90 per cent. of all the water pumped is accounted for. This however, is rare, and has never been reached in American practice. Sixty per cent. is a good American average, and on this basis the average meter rate should be about nine cents per thousand gallons.

With very large consumers the rate should be somewhat less than for small consumers, and eight cents, or the present minimum rate, may be taken in these cases as not far from right, while the domestic rate must be maintained considerably higher on account of the greater slip in the small meters, and waste and leakage from service pipes.

This basis, however, would not be a safe basis to assume in adopting the meter system. As I have shown, the greater part of the water pumped at the present time is wasted. With the meter system installed the consumption will be very much reduced, and consequently the revenue. A large part of the operating expenses, namely the cost of filtering and pumping, are nearly proportional to the quantity of water pumped and will be reduced. The general administrative expense will not be reduced by reducing the consumption.

The question of loss of pressure from wasting of water has been again and again brought to the notice of the City Council. If the wasting of the water be, as alleged, the chief cause of so much falling off in the pressure during the winter months, it is reasonably asked why the Commissioners do not stop the waste. The answer is that the Commissioners, at present, have no power to stop it effectually. The only check in their power, at present, is the turning off, but this is almost entirely disregarded, because the water cannot be kept off more than a day or two, so that the punishment is soon forgotten. The Commissioners are convinced that the only effective remedy for needless waste of water is to be found in the imposition of fines, to be enforced in every case without fear or favor.

Owing to the irregularity in the supply last winter, from the causes stated, an idea got abroad that the lakes were giving out; that they were in fact not capable of supplying the demands of the City. It is needless to say that such an idea was entirely erroneous. The lakes now in connection with the City are capable of supplying from five to six millions gallons daily, which is very near the quantity supplied every twenty-four hours to the City of Montreal with 120,000 inhabitants. At the same time, it is certain, that if the prodigious and reckless waste of water in this City be allowed to continue, a day will certainly come when our vast supply will be found insufficient.

The drainage area of the Spruce Hill Lakes is not so great as that of the Long Lake, but the Spruce Hill Lakes are 150 feet higher than the Long and Chain Lakes, being in fact the highest lakes within ten miles of the City. The Spruce Hill Lakes are capable of supplying on an average a million and a half of gallons daily, which is, or ought to be, an ample supply for 20,000 persons, and they have this decided advantage, that they belong exclusively to the City, not being encumbered in any way, as the other lakes are, with private claims.—Report Commissioners of Water Supply, March 31st, 1872.

EXTRACTS REPORTS HALIFAX WATER WORKS.

From the very inception of the works, when the supply was ample, and the pressure good, people became lavish and wasteful in the use of an article which many deemed as inexhaustible; but the result was sooner felt than anticipated, and ended—for the time—in laying down an additional 15-inch main from the lakes to St. Andrew's Cross, in the year 1856. The Engineer who was called on to report upon the advisability of this scheme, stated that such a pipe would deliver fully one-half more than the existing 12-inch one. Assuming the above data as correct, (and the results are considerably less than the calculated quantities would give) there were delivered into the town at the close of 1856, 1,750,000 gallons by the two mains, or at the rate of 58 gallons a head per day for a population of 30,000. But even this was found insufficient for the wants of the people, as in a very short time, precisely the same evils as formerly began to show themselves. Waste went on everywhere, and increased ten fold; there was no pressure, and the water would not rise above the basement. Speculations were indulged in as to the lakes giving out, extensive underground leaks, and such-like suppositions. The Council suggested and urged the purchase of the works, as early as 1856, and this was effected in 1861, at a cost of £56,000, when a new state of things was inaugurated under a Board of three paid Water Commissioners. There were then about 21 miles of piping laid for the supply of the City.

The new commission seemed to work well, and great praise is due to the gentlemen who comprised that Board for the energetic way in which they grappled with the difficulties against which they had to contend, and for the manner in which the work of the Department was planned and executed. To them is due the credit of establishing the works as we have them to-day, and if unsatisfactory (as they certainly are) it is through no fault that can be attached to the plans that were adopted, but rather through the neglect of enforcing stringent ordinances, the necessity for which, was I am informed, repeatedly urged upon the Council by the Board. The Commissioners at once devoted attention to the necessity of remodelling and enlarging the works, and of obtaining high pressure for fire purposes, and for supplying the more elevated portions of the Peninsula.

The distribution is made through one 15 and three 12 inch pipes, and it is quite safe to assume that by these 4 millions of gallons, at least, are every twenty-four hours delivered into the City. But even this enormous quantity has recently been found insufficient to gratify the extravagant wants of our people, though probably not three-fourths of the population receive the benefits of this supply. In other words (assuming the population at what I have already stated, viz: 34,000) we have reached the unprecedented high rate of 157 gallons a head per day. This may seem so large a quantity that possibly my calculations may be called in question, but I believe that if there is any error at all it will be found on close examination that I have estimated less than the amount actually consumed and wasted. The present low service supply should be ample to meet all the ordinary requirements of a population double that which Halifax now possesses, and to give to each individual about 60 gallons per day; provided, of course, that the distribution were confined within the proper limits.

It is needless for me to say much on the evils attendant upon this profligate waste, as I am aware that you are already well informed on the subject; but this I would say, that it is quite practicable to put a stop to the great bulk of it, though probably it will be found a difficult

and tedious undertaking. Stringent laws, of course, will be required, but they have become a necessity, that is, unless the City is contented to tolerate such a state of things, and to tax itself with the cost of increasing the extent of the works, which is most unnecessary.

There will be found little use in cautioning people against the extravagant waste of water, or even in adopting the more arbitrary measures of turning off and extracting a fine in the case of offenders. The real causes of the evil lie in the insufficient depth of service pipes; the careless manner in which the plumbing is arranged; the cheap style of buildings—little better than mere shells—which have long since become prevalent amongst us; the cold and exposed positions in which pipes are laid; and the unprotected states of the pipes everywhere. So long as these things are allowed to continue unchecked, great waste must take place. No householder will be foolish enough, even at the risk of having to pay a paltry fine, to stop a tap from running when he knows the inevitable results will be a burst pipe, his house inundated, and a heavy bill for repairs as well; besides all the attendant annoyance, discomfort and misery.

It has been advised just to run a small stream—the smallest possible—which, it is asserted, will be quite sufficient to obviate frost. Granted; but when shall we arrive at that happy period when the people will be so well educated as to act upon such salutary advice? I say, stop even the small run, so far as it is possible to do so, and compel householders to protect their pipes. No other plan will ever be found to work satisfactorily.—City Engineer's Annual Report, 1872-3.

THE WATER DEPARTMENT.

The Commissioners feel assured that if not attended to the time is not far distant when our hitherto unsurpassed facilities for the extinguishing of fires will be rendered inoperative, not from any deficiency of water in the lakes, but simply because the number of taps allowed to run full bore in the winter season takes all force and pressure from the fire plugs in the very months of the year when danger from fire is most imminent.—Report of Commissioners City Works, Dec. 31st, 1873.

WATER SUPPLY.

This is a matter which deserves the serious consideration of every citizen, as it is exceedingly desirable that all portions of the City should be abundantly supplied with water, both for domestic and fire purposes, particularly during the winter months. But it seems an impossibility to remedy this state of things until the wanton and reckless waste of water which is now practiced is put a stop to. Having this object in view, the Board succeeded in getting an Ordinance passed by your Council, and sanctioned by the Local Government, which the Board confidently hope may have the effect of remedying this great evil to a large extent. It is monstrous to think that there is as much water wasted and consumed in this City as is required to supply effectively a place having three or four times the population of Halifax, and this statement can be verified by facts and figures. A great many persons cannot readily understand how it is that this grievance is increasing every season; but when it is considered that every year a larger number of consumers are added to the list of those who allow water to run to waste, it is nothing wonderful that the pressure is steadily decreasing.—Report Commissioners City Works, October 5th, 1875.

The evil effects of permitting the continuance of the excessive waste of water which now occurs in nearly all private and public establishments, can scarcely be looked upon in too serious a light. Halifax is by no means singular in her experience in respect to the rapid increase in waste where the greatest efforts are not used to check it.

The subject has been so well and so frequently discussed in reports from other cities that little remains to be said that would be new; and as it has been frequently brought to the notice of the Council, both by the present Board and the late Water Commissioners, it can be necessary for me to do little more than point out the reasons why such enormous waste takes place, in order that, for the future, better regulations may be adopted, and to show in what way it can, to a great extent, be prevented.—City Engineer's Report, December 31st, 1875.

There can be no equity in one person paying 40 or 50 cents per 1,000 gallons, while another pays less than 4 cents for the same quantity. Yet this state of things has existed, and there is little doubt that it does so still to a large extent. From the last readings taken, the effect of placing meters at the Halifax Hotel has been to reduce the average daily consumption from 18,600 gals. to 6,700 gals., and at the International Hotel, from 10,500 to 1,290 gallons. It cannot be necessary to give here a detailed statement of the readings of the meters, enough, however, has been shown to prove that in an ordinary house where care is used to prevent waste, the cost to the consumer would be less by meter than under the present system of assessment, while those persons who require and use large quantities of water, and others who will not exercise common care would have to pay in proportion to their consumption.—City Engineer's Report, Jan'y. 2nd, 1877.

In each Annual Report that has been issued from this office attention has been called to the great waste of water which takes place in this City, and different remedies have been proposed for its suppression. I must again urge upon your Board and the Council the great necessity that exists for the most decided steps being taken to check this evil. From this cause our water works are in a most unsatisfactory condition and matters are daily growing worse. The water pressure, year by year, continues rapidly decreasing, and in some parts of the town where, a few years ago, streams from the hydrants could be thrown over the tops of the buildings, the water now will not rise to the nozzles.

I think I am safe in saying there is not a City in existence that can show a similar record.—City Engineer's Report, February 18th, 1880.

The cause of the whole trouble and of the unsatisfactory condition of the water works is due to the lack of proper system in controlling the consumption and waste of water in the City, and until this is recognized, and stringent measures for the suppression of the extravagant use and waste of water are adopted and firmly enforced, without fear or favor, no improvement in the general supply within the City can be expected, no matter what amount of money may be expended in perfecting the head works or improving the principal reservoirs from whence the supply is drawn. In fact, matters will continue to grow worse and more unsatisfactory yearly.

From this cause the High Service works are in even a more unsatisfactory state than the low service. The Spruce Hill Lakes, which furnish the supply to the High Service, are now drawn upon to their full capacity, and unless some means are adopted to check the lavish consumption and waste on this service, and extensions from it to districts to which it never was intended to be conveyed, the lakes cannot be relied upon to hold or

furnish sufficient water to meet the demands made upon them. In any dry season the supply might, and probably would be, exhausted. — City Engineer's Report, April 30th, 1888.

Extract from Report E. H. Keating, on the methods employed for extinguishing and preventing the spread of fires, and on the different Fire Escapes adopted in several American cities:

In most American and nearly all European cities waste is regarded in the light of a crime and is punishable as such, while in this highly favored City of Halifax a citizen may with impunity lavishly waste \$1,000 worth of water—or more if he has the facilities for doing so—and if, by chance, detected he can escape by the payment of one dollar, which, by the way, can seldom be collected. It is true we have an ordinance forbidding the water to be wasted and empowering the Board of Works to place meters wherever it may be thought advisable, but this law is largely inoperative and does not confer the power to charge for the water consumed. While this state of things exists it is useless to complain of the low pressure in certain districts or to be expected that it can be made permanently better. It is not a question of the amount of water in our lakes or reservoirs, as some seem to imagine; there is always abundance there. The true state of the case is that the mains are capable of delivering only a given quantity of water in a given time under a given pressure. If the water is being consumed or allowed to run from open taps in certain districts where it will readily flow, the pressure requisite to discharge it in the given time will also be consumed, both are lost, and neither can be utilized elsewhere at the same time. This is the whole case and is the reason why the water pressure is small in some parts of this City. The only proper remedy is one of prevention, which although difficult to inaugurate is not impracticable to be carried into effect, and if prudently enforced with diligence, the effect would be at once felt, and there should be no more complaints (at least until the City more than doubles its present population) of short supply on the higher levels, or lack of pressure at the commencement of a fire when an abundant supply of water is most needed.

I cannot close this section of my report without again calling attention to the necessity of adopting some active measures towards suppressing the general and excessive waste of water which is allowed to take place throughout this City. Although the evil effects are more severely felt throughout the winter owing to the practice of leaving taps or faucets open wherever the water will flow at all, having become habitual during that quarter of the year, the lavish waste of water is constantly going on at all other times. Some citizens are under the impression that by allowing a constant stream of water to flow from one or more taps they are thereby flushing out their house drains; this, however, is not the case, a continuous small stream of water will not flush a drain, a bucketful of water or two poured down a drain once a day or less often, will accomplish the needed flushing much more effectually than all the continuous streams that can be obtained from an ordinary service pipe. The lavish waste of water for this purpose, therefore, is not productive of any good result and there is no plea whereby it can be justified, while it is the direct cause of danger in other respects, especially in case of fire. It is this waste which has gradually diminished the water pressure throughout both the high and low service districts so that the water will not now rise to the upper stories of buildings where otherwise there would be good force, and this state of things is rapidly growing worse, notwithstanding the cleaning out of the principal mains, the effect of which was

to greatly increase the volume of water poured into the City. It also prevents the extension of the mains in some localities, and is the sole cause why hydraulic motors and elevators which would pay a handsome revenue would not be introduced by parties who otherwise would have adopted them. But what is probably worse than all, it destroys to a large extent the value of the Fire Department. Our turnkeys are perhaps now as well drilled to their work as it is practicable to have them, and upon the first alarm of fire being sounded their energies are at once devoted to concentrating the whole available force of water upon the locality where it is needed; yet in spite of all their exertions it sometimes happens that they cannot succeed in getting a really good force of water on to a fire as quickly as is to be desired, great caution is needed in all such cases, not only for fear of opening or closing the wrong valves and thus depriving the district entirely of water, but for fear of closing the valves in too great a hurry and bursting the mains. This catastrophe has occurred on more than one occasion and sometimes results in the supply being almost entirely cut off. Precautions are now being taken to prevent similar accidents from happening again as far as it is practicable to do so, but further expenditure will probably be needed in this direction. I might add that there is abundance of water for all the legitimate wants of the citizens if it is used with common care. There is no occasion for a single individual to be stinted in the smallest degree, but the present mains are not capable of yielding this supply and of maintaining at the same time the enormous draught upon them caused by thousands of open taps and defective pipes, water closets and cisterns which discharge their contents directly into the sewers for no purpose whatever.—City Engineer's Report, 1884.

There are between 55 and 60 miles of piping laid in the streets and there are 327 fire hydrants attached. The number of water takers is unknown, as the rates are largely assessed to landlords, but it is probable that 80 per cent. of the population are totally dependent on the City water for their daily wants. At this estimate the daily delivery of water is about 220 gallons per head per diem, a rate attained by few cities in Europe or America. This should certainly be considered, even by the most extravagant, an extremely abundant supply.

No machinery is used for forcing the water into the City, gravitation alone being the propelling power. The pressure at the fire hydrants varies from 15 lbs. to 60 lbs. to the square inch. A system of concentration is operated at fires, by which means the pressure is largely increased in the district threatened. This is the more necessary, to counteract in some measure, the enormous waste of water in winter when thousands of taps running all over the City to prevent freezing, affect seriously the pressure for fire purposes.

While the whole of the works may be considered in an effective condition, at times there are complaints from some sections of the city of a limited supply of water. And as before noted the labors of the firemen are greatly increased by a "weak head" at the hydrants. As the quantity of water delivered in the City daily is not less than seven millions of gallons giving over 200 gallons per head, or counting an average of six persons to a house, 1,200 gallons per household, it will be patent to the most casual observer that there is an enormous waste going on in thousands of houses. The short supply is wholly caused, as before stated, by the prodigality of water takers, who, fearing the freezing of their pipes in winter, allow them to run, in many cases full force, thus reducing, in some instances totally cutting off the supply of other citizens, causing

these latter great inconvenience, besides being a constant source of worry to the Engineer and staff of the Water Department, who are blamed.—Mayor's Address, 1884-5.

While much care and forethought have been exercised, and large sums expended from time to time in designing, enlarging and improving the works, I regret to say that the community does not derive anything like an equivalent benefit for the money expended. Latterly the drain upon the high service works has been enormous, and owing to orders from the Council in some cases and from the Board of Works in others, the pipes have not only been carried into low districts, but localities which were formerly supplied from the low service, and should, under proper control have remained so, have been placed on the high service, contrary to your Engineer's advice.

There are a few districts supplied off each service where the normal pressure is not sufficient to force the water much above ground level, and there would be no pressure at all at those and other places if the greatest care were not exercised by your officials in regulating the supply to the best advantage possible under the circumstances.

It is fortunate that we still have the means of increasing the pressure at points where it is weak, on an alarm of fire being given, but in some cases time is required to do this, which is sometimes of vital importance on such occasions.

Neither the high nor the low service works can be said to be in a satisfactory condition, owing chiefly to defects in the system of management and control to which attention has frequently been drawn, but for which there appears little hope of any effective remedy being applied under existing circumstances. For further particulars the annual reports may be referred to.

While the low service reservoirs are now capable of storing a sufficient supply of water for that service for some years to come, the main is now drawn upon to its full discharging capacity. Some sections of the City do not feel the inconvenience of this, but others do in the way of an insufficient supply. The only proper remedy is to control the consumption within reasonable bounds and to stop the waste of water. The remedy hitherto applied has been to tap, divert and ruin the high service.

The Spruce Hill Lakes, which are the High Service reservoirs, are in a different condition. Owing to the extensions referred to, and to the lavish consumption and waste of water in the City, these Lakes can no longer be relied upon to hold in reserve and furnish sufficient water to meet the demands which are being made upon them. The proper remedy in this case is the same as that just stated, but in addition the service should be confined within its legitimate limits and steps should be taken to enlarge the capacity of the lakes as far as practicable.—City Engineer's Report on the efficiency of the City Water Supply, November 9th, 1889.

It will, I suppose, be admitted that the efficiency of the water works is of such vital importance to the citizens that they have the right to expect its affairs to be managed at least with good judgment and ordinary care. At present the works are under the control of a Committee of the City Council, who are appointed annually, and it appears to be that this system is at the bottom of most of the troubles under which the department suffers. It would be unreasonable to expect that any individual member could, within one year, inform himself thoroughly upon all matters relating to the department that it is necessary he should clearly understand. Even if he were disposed to devote himself to the

study of its affairs, and should succeed in mastering them, he would no sooner have acquired the information necessary for his guidance than he would relinquish his office. It is not hard to see that such a system must inevitably lead to confusion in the department, mismanagement and loss to the City.

The best remedy for this would appear to be either to change the character of the commission and its duration of office, or to place the works, under proper restrictions, in charge of one responsible head removable only for neglect, incompetency or misbehaviour.—City Engineer's Report on efficiency of Water Supply, November 9th, 1889.

Notwithstanding the fact that the supply considered sufficient at the inception of the works has been multiplied by from 12 to 15, while the population has not even doubled, we are again compelled to consider the question of increase. The experience of Halifax is repeated in few cities and the consumption per capita at times has been exceeded by none. Taking the statistics of consumption for works all over the country we find on comparison that there is a great difference in the amount of water consumed in different places, and if from 30 to 50 gallons suffice in certain cities the use of 90 or 100 gallons in others presupposes a considerable waste. For domestic and household uses 20 gallons per person per diem is a sufficient allowance; taking into account the water used for mechanical and manufacturing purposes, that necessary for street sprinkling, extinguishing fires, for use in stables, etc., 60 gallons per diem for each inhabitant is a liberal quantity in the case of the larger cities and manufacturing towns. In the case of the smaller, non-manufacturing towns 35 or 40 gallons should suffice.

The great waste which takes place in Halifax being acknowledged, the question arises how to prevent or at least diminish it. There should be no doubt in the mind of any citizen that a great waste does take place, for instead of 60 gallons per day being sufficient on an average, our daily consumption has at times reached four times that quantity. The cause of such an enormous consumption has been pointed out so often that the City Council has ceased to take any notice of it, if indeed it ever did. As a natural consequence of the complaints respecting waste being made to unheeding ears we are now compelled to face a possible expenditure of \$150,000 to improve the service, to say nothing of the thousands of dollars that have gone up in smoke in some parts of the City, which better pressure might have saved. Nor will the expense stop on the completion of the proposed improvements, for if the consumption increases as in the past the quantity of water available will be exhausted and we will be asked to solve the problem of augmenting the supply.

If the question of expenditure were less important and the supply inexhaustible I would have no hesitation in recommending immediate increase on account of the difficulty in checking waste in our climate and the impolicy of restricting every legitimate use of water. A lavish waste of water seems to have begun soon after the first pipe was laid, and following the history of the works we find the water pressure rapidly decreasing and in some parts of the town where a few years ago streams from the fire hydrants could be thrown over the top of buildings, the water now will not rise to the nozzles. In consequence the High Service had to be diverted to the low, thereby destroying the High Service System. All over the City stopcocks have had to be partially or entirely closed in order to give a supply to houses which otherwise would have none. As the consumption increases from year to year the loss of head which was at first trivial must increase so that during fires and in times

of greatest draught the water must fall away in houses receiving it on the second and third floor to the first floor and basement and from elevated houses altogether.

Not only will the maximum daily consumption when reached generally take place in the 12 hours of the day and therefore require a capacity double the average for the twenty-four hours, but at all times when fire occurs the demand requires the utmost efficiency throughout every part of the pipe. That the maximum of daily supply has been reached has been proved by the fact that at times the draught is so great that not only is there no pressure on Quinpool Road, but the water does not fill the pipe. By the time those who are inclined to doubt the enormous consumption or waste have digested that statement they may, perhaps, be converted.

The most important result of the great waste is the greater risk from fire and consequent higher rate of premiums. Waste and therefore loss of pressure destroys the value of the fire department. When a fire breaks out the first sound of the alarm calls the turnkeys, who have special instructions, and the Foreman of the Water Department, under whose immediate direction the turnkeys are. I also attend as many alarms as possible myself. The first duty of the men is to concentrate the water as much as possible to the locality of the fire by shutting it off from the other parts of the City, and in this way the pressure necessary can be obtained, although in the higher parts of the Low Service, where there was formerly a fair fire pressure, the High Service has to be utilized. It is necessary to exercise the greatest caution in concentrating the whole available force of water so that the wrong valves may not be opened or closed and the district entirely deprived of water. There is also a danger of the same result from the bursting of a main caused by a valve being closed too hastily. If the waste were checked the normal pressure would be greatly augmented and the necessity for concentration would not exist. Moreover, I shall be able to prove that if the waste were stopped the benefit obtained would be greater than that from any other improvement within our present means.

The principal causes of waste are bad plumbing, exposed pipes, taps and fixtures and hopper water closets. One strong proof that waste is caused by exposed pipes, taps and fixtures and bad plumbing lies in the fact that the consumption in winter is much greater and the pressure consequently much less than in summer.—City Engineer's Report on Improvement in the Water Supply of the City of Halifax, N. S., Feb. 12th, 1892.

NEW MAIN.

The deplorable waste of water which has caused the expenditure still continues. When the proposed work is completed our water supply system will have cost over one million dollars, and if the waste continues and increases with the increase in pressure, the present supply will not be sufficient, and the taxpayers will be asked to start on the second million to bring in a new supply.

If the waste is checked the pressure will be increased and the danger from fire in the low service district will be greatly diminished as each main will give an independent service and while one is turned off the other will supply the City.—Annual Report City Engineer, August 1st, 1892.

There is another effectual remedy for waste which should be generally adopted in Halifax. The experience in other cities shows a great reduction in the consumption by the use of meters for detecting waste. Where-

ever they are used they play a most important part in reducing or keeping down the consumption of water and consequently the necessary size and corresponding cost of water works. There are a few in use in Halifax, but very few compared with the number of taps. Meters were first used in the City in 1876. The meter put on at the Halifax Hotel in that year reduced the daily consumption from 18,600 gallons to 6,700 gallons, and at the International Hotel from 10,500 to 1,290 gallons. At present there is no meter on either of those houses.

In one instance coming under my own notice during the past summer a meter was put on where the average consumption was supposed to be about 10,000 or 12,000 gallons a month. During the first month a waste amounting to 1,400,000 gallons was detected. As a result of the application of the meter that amount is saved to the City every month.

Of seventy-seven German cities with a population of 7,600,000, twenty-six per cent. sell water exclusively by meters. In the remainder meters have been generally adopted. Since 1878 Berlin has used meters exclusively in selling water, Manchester, New Hampshire, has a population of 44,126 and uses 1,135 meters. Providence, Rhode Island, with 14,896 taps has 9,286 meters. Halifax with 13,966 taps uses 44 meters. In the United States 43.1 per cent. of all the works have meters in use. Allegheny, with a consumption per capita of 233 gallons per diem, uses no meters. Atlanta, with 89.6 per cent. of taps metered, consumes 36 gallons, and Fall River, with a population of 74,398 and 74.6 per cent. of taps metered, consumes only 29 gallons per capita, or 2,157.542 gallons per diem. Halifax with one-half the population of Fall River, has an estimated consumption of 6,500,000 gallons. No further comment is necessary.

Under the present conditions some parts of the City have no reason to complain and probably always have had a good supply for domestic and fire purposes. It is necessary that the same benefit should be extended to all parts of the City in order that the feeling of security, the advantage arising from reduced premiums for insurance, and the luxury of a full supply of pure water enjoyed by that part of the City where the most trade is carried on, the bulk of the merchandise stored and the most costly buildings erected, may be equally enjoyed by all.

The quantity of water available in the High Service system should be ample to supply one-half of the City (in population). The City works yield enough water to supply a population of 80,000, and if anything like economy were enforced the supply would suffice for a much larger number. With a source 200 feet above tide, making every allowance for loss of force from friction in pipes and constant draught for domestic supply, all points 150 feet above tide should be provided by the Low Service with sufficient means for extinguishing fires. Such, however, is not the case, and in some places the High Service is let down to points 94 feet above tide. These extensions have destroyed the High Service, and in any dry season it is liable to become exhausted.

In 1889 there were 5215 service pipes, with a total of 13,966 taps. In 1890 there were over 800 exposed pipes and taps. About 3,500 taps running at a rate of one gallon in a minute would consume almost the entire available supply. In some cases tested it was found that the waste from a single tap was 8 1-2 gallons in a minute. In view of this fact it is not surprising that the pressure is weak, and when to the waste from exposed taps is added that from hopper closets does anybody wonder why the mains cannot supply the draught caused by the enormous useless discharge into the sewers. In 1879 there were 880 hopper closets; in 1884

there were 1400. In a report dated August 3rd, 1891, now on the Order of the Day in the City Council, I gave the result of some experiments made in Boston to determine the waste in hopper closets, and taking the result as an average in our own case showed that the waste in Halifax would be over 400,000,000 in a year. It was also stated that we had been able to make a test for ourselves with 9 closets, and applying the average result to the whole number of hopper closets in the City, we were sending a useless stream into the harbor during the year, amounting to over 900,000,000 gallons, a quantity equal to the whole storage capacity of Long Lake.—Engineer's Report on Improvement on Water Supply, etc., Feby. 12th, 1892.

The first six months usually shows a large consumption, and the bill is objected to. The bill for the next six months shows considerable reduction, as the water taker is not anxious to pay for waste, and is careful to confine the use of water to legitimate purposes, when he realizes that the size of his bill depends on the care he exercises and the condition of his plumbing.

Meters placed on the service pipes of the "Ladies' College" showed an enormous consumption, which was largely due to waste from defective closets and leaky plumbing work. During one night when every precaution was taken to close closets, etc., and no taps were opened, the waste amounted to over one thousand gallons. Efforts are now being made by the authorities of the College to place the plumbing in good order so that waste may be prevented.

At T. & E. Kenny's warehouse a waste of from 5,000 to 7,000 gallons a day was discovered, which in the absence of a meter would have continued for months.

At Conlon Bros. stables 76,000 gallons were consumed in February, while the average amount used in the same place last summer was less than 4,000 gallons a month. At King's stables, the average consumption last summer was 1,100 gallons a day. Since the first bill was sent out the average quantity passing through the meter is 494 gallons a day. Several meters have been tested at the request of property owners, and in all but one instance they have been very accurate. Any defect so far discovered is decidedly in favor of the water taker. A number of meters were frozen this winter, and steps will be taken immediately to protect them from future frosts.—City Engineer's Annual Report, 29th April, 1893.

METERS.

The number of meters in use at the close of the year is only 139. This is small in comparison with the number of service pipes. As the service is extended, its efficiency must be seriously affected unless the meter cure is applied. There is not the slightest doubt that reckless waste is still prevalent, and no City should shut its eyes to the danger and folly of permitting waste of water to go on unchecked. We must not go blindly on until we are obliged to choose between the Scylla of an insufficient water supply and the Charybdis of an enormous expenditure for new works. In order to insure the safety of our homes and preserve our system in the good condition which I was able to report last year, we must extend the meter system and place upon reckless waste the check of self-interest. We have had several meters frozen through negligence on the part of property owners, but precautions are being taken to prevent a repetition.—City Engineer's Annual Report, May 1st, 1896.

The adoption of meters is strenuously opposed in some quarters.

Among owners and occupants of dwellings this is chiefly through ignorance of the facts. It is claimed that the generous use of water should not be prevented, as it is necessary for sanitary reasons; that the charge by meter is exorbitant; that the supply of water is ample for all our requirements, waste included, and that the waste is exaggerated.

In answer to the first argument, we readily agree that water should be used freely for flushing and other sanitary purposes; but almost all waste is in small streams that are useless for flushing. One bucket of water will do more good than 1,000 gallons wasted daily in a small stream. The cost by meter should not prevent the free use of water. One-half cent's worth of water supplies a liberal bath. The minimum charge by meter is the same as by assessment and allows the consumer sufficient water for every legitimate purpose, and even waste, before the meter registers a quantity equivalent to the minimum charge.

The answer to the third argument may be given by many citizens who know from experience how the pressure decreases in cold weather, and the season of 1894, when we were compelled to discontinue street sprinkling during the Exhibition for want of water, is still fresh in the memory of those who take an interest in such matters.

That the waste is not exaggerated has been proved over and over again. In one instance a meter put on a wharf registered 1,400,000 gallons the first month and has averaged 10,000 to 12,000 since. In another instance a meter was put on a pipe supplying a water closet where the valve in the flushing cistern was worn, and did not fit its seat tightly. The waste was but a trickling stream, yet 407,750 gallons of water went through the closet between March 23rd, 1896, and April 7th, 1897, an average of 1,073 gallons per day. The valve was repaired on the latter date, and from that time until April 1st, 1898, the consumption was only 15,750 gallons, an average of 43 gallons per day.

The adoption of meters is the only practicable means of compelling wasteful consumers to keep their plumbing in good order and watch for waste of water as they do now for waste of gas. Our fire pressure must not be allowed to decrease, to say nothing of domestic supply.—City Engineer's Annual Report, May 2nd, 1898.

"The last inspection showed hundreds of places in which water was running to waste unnecessarily. Inspection does no good, and would require a large staff. As soon as the Inspector leaves the premises the water runs as usual.

The adoption of meters seems to be the only sure cure for waste, and if the waste is stopped the supply is ample.

"A meter placed on a south end wharf registered 1,400,000 the first month, and about 12,000 gallons since. At a stable in the centre of the City, the month's reading was 40,000 gallons. The reading now is 4,000. A washing water closet in an Inglis Street house used 1,000 gallons a day when the meter was put on; it now averages 6 gallons.

"Providence, R. I., a city which requires a large quantity of water for manufacturing purposes, and has 80 per cent. of supplies metered used 54 gallons per head of the population. Fall River, another manufacturing City, with all supplies metered, uses 34 gallons. Halifax uses nearly 200 gallons. Fall River has 102,281 population, but does not consume half as much water as Halifax.

"If the water running into Halifax were used at the same rate per head as in Fall River the supply from the high service alone would be

sufficient for the whole City. In the face of this it seems absurd to talk of an expenditure of \$1,000,000 besides the necessity of tearing up the streets to alter the distribution pipes so that more water could be brought in.

"The low service is also unsatisfactory and the time is approaching when the remedy must be applied to that district.

"It is claimed that water is free, but it has cost Halifax \$1,100,000 to put it into the taps. No man questions the necessity of measuring gas, electric current, etc. No man thinks it is a hardship that Boards of Health prevent any citizen from doing anything to cut off an ample, pure and free supply of fresh air from his neighbor. It is an injustice to a man to take his water supply from him and throw it away. High service householders are daily taking from the pipes water which they do not need and do not pay for, but which belongs to others who do need it and do pay for it, but do not get it. Meters will stop the carelessness of consumers and use of bad and exposed plumbing which causes the great waste.

"Meters can be placed in the high service district without increasing the water tax or the City Works Department staff. The new meters are not injured by frost and have a long life.

"If they are not adopted, the City must seek an additional supply at a cost which will increase the water tax by \$50,000 a year at least."—F. W. W. Doane, City Engineer, Halifax, N. S.

EVENING SESSION.

8.10 o'clock.

COUNCIL CHAMBER, CITY HALL, March 5th, 1908.

The regular monthly meeting of the City Council was held this evening. At the above named hour there were present, His Worship the Mayor and Aldermen Archibald, Shaffner, Whitman, Murray, Johnson, Chisholm, Taylor, Douglas, McManus, Hubley, Kelly, Hoben, Davison, Martin and MacKenzie.

The Council was summoned to proceed with business standing over and the transaction of other business.

PRESENTATION OF PAPERS.

The following named papers are submitted:—

Report Charities Committee, by Alderman MacKenzie, Chairman.

Report Joint Committee on Assessment and Laws and Privileges Committee on assessment covering draft Act, by Alderman Murray, Chairman.

Report City Prison Committee, by Alderman Hubley, Chairman.

His Worship the Mayor submits the following named papers:

Letter City Treasurer re Dry Dock subsidy.

Application of G. A. Wooten for a license for a moving picture show.

Reports (8) Committee on Works, viz.:

Transfer of Large Fuel Yard.

Draft Act re water rates.

Surface water Merklefield.

Water extension for A. P. Calnan. Atlantic Street.

George Street sidewalk.

In re City Treasurer's office.

Accounts.

Tenders for water meters.

CONSIDERATION OF PAPERS SUBMITTED AT THIS AND PREVIOUS MEETINGS.

Read report Chief of Police reporting no violations of Liquor License Act on Sunday since last report. Filed.

Read letter County Councillor S. W. Lydiard re rate of fares on Dartmouth Ferry.

Referred to Committee on Works for report.

Read letter Church of England Cathedral Executive Committee accepting the offer of the City to pay \$3,750.00 for strip of land for straightening Coburg Road.

WIDENING COBURG ROAD

HALIFAX, N. S., March 2nd, 1908.

L. FRED MONAGHAN, ESQ., *City Clerk.*

DEAR SIR,—I am instructed and authorized by the Bishop of Nova Scotia to acknowledge the receipt of your letter of 18th February, 1908, addressed to The Dean and Chapter of St. Luke's, containing an offer of three thousand seven hundred and fifty (\$3,750.00) dollars for a certain lot of land situate at the corner of Robie Street and Coburg Road; and further to state that the Bishop of Nova Scotia will accept the offer as set forth in the letter above referred to.

G. E. E. NICHOLS,
Secretary Cathedral Executive Committee.

Moved by Alderman Murray, seconded by Alderman Taylor, that the sum of \$3750.00 be borrowed to pay for the property for widening Coburg Road as per plan filed in the City Engineer's office.

Motion passed unanimously, there being fourteen Aldermen present.

Read report City Prison Committee re accounts and deficit in appropriation.

CITY PRISON ACCOUNTS, ETC.

COMMITTEE ROOM, CITY HALL, March 5th, 1908.

To His Worship the Mayor and City Council:

GENTLEMEN,—Your Committee on City Prison beg to recommend the following accounts for payment, viz:—

Jordan & Mann, horseshoeing, \$2.50. Hillis & Sons, Ltd., stove fittings, \$1.80. Clayton & Sons, uniforms, \$66.75. W. E. Crowe & Co., groceries, \$28.76. M. Conroy, dry goods, \$3.46. W. I. Hubley & Co., straw and bran, \$4.90. W. A. Maling & Co., ox heads, \$11.00. G. F. Hills, boots, \$3.00. W. Y. Kennedy dry goods, \$7.90. S. Cunard & Co., coal, \$401.18. Halifax Tram. Co., light, \$1.85—\$533.10

Your Committee further report that owing to a reduction in the appropriation for the prison in preparing the estimates for 1907-08 it will have to face a large deficit this year. Last year the appropriation was \$5,500.00, and there was received for broken stone, &c., \$749.50, making a total of \$6,249.95. This year the appropriation is \$5,000.00, and the receipts from broken stone are only \$378.00, making a total of \$5,378.00, or \$871.95 less than last year.

We have had to provide for considerable extraordinary expenditure not estimated on an account of recent fire which destroyed all the prisoners' clothing as well as a lot of other valuable material which had to be replaced. This with the increased cost of supplies has greatly handicapped your committee.

There is now to the credit of the prison after providing for above accounts \$490.00,