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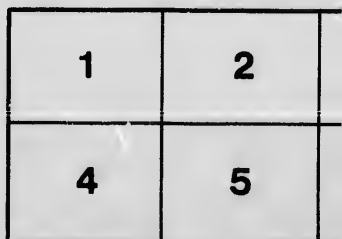
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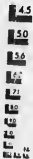
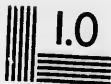
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THE WATER SUPPLY

*H. N. Ruttan*  
OF THE

CITY OF WINNIPEG.



REPORTS

*Of 2nd March and 12th November, 1886, on the Water  
Works System, by*

H. N. RUTTAN, C.E., CITY ENGINEER.

WINNIPEG:

PRINTED BY WALKER & MAY, HARGRAVE BLOCK, MAIN STREET,  
1886.

# THE WATER SUPPLY

—OF THE—

## CITY OF WINNIPEG.

CITY ENGINEER'S OFFICE,  
WINNIPEG, 2nd March, 1886.

*To His Worship the Mayor and City Council of Winnipeg :*

GENTLEMEN,—In accordance with the following motion adopted by the Council :

"Moved by Ald. Woods, seconded by Ald. McNee, that the City Engineer be requested to report to the Council as to how far the contract made by the City with the Winnipeg Water Works Company has been carried out, particularly as to whether the proper number and sorts of hydrants and drinking fountains have been placed. Whether the mains have been extended as provided for, and if not, what in any of these respects the City has a right to ask for. Also, as to the capacity of power and supply now in use by the Company being sufficient should such an extended service as the City may have a right to call for be demanded ;"

I have the honor to report that there is no regular contract between the City of Winnipeg and the Winnipeg Water Works.

After correspondence between the City of Winnipeg and the promoters of the Winnipeg Water Works Company, the latter obtained a charter from the Local Legislature to the terms of which both parties appear to have agreed.

### HYDRANTS.

1. As to whether the proper number and sort of hydrants and drinking fountains have been placed.

The charter states that "the said company (The Winnipeg Water Works Company) bind themselves to erect and maintain at their own expense and cost, hydrants on all highways and streets, where said company shall have mains laid at a distance not exceeding five hundred feet apart on one side of such street or highway."

The number of hydrants the city is entitled to under the above clause is seventy.

The number of connections with the water mains from which water can be drawn for fire, sewer flushing and public purposes is thirty-four. Seven of the number are hydrants which, with one exception, have no drip connections with the sewers or otherwise, and cannot be used in winter. One hydrant at the corner of Market and Princess Streets, has a drip connection which empties it after use and there is apparently no difficulty in working it at any time. The remaining twenty-eight connections are valves in the water pipes which are enclosed in man-holes built from the pipes to the surface of the street. Water is drawn from these by means of stand pipes  $2\frac{1}{2}$  inches in diameter. The valves and movable stand pipes are very imperfect substitutes for hydrants, and are open to the following objections:—They are not large enough to supply water to a steamer, having the capacity of one hose stream only. The actual quantity of water delivered by these valves with a pressure of 40 lbs. at the works is from 10 to 18 cubic feet per minute through open hose, the quantity varying with the length of hose. The valves leak more or less and the man-holes over them become partially filled with water, making it difficult and sometimes impossible to fix the stand-pipes in position.

Having no drip connections they are liable to freeze and become useless.

The hydrants should be from four to nine inches in diameter, according to the position in which they are placed, and the quantity of water which can be supplied to them; they should be furnished with both steamer and hose nozzles and should be provided with properly drained drips. Each hydrant so constructed would be in itself a powerful fire engine, the only thing necessary to bring it into use being to attach the hose.

2. "By the charter the Company are required to furnish, free of charge, water to a drinking fountain for man and beast, to be erected, one in each ward of the City as now existing, at such places as the Mayor and Corporation of the said City shall direct."

No fountains have yet been erected.

3. "Whether the mains have been extended as provided for, and if not, what in any of these respects has the City a right to ask for" The charter says, "that the Company shall be bound, on notification by the Corporation of the City, to extend their mains wherever in each quarter of a mile of street or streets contiguous to the mains of the said Company it is shown that a rental amounting to 10 per cent. on the cost of each quarter of a mile is obtainable, such extension to be made with all due diligence."



It does not appear that the Company have been notified to extend their mains. The City has a right to ask, under the above clause, for an extension of mains equal to, approximately, 22.35 miles, as shown by the detailed statement attached.

4. As to the capacity of power and supply now in use by the Company being sufficient should such an extended service as the City may have a right to call for be demanded. The present supply is taken from the Assiniboine River, which at low water has a flow of 416,000 cubic feet per minute. The following table shows the capacity of the present works—the capacity of works required for the present population of Winnipeg estimated at 20,000 and the capacity of works for a population of 40,000, upon which works for the City of Winnipeg should be based.

It will be seen that the capacity of the present works is not sufficient for the present requirements.

	Present Works for population 10,000.	20,000.	40,000.
Capacity of pumping machinery, gallons per day . . . . .	1,500,000	3,600,000	7,200,000
Quantity of water in cubic ft. per min. delivered at cor. of Main St. and Portage Ave., with a pressure equal to a head of 150 ft. Domestic supply . . . . .		200	400
Fire supply . . . . .		200	400
Total maximum quantity which works are capable of delivering, cubic feet per minute, with an effective head of 150 feet . . . . .	55	400	800

The calculations in the above table for 40,000 population are based upon the following data :

Average domestic consumption per head per day, gallons . . . . .	60
Maximum domestic consumption per head per day, gallons . . . . .	90

Fire supply providing for the occurrence of two fires at the same time, each requiring ten-hose streams of 20 cubic feet per minute.

The maximum capacity of the works has been based upon the maximum consumption which would occur if two fires took place at the same time of day when the greatest draught was being made upon the domestic supply.

A 24-inch main, or its equivalent in smaller mains, has been calculated to deliver the maximum quantity of water at the intercession of

Main Street and Portage Avenue, which has been taken as the point of comparison of the several systems.

The loss of pressure between the pumps and the point referred to in the 24-inch main, due to friction, would be 11 lbs. The water to be delivered with an effective pressure of 65 lbs. per square inch.

In a main smaller than 24 inches the loss of pressure would be too great for economy in working.

Table comparing water works now in operation with that recommended for Winnipeg:

Place.	Population.	Daily Consumption. Gallons.	Size of Pipes.	Miles of Pipes.
Reading, Pa. ....	43,278	3,000,000	24-4	35
Wilmington, Del. ....	42,478	4,625,000	16-1 1/4	61
Hartford, Conn. ....	42,015	.....	24-3	75
Camden, N. J. ....	41,659	3,087,419	30-3	38
St. Paul, Minn., (1883) .	41,473	.....	24-4	29
Lawrence, Mass. ....	39,151	2,162,919	30-1	40
Dayton, Ohio. ....	38,678	1,182,589	20-2	30
Lynne, Mass. ....	38,270	1,557,974	20-4	70
Halifax, N. S. ....	36,102	6,000,000	24-3	50
Hamilton, Ont. ....	35,961	3,750,000	.....	63
Portland, Me. ....	33,810	4,000,000	26-4	76
* Winnipeg, recommended for a population of	40,000	3,000,000	24-4	

\* This column shows average daily consumption. The maximum capacity of works recommended for Winnipeg is 7,200,000 gallons.

Comparison between the waterworks now in operation in Winnipeg and those in other cities of about the same population:

Place.	Population.	Daily Consumption. Gallons.	Size of pipes.	Miles of pipes.
Sacramento, Cal. ....	21,400	2,000,000	24-3	23
London, Ont. ....	21,000	1,250,000	12-4	40
Bay City, Mich. ....	20,693	2,120,391	16-3	25
East Saginaw, Mich. ....	19,016	2,218,336	24-4	25
Yonkers, N. Y. ....	18,892	1,246,200	24-4	27
Winnipeg. . . . .	20,000	342,849	12-4	6 1/2

The information for the last two tables, except that relating to Winnipeg, is obtained from statistical tables of American water works by J. J. R. Croes.

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ance that a distribution system be adopted which will meet the wants of increasing population, and that the present system be re-arranged when necessary. It would be a waste of time and money to make the extensions with small pipes corresponding to the present system

*Addenda.*—Differences in levels of pipes throughout the city being too small to make any material difference in the calculations have not been used.

It has been assumed that the effective fire pressure should not be less than 65 pounds, equal to 150 ft head

In estimating the pressures, in addition to the allowance for friction, a slight additional allowance has been made for valves and angles."

CITY ENGINEER'S OFFICE,  
WINNIPEG, MAN., 12 NOV., 1886.

*The Chairman and Committee on Fire, Water and Light:*

GENTLEMEN,—Referring to the report of the engineer for the Winnipeg Water Works Company, made to the Directors of that Company in reply to my report of the second March last.

It will be seen that there is no material difference of opinion between the Engineer of the Company and myself with regard to the scale upon which the works should be constructed and the quantity of water which should be supplied, except that he does not concur in so large an extra provision for fire.

In my former report I recommended that the capacity of the new works be based upon a population of 40,000, and that they should be so constructed that they could be increased from time to time as might be required. I estimated that for fire protection the works should be able to deliver 20 hose streams of 20 cubic feet per minute each at a pressure of 65 lbs. per square inch. I still think that this quantity should be provided for in addition to the maximum domestic draught.

Though the fire supply recommended for a population of 40,000 happens to be the same as the domestic supply at that population, it does not follow that as population increases the fire supply should be increased in the same ratio. As the distribution system and engine power increase with population it becomes an easy matter to concentrate large supplies of water at heavy pressure at any desired points.

With reference to what the Company is bound, under its charter, to do, there is a wide difference of opinion between the Engineer for the Com-

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pany and myself. I shall briefly review the points of importance where we differ, giving my reasons for the opinions which I have formed.

### HYDRANTS.

In my former report I referred to those in use as very inferior substitutes for hydrants:

The Engineer for the Company says:

"The City Engineer appears to claim that the Company are bound to supply, not only hydrants, but permanent stand posts as well. The Company has done this voluntarily in some places, but it seems to me that there are no obligations on the Company under the charter to supply anything beyond hydrants, pure and simple, that is, a valve or fire-cock on the main. The term 'hydrant' is sometimes applied to the whole apparatus of valve, stand-post, frost case, &c., used in some cities, but in interpreting the charter technical terms should be taken in their strict technical sense. A reference to Humber's work on the water supply of cities, the best on this subject; to Fanning's smaller work, and other authorities, will show that 'hydrant' means the valve or fire cock, and if a permanent stand pipe is to be added, the whole apparatus is correctly distinguished as a 'Post-hydrant,' or by other special designations."

Humber's is a very old and comprehensive work on water supply, and in addition to its useful information I have no doubt it contains descriptions of many appliances which would not answer modern purposes.

Fanning's, the other work which is referred to, is recognized as the best American authority on the subject. He gives the following technical definition of hydrants:

"506 Post Hydrants —In the smaller towns and in the suburbs of cities, *post hydrants*, of which Fig 121 illustrates one pattern, are more generally preferred, as they are more readily found at night, and are usually least expensive in first cost. They are placed on the edge of the sidewalk, and a branch pipe from the service main furnishes them with their water. If the service main is of sufficient capacity, the post hydrant may have one, two, three or four nozzles. In cities where steam fire engines are used a large nozzle is added for the steamer supply, and if there is a good head pressure two nozzles are usually supplied for attaching leading hose.

"For the supply of two hose streams or a steamer throwing two or more streams, the hydrant requires a six inch branch pipe from the service main, and a valve of equal capacity. The supply to post hydrants has too often been throttled down, when there was no head pressure to spare, and the effectiveness of the hydrant very much reduced thereby.

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"507. Hydrant details.—In New England and the Northern States a frost case is a necessary appendage to a post hydrant, and it must be free to move up and down with the expansion and contraction of the earth, without straining upon the hydrant base. In clayey soils those frost cases are often lifted several inches in one winter season, and if the post is not provided with a movable case in such instances, it is liable to be torn assunder. A waste valve must be provided in every hydrant that will with certainty drain the hydrant of any and all water it contains as soon as the valve is closed, and the waste must close automatically as soon as the valve begins to open

"The main valve must be *positively tight*, or great trouble will be experienced with the hydrant in severe winters, a moderate leakage as in some stop valves, cannot be permitted. A free drainage must be provided to pass away the waste water from the hydrant, or if the hydrant is frequently opened, for testing or use, the ground will soon become saturated and the hydrant cannot properly drain, &c

"508. Flush Hydrants.—A style of flush hydrant, that may be placed under a paved or flagged sidewalk, near the edge, is shown in Fig 122. This style may have one, two or three fixed nozzles

"Figs. 123 and 124 illustrate a style of hydrant with a portable head. This style is manufactured under the Lowry patent. It is designed to be placed at the intercessions of mains in the streets, or in the line of a main, but may be placed in the sidewalk. In either case it is placed within an independent curb, and the cast iron case rises about to the surface. The portable head is of brass and composition, nicely finished, as light as is consistent with strength, and is usually carried upon the steamer or hose carriage. It has any desired number of nozzles from one to eight, each of which has an independent supplementary valve. In the centre of the portable head is a revolving key which operates the main valve stem."

The above are the only kinds of valve hydrants mentioned by Fanning, and the post hydrant is the simplest and cheapest of the two

The term post hydrant is used because the hydrants extend above the surface of the street and to distinguish it from the flush hydrant, which is finished at the street level.

The flush hydrant is used in large cities in positions where traffic would be interfered with by projecting posts, and where very large quantities of water are required to be drawn from the mains.

From a large number of trade catalogues, which are submitted herewith, it will be seen that the term "hydrant" pure and simple is applied without exception to what has been described above as the "post hydrant," and that no such contrivance as that in use in Winnipeg is made or recognized. From the above it is clear that both the scientific and

practical authorities technically define the hydrant as described in my former report.

There is no doubt that some manufacturing firms in England who make up by contract and ship small water works systems, send out the simplest and cheapest articles which will be accepted, and the style of hydrant now in use here may be accounted for in that way, but the fact that the Company has been allowed to use them in the past does not, I am inclined to think, relieve them from the obligation to supply a reasonable and ordinary form of hydrant when required to do so by the City.

The fear is expressed by the Engineer for the Company that the post hydrant would be effected by the frost because in certain parts of Ottawa a steam boiler is continually employed during cold weather in thawing them out. I think the trouble in Ottawa may, in a great measure, be explained by the fact that the water pipes over large areas of the city are laid in trenches excavated in the solid rock, and near the surface of the ground, and that the hydrants on such pipes have no proper drip connections.

The experience in Winnipeg does not confirm the opinion of the Engineer for the Company in this respect. The hydrant at the corner of Market and Princess Streets (mentioned in my last report as the only one in the city with a drip connection), was thoroughly tested and worked in a satisfactory manner during the coldest weather last winter.

In reference to the danger of contamination of the water supply if hydrant drips are connected with the sewers. The water would not rise to the hydrant level except in the case of such an extensive flood as that of 1882, and even in such a case it is impossible that there should be communication between the sewer and water main through a properly constructed hydrant.

The cost of connecting the hydrant drips with the sewers would be about \$25 each, an amount which, in view of having water immediately available in case of fire, cannot be considered excessive.

#### EXTENSION OF MAINS.

This is a point which will probably have to be settled more from a legal than from an engineering standpoint. I would point out, however, that in claiming that, to the actual cost of extensions should be added the proportionate cost of leading mains and working expenses, the Company are asking for a guarantee of 10% on the whole of their investment, including current working expenses, and this notwithstanding the fact that they may, at the time of the extension, be earning 10%, or perhaps 20% on the more central portions of their works. I do not attach much importance to the extension of mains clause from the fact that if the Company mean to carry on their works in a business-like way,

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### CAPACITY OF POWER AND SUPPLY.

The Engineer for the Company says :

1. "Apart from the stipulation as to hydrants, the Company's obligations are limited to providing mains and pumping power sufficient to supply 25 gallons per head to the population of those streets on which contracts to take to the extent of 10% on cost can be obtained.

2. "They are not even limited to the system of constant supply, neither are they bound to deliver water at any particular pressure.

3. "Your Company, as a private commercial undertaking, cannot be expected to lay out a large amount of capital for the benefit of the city in establishing a system of fire protection, which you are under no obligation to provide, and the question therefore arises, if the corporation and the citizens desire such a system, which is, in fact, a necessity in every well organized city, how is you Company to be compensated for the outlay?"

The above is the statement from the Company's point of view of what they are obliged to do under the charter.

The obligation to erect hydrants is admitted, but it is claimed that small mains may be laid, which would leave the hydrants on them quite useless.

It is further claimed that the Company is not limited to constant supply, that is, that they may run during a portion of each day or week, as the case may be and that water is to be drawn while the pumps are working for use when they are not. It is claimed that there is no obligation to supply any water for fire purposes beyond the capacity of works to supply 25 gallons per day per head, which has been before mentioned.

On these points the charter reads as follows :

"That the Company furnish free of charge to the city to the full extent of the resources and powers of their works, all water requisite for the extinction of accidental fires, and for the refilling of tanks emptied for the extinction of accidental fires, during the twenty years aforesaid in the City of Winnipeg, and the said Company bind themselves to erect and maintain at their own expense and cost, hydrants on all highways and streets within the city limits, &c."

The above appears to express clearly the obligation of the Company to maintain works of such a character that, in case of accidental fire, they would be in a position to furnish all the water requisite for its ex-

tion. It does not mean that the city is to take the water at times when there are no fires and store it for use when occasion arises, because that also is provided for in the words, "and for the re-filling of tanks emptied for the extinction of accidental fires." If what is claimed on behalf of the Company had been intended, the charter would have read, Provide all water requisite for the extinction of accidental fires by re-filling tanks emptied for the extinction of fires.

The mention of hydrants 500 feet apart in the same clause, also clearly indicates the use for which they were intended.

There appears to be no doubt that the charter intended that for the very valuable concessions which the Company obtained from the city, it should give the city a first-class water-works system.

It appears to me that the Engineer for the Company is hardly correct in referring to the Company as a private commercial undertaking. As far as the city is concerned, it is a public contractor with certain obligations to fulfil. And I feel sure that in asking the Company to give them a first-class water works system, the City asks nothing unreasonable and nothing that is not fully covered by the true intent and meaning of the charter.

If it is claimed that, in any sense, the present works are, as far as they go, reasonable and proper works, sufficient proof of the contrary is obtained in the statement of the Company's Engineer that at present with only about 100 house connections, they are supplying the full quantity required under the charter for a population of 20,000.

#### RATES.

The rates which the Company are permitted to charge are certainly very high, and I think their reduction would afford a fair ground upon which the City could treat with the Company on the basis of compulsory rates on streets where mains and sewers are laid. This system works very well in places where the works are the property of the corporation. In Winnipeg, where there are practically no private wells, there should be no difficulty in making the rates so low that there would be an actual saving in the cost of water over that of the present uncertain and awkward means of supply, and at the same time leave the Company a handsome profit.

#### SOURCE OF SUPPLY.

In entering into any new arrangements with the Water Works Company it would be well to consider the possibility of improving the source of supply. The Assiniboine water, in the spring and early summer, is, without filtration, entirely unfit for drinking or washing purposes, and the cost of filtering galleries in connection with the Assiniboine would be very great. In my annual report I mentioned the fact that in all

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probability a sufficient supply could be procured from the subterranean source which supplies the city wells.

From examinations made this year I am more than ever convinced that it is possible to obtain from this source a much larger supply than the city is likely to require. If water can be obtained in this way it will be a great advantage to the Company, saving them a lift of from 20 to 40 feet, and the construction of expensive filtering galleries on the Assiniboine.

#### STAND PIPE.

It would add much to the value and general efficiency of the works if the water was delivered through the medium of a stand pipe, or water tower, instead of being pumped directly into the mains, as at present.

#### POWER TO PURCHASE WORKS.

The charter gives the city power to acquire the works in 1890 by arbitration. I have no doubt that it will be found in time that it will be in the interest of the city to own the water works, and in making any alterations in the charter, the right to purchase should be guarded.

#### CHARTER.

In reading the charter of the Company it should be remembered that it states in general terms what the Company are to do. It is in no sense a specification of the works, and could not be expected to go into such details as, size of mains, pressure, form of hydrants, &c. These are simply matters of calculation and practice, depending upon the population, area to be supplied, &c.

In addition to the clauses of the charter quoted above the following :

"And whereas the proper and convenient supply of water through and around the streets of the City of Winnipeg, and the advantages which the said supply will give to the inhabitants in case of accidental fire and to the security of commercial enterprises in the said city, will be of great benefit, &c., &c."

Leaves no doubt as to the intention of the framers of the charter.

In determining the details of the works, then they are to be adapted to furnishing a "proper and convenient" supply of water through and around the streets of Winnipeg. They are also to furnish "all the water requisite for the extinction of accidental fires."

The question at issue then is, do the works as they exist and as they are projected by the Company, fulfil these conditions? The Engineer for the Company fully admits that they do not, and the Company ask for further compensation from the city in order to make proper and convenient works and supply water for fire protection.

It will be observed that in a schedule, referred to as a schedule of rates, attached to the charter, is a statement that the supply will be based upon 25 gallons per head per day. This clause is not only inconsistent with the rest of the charter, but is so absurd that if enforced, it would put an end to the Company as a paying enterprise.

Up to the present time the Company have not attempted to confine the consumption to this small quantity. If they were to do so it would be found that the allowance of water for the day would have been consumed say at 10 o'clock each morning, and, according to the claims of the Company, no more water should be delivered that day, either for domestic or fire protection purposes.

How far this would be from fulfilling the conditions of the charter as to proper and convenient supply and all requisite for the extinction of accidental fires, is apparent.

That the amount 25 gallons was placed in the charter by a clerical error or want of knowledge is evident from the fact that, if the Company were to limit the supply to that quantity (instead of pumping four or five times that quantity as at present, see report of the Company's Engineer) they would at once lose their customers, as no one would submit to paying water rates for such a partial and unsatisfactory service.

As far as the character of the works, and the improvements which the city is entitled to demand are concerned, I see no reason to change any of the opinions expressed in my former report. As I have before stated here the question of reduction of rates is one which might be considered with advantage both to the City and the Company.

The Company will find that the right to charge excessive rates and deliver partial supply of water would be of no benefit to them, but that, as in every other business enterprise, their success will be in proportion to the efficiency of their works and the reasonableness of their charges to the public.

Your obedient servant,

H. N. RUTTAN,  
*City Engineer.*



