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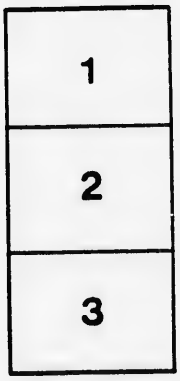

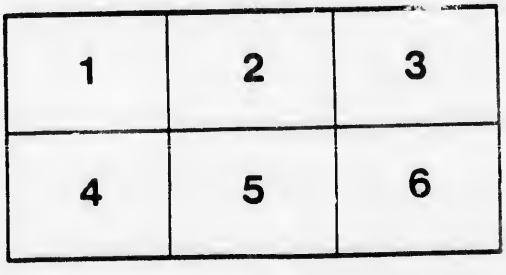

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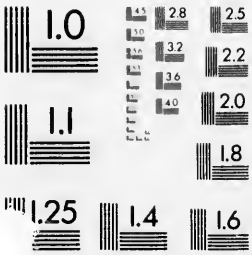

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PROSPECTUS

OF

The Georgian Bay Ship Canal and Power Aqueduct Company.

ELECTRICITY AND WATER-POWER.

"There is no form of energy that is so far reaching in its benefits to the welfare and comfort of the world as electricity.

"There is no force so plentiful in a static condition as electricity.

"There is no kind of power that can be so absolutely controlled by a consumer as electrical power.

"There is no source of energy so easy of access or so richly provided for as water power.

"There is no form of motion that is more perpetual than a water-fall.

"There is no machine that depreciates so little for the amount of work it performs as the dynamo.

"There is no medium of transmission so little wasted by transmitting power as a wire.

"There is no form of investment more certain of continual returns than an intelligent development of electrical water-power plant.

"There is no reason for delaying the use of our water-falls except that our investors do not as yet fully appreciate their importance.

"There are water-falls enough to turn all the machinery required for the comforts of mankind for centuries to come, and, unlike other sources of energy, they are exhaustless.

"By the union of electricity and water-power, our great and now smoky manufacturing cities can be models of comfort and cleanliness.

"By the combination of these two forces the locomotive, with its soot and cinder, can be hushed and side-tracked.

"By the adoption of these sources of energy and heat, our great blast furnaces and smelting works may become odorless and clean. Mark A. Replogle in *The Electrical Review*."

"The labor of the future will consist of pressing electric buttons." Nicola Tesla.

OBJECTS OF THE COMPANY.

The objects of the Company are three-fold, namely:

1. The development and distribution (and sale) of electric energy by means of water-power.
2. Supplying municipalities and the inhabitants thereof with pure and abundant water, for fire protection, domestic use and other purposes, cheaply, by means of gravitation.
3. The construction of a ship canal between Lake Ontario (at Toronto) and the Georgian Bay via Lake Simcoe.

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PROSPECTUS

—OF—

The Georgian Bay Ship Canal and Power Aqueduct Company.

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3. The construction of a ship canal between Lake Ontario at Toronto and the Georgian Bay via Lake Simcoe.

These three phases of the scheme will be taken up and described separately, as they are in no way interdependent on each other, although the construction of any one is a partial construction of the other two, but any one can be constructed with profit and advantage without reference to the others.

While the first two sections of the undertaking are but a small part of the great work, it is proposed to construct them together under a separate contract, and for purposes of bonding to treat them as **a separate and complete work** by themselves. But, while this is the case, a general description of the Charter powers of the Company is given together with an outline of the whole undertaking that it proposes to carry out.

THE CHARTER.

As to the Charter its scope, value and importance, it is only necessary to quote the words of the late Hon. C. F. Fraser, as reported by the Toronto *Globe*, April 21st, 1894:

"I tell you that you are creating a monopoly on this side as great in its way as the Standard Oil Company on the other side of the line. You are investing this Company with enormous privileges. You are giving it an actual monopoly of water power and water toll over a large section of the Province. I know of no company in the Dominion with such enormous powers as you are giving this Company."

Mr. Fraser's opposition to the bill proved futile, the progressive element in the Legislature predominated and the measure was carried by a vote of almost two to one, it passed in 1894, but during the sessions of 1895 and 1896 many amendments were made to the charter, greatly enlarging and extending the Company's powers.

ELECTRIC POWER DEVELOPMENT.

The following is a brief outline of the power aqueduct.

Most people know what a mill pond is. The power aqueduct will simply be a series of very large mill ponds—natural and artificial lakes—one above the other, in immediate succession to the north, each having a very great head of water and each supplying all below it. The water will be used many times over, each section serving as a reservoir for all the lower ones. The only difference between this system of mill ponds and others consists in:

1. The immense available head or fall.

2. The practically unlimited capacity for the expansion and extension of the system.

3. The increased value of the work in geometrical proportions as the upper sections are completed.

4. The presence of an immense available market Toronto and vicinity for the electric energy that the system will produce.

5. The smallness of the capital involved when compared with the results to be secured.

6. The ease and success with which the work can be carried out upon the "instalment plan," and

7. The revenue-earning character of the undertaking almost from its inception.

Mr. Willis Chipman, C.E., reports the Humber watershed area to be 337 square miles. (see page 5).

Mr. Chipman makes two reports. The first contains general statistics and data that gives a key to all of the watersheds of this part of the Province. No more useful, complete or reliable figures could be compiled.

The first and largest of these reports deals most minutely and exhaustively with the watershed of the Humber valley. It also gives general statistics and data applicable to all our other local watersheds. The second one deals with the power that can be developed from the Lambton reservoir, comprising section one of the company's work. It will be seen from table "D," page 8 of this work, that 4,800 horse power can be procured from section one alone, without any reservoirs above it.

Upon the completion of the second section 9,600 horse power would be produced at the first dam below Lambton and over 2,400 horse power at the second dam above Weston or a total of 12,000 horse power for the two sections.

The doubling of the power of the first section would result from the added reservoir capacity of the second section. On the same principle the power of the first and subsequent sections would be indefinitely augmented by the diversion of other waters and increased storage capacity.

The upper sections of the Humber will cost less and less in proportion as the work is completed from the south, the land for reservoirs and right of way being much cheaper and the dams can be more cheaply constructed. These two items alone will absorb the great bulk of the expenditures.

But while the upper sections cost less than the lower ones they are of far greater value than the latter. This is well illustrated on page 4 where it will be seen that section one will cost $910,000 and will only produce 4800 horse power, but so soon as the next section is completed at a cost of $490,000 the new reservoir (of section two) doubles the capacity of section one, in addition to the power that will be produced at the second dam (section 2).

Thus $910,000 will only produce 4800 horse power, but with a further expenditure of but $400,000 we have over 12,000 horse power. In other words, one dollar expended on the second section gives nearly the same results as three dollars expended on the lower section. The same rule holds good in the same or a greater geometrical ratio until the whole power system is completed.

The waters of the Humber alone can be made to develop over 15,000 electric horse power at a cost of less than $3,500,000, this volume can be increased to over 130,000 horse power at an expenditure of less than $700,000 by the diversion of the waters of the Credit river into the Humber valley at Caledon East, in the County of Peel. the credit waters have an available fall of from 700 to 1,100 feet to Lake Ontario.

At an expenditure of about $1,500,000 more the Lake Simcoe division can be completed, this will add 230,974 horse power according to a report made by Mr. R. McCallum, C.E., chief engineer of the Ontario Public Works Department, but a further application of the rules laid down by Mr. Chipman would make it about one-ninth less or 223,088.

According to this showing the Humber, Credit and Lake Simcoe divisions would yield over 355,000 horse power for ten hours each day at a total cost of about $5,700,000. Mr. McCallum claims that the Lake Simcoe power can be more than doubled at small cost by the diversion of other waters of higher attitudes into Lake Simcoe.

The doubling of the capacity of the Lake Simcoe section would bring the total available power up to the enormous volume of 576,176 horse power. The object in going into these figures is to give as complete an idea as possible of the whole undertaking upon the conservative basis laid down by Mr. Chipman.

Electric power in a country like ours, with such a great market to begin with, will create a further market for itself, and the sale of this great volume of power at even $15 per horse power (one-third of the present lowest Toronto price) would yield a revenue of $8,042,640, or sufficient to pay interest at 4 per cent. on $200,000,000, besides leaving $642,640 for maintenance, working expenses and contingencies.

It is not claimed that these results will ever be realized, they are simply given to show the scope and possibilities of the undertaking, but even the putting forth of such unthinkable figures tends to frighten ordinary people away from the enterprise, they at once regard it as something quite beyond them, but if Mr. Chipman's report shows anything, it shows that a very ordinary amount of capital will produce very great results. It has been shown that an increased capital will produce immensely greater results. It will now be shown that the principle is capable of inverse application.

There is one remarkably unique feature of the work that has not been dwelt upon heretofore, namely, the undertaking becomes revenue producing at once; for instance, by an expenditure of $15,000 or $20,000 several hundred horse power can be developed within four months; by an expenditure of $90,000 over 1,500 horse power can be developed and sold in less than eight months, the supply being rapidly augmented at a more profitable ratio until the entire system is completed, besides giving time for the market to gradually adjust itself to the supply; this immediate revenue would go a long way towards defraying the cost of construction and to that extent obviate the necessity for borrowing.

MR. MANSERGH CONFIRMS.

The people have been grossly misled when they were assured that Mansergh examined into and condemned the power aqueduct project. According to his own admissions he never looked into the power scheme at all. Here are his exact words:

"I do not intend to be led away into hypothetical discussion of the question of providing power for all sorts of fanciful purposes that may be ever suggested."

"I am of opinion that it is no part of the duty of the Corporation to enter into speculations of this character, and I am quite clear that it is not my business, under the terms of my engagement, to consider any of the power schemes which have of late been so persistently advertised in the city."

"You may banish from your minds any idea that the Simcoe scheme should be carried out, because of the power that the water will bring with it.

"Power can be manufactured in Toronto more cheaply in other ways."

"I promised in an early part of this report to tell you how much power could be got out of the 50 million gallons a day, and at what cost, and I will now proceed to do so."

Mr. Mansergh stated that power could be manufactured in Toronto more cheaply in other ways, but he failed to say what the other ways were. A table prepared by Mr. H. Holgate, C.E., will be found on page 4 of this work, which will give the most accurate information available on this point. Mr. Mansergh volunteered to tell the city how much power can be got from 50 million gallons per day after coming through a pipe from Lake Simcoe. He makes it clear however, that 50 million gallons falling 96 feet would produce 1,010 horse power for 24 hours continuously. Mr. Mansergh omitted to say that the yield for ten hours per day would be over 2,400 horse power. Ten hours is the real commercial day upon which all calculations should be based; he condemns this scheme as being entirely too costly for production of power. Every person who has any knowledge of hydraulics will entirely agree with him. The absurd scheme which he condemns, which every sensible man would condemn, is not and never was the Aqueduct Company's scheme; it is one entirely of his own conception or creation. The Aqueduct Company propose to use in the neighborhood of from one thousand to three thousand million gallons of water per day, as may be required. Taking the latter figure it would, according to Mr. Mansergh's report, represent sixty times 2,400 horse power per day for ten hours,

of 144,000 horse power gross. Then, instead of having a fall of 96 feet, as Mr. Mansergh suggests, the Company's system would have a head or fall of 367 feet (in the aggregate) by means of four dams, or nearly five times the fall of Mr. Mansergh's proposed Eglinton system. **Multiply the quantity of water by 60 and the fall by 5 and we have 720,000 horse power gross for each and every day of ten hours on the basis laid down by Mansergh.**

Mr. Mansergh makes an allowance of from 4 to 5 per cent. for friction, transmission, etc. Experts on hydraulic power development allow about 25 per cent. After making a liberal allowance, say 30 per cent., for friction, transmission, etc., the net available power would be 480,000 horse power for ten hours out of twenty four each day in perpetuity.

The volume of available supply of water is made up from the waters of the Humber, the Credit, Lake Simcoe and several thousand square miles at a greater altitude to the east, north east and north of Lake Simcoe.

THE SECTION SYSTEM.

The Niagara Falls Power Company were compelled to expend between four and five millions of dollars before a single horse power could be produced or a dollar of revenue obtained.

The Aqueduct Company is more favored by nature, as it is by no means necessary that the whole of the work contemplated by the Company should be completed before a revenue can be derived, nor does the success of the undertaking depend at all upon the ultimate completion of the whole work. The reverse is the case. The work is divided into three principal divisions, viz. **the Humber River, the Credit River and Lake Simcoe**. The former will be constructed first, in sections, commencing at or near the mouth of the Humber. Each section will be a complete work in itself, and if the second or following sections were never proceeded with the first would yield a revenue that would pay large dividends on the capital invested. But, of course, the more reservoirs constructed the more power would be obtained, and the greater the efficiency of all the sections below the most northerly one, for the greater the total reservoir capacity the greater the amount of water saved and the larger the daily average supply.

Thus it will be seen that several hundred thousand dollars can be profitably invested, and the work may be extended so as to use several million dollars with better proportionate results. But the first one, or first several sections can be constructed and the rest abandoned, yet the work done would not be a loss, but a most valuable and productive property.

This unique feature of the project brings it in point of simplicity among the very ordinary transactions of life, and within the grasp of those unacquainted with works involving the expenditure of millions of dollars. Besides the safety of whatever may be invested in one or several sections of the work, the adoption of this plan will bring a revenue to the Company in a few months, whereas they would have to wait several years for dividends if the entire work were to be completed before any revenue could be derived.

Still another advantage from the section system would be that while other parts of the work are being prosecuted, the market will be gradually developed by the introduction of large quantities of cheap power from the completed portions of the work.

WHAT NATURE HAS DONE.

One of the most remarkable features of this enterprise is the manner in which nature, with a most lavish hand, has provided on the very spot where it is required an exhaustless supply of most suitable building stone. With the exception of the cutting that will have to be made through the ridge dividing the Humber and the Holland River, there is very little cutting to be done south of Lake Simcoe, but such other cuttings as will be necessary will be made close to the four dams that will form the southern terminals of the four Humber sections. In making these cuttings enough stone will be secured to furnish every want in that direction for the entire work. Thousands of cubic yards already quarried by nature, lie available on the very spot where it is most wanted.

AN OPPORTUNE TIME.

There never was a more opportune time than the present for the carrying out of such an undertaking. The labor market was never in a more congested condition, the financial centres of the world were never so glutted with vast sums of money seeking investment at low rates of interest upon just such securities as the Company have to offer.

The agitation of the silver question, that has now assumed such alarming proportions in the United States, is causing the withdrawal from that country of British and other foreign capital, which will be added to the idle millions that already glut the financial centres of the old world. This will come to the benefit of large legitimate enterprises in sound money countries, among which Canada has no rival.

But that is not all, for besides the unprecedented favorable condition of the foreign money markets, the land required for reservoirs and right of way near the city can now be secured many hundred per cent. less than several years ago. There is now not a vestige of the insane boom that prevailed in Toronto and its environs seven or eight years ago. The land that the Company requires is for the greater part broken and unproductive, and its actual commercial value is less than that of good farming lands situated thirty miles from Toronto.

BONDING.

The Company proposes to make a $2,000,000 (£ 400,000) four per cent. twenty year bond issue, to be secured by first mortgage upon the first two sections of the Company's undertaking.

The first two sections comprise that part of the proposed work from the present northerly termination of the level of Lake Ontario, on the River Humber, (at Bloor Street), to a point 320 feet above the level of Lake Ontario, near the south limit of the Village of Woodbridge.

It is proposed that trustees should not only hold the mortgage to secure the bonds, but that the proceeds from the sale of the issue be paid direct to the trustees, and be applied as follows:

1. A sum sufficient to pay the interest on the whole issue during construction, 2½ years, to be set apart and used for that purpose.

2. The balance $1,800,000, less discounts, commissions &c., or such part of it as may be required to be paid to the Contractors as the work progresses, upon the certificates of engineers appointed by the Company, and approved by the Trustees.

3. All contracts to be approved by the Trustees.

According to the report of Mr Willis Chipman, C. E. (see page 8), the construction of the first dam at Babys Point on the River Humber, would enable the Company to develop 4,800 horse power within a mile and a half of the City limits. The construction of another dam above Weston would (owing to the additional reservoir), more than double the capacity of the first dam, making it produce 9,600 horse power. The second dam would itself produce over 2,400 horse power, making a total of over 12,000 electric horse power for the two sections. This power would find a ready market at $30 per horse power per annum, or a total of $360,000. This revenue would pay interest on $8,000,000 at four per cent., besides leaving $40,000 for working expenses. Such a security would warrant a loan of four or five million dollars, but it is only proposed to charge it with $2,000,000.

The estimated cost of the two sections is as follows: —

SECTION 1.

Land Damages, (a liberal estimate)	**$180,000**
Dam	**450,000**
Bridges and Roadways	**70,000**
Power House, Plant, &c.	**150,000**
Engineering, Legal Expenses, &c	**60,000**
	$910,000

SECTION 2.

Section Two, (including $40,000 for Engineering Expenses, &c.)	**$490,000**
Total for both sections	**$1,400,000**
Interest on Capital during construction	**200,000**
Contingencies, &c.	**400,000**
Total	**$2,000,000**

RELATIVE COST OF POWER.

Mr. Henry Holgate, C.E., late chief engineer of the Northern and North Western Division of the G. T. R., (now of the Royal Electric Company, Montreal), gives a most reliable table, showing the ascertained cost of steam power under the best modern conditions in different quantities. Mr. Holgate's calculations are based on the commercial year, (300 days of 10 hours each) he says:

"The value of electric power is based on two conditions, the cost of steam power and the demand for power."

"As to the cost of steam power, it may safely be estimated that:

Engines of	**5**	**h. p. cost**	**per**	**h. p. per**	**year $175**
"	10	"	"	"	105
"	15	"	"	"	90
"	20	"	"	"	73
"	25	"	"	"	67
"	50	"	"	"	52
"	100	"	"	"	36
"	200	"	"	"	28
"	300	"	"	"	26
"	400	"	"	"	25
"	500	"	"	"	24

Apart from the Toronto Railway and several large manufactories in Toronto, the amount of power used by the average user does not exceed 20 h. p., and that amount of power developed by steam would cost on the average $73 per h. p. **As a matter of fact, electric power is selling in small quantities, in Toronto to-day for eight cents per h.p. per hour, or $240 per h. p. per annum, (3000 hours).**

In view of these figures, it can safely be assumed that the first twelve or fifteen thousand h. p. from the Humber would yield the Company at least $30 per h. p. per annum. When the works are extended and produce a larger volume of power, the price could be reduced to large consumers to $20, or even to $15 per annum. The Company could make such a reduction with immense advantage to the community and the shareholders. The actual cost per h. p. to the Company of the first 12,000 h. p. would be the interest on $2,020,000 at four per cent., ($80,000), and the cost of operating and maintaining the system, which is put at the liberal sum of $40,000, or a total of $120,000 per annum, this amounts to exactly $10 per h. p. for the first 12,000 h. p. The cost per h. p. would decrease as the work proceeded and the actual average annual cost of production per h. p. would be reduced as the supply increased until it would be less than $4 per h. p. per annum.

It will be seen that it would not be possible for any other power that can now be conceived of to compete with electric power developed by water from this system. But, besides the mere cost of production, electric energy has many other advantages over steam. Here are a few of them:

1. **Largely reduced insurance rates.**
2. **It is always ready and available.**
3. **It is cleaner, more healthy and wholesome.**
4. **It is less dangerous.**
5. **It is under better control.**
6. **By using a number of small motors at different parts of a factory, one or more machines can be run (when the rest are not required) without keeping a lot of heavy shafting running throughout a large building.**
7. **It requires less time and capital to equip a factory large or small) with electric motors than with steam engines.**

Under these conditions, electric energy would be much cheaper and more desirable than steam even at the same gross rates per h. p.

As before stated, it is the intention of the Company to make a two million dollar bond issue to complete the first two sections. While these sections are under construction, preparations will be made for a much larger bond issue to complete the other sections of the Humber division and construct the Credit and Lake Simcoe divisions, and also to establish the system for municipal water supply.

For detailed and technical information *re* the Humber division, the reader is referred to the following carefully compiled reports by Mr. Willis Chipman, C.E.

REPORT UPON THE WATER AVAILABLE FROM THE HUMBER WATER-SHED.

BY WILLIS CHIPMAN, C. E.

To the President and Directors of the Georgian Bay Ship Canal and Power Aqueduct Company:

GENTLEMEN:—I beg to submit the following report upon the water-shed of the River Humber, and the amount of water available for power and other purposes that can be utilized.

RIVER DESCRIBED.

The River Humber discharges into Lake Ontario about half a mile from the present western limit of the City of Toronto. From the outlet to Bloor Street, a distance of about two miles, there is no rapid or fall to obstruct navigation for light draught vessels, but

above Bloor Street the stream is broken with rapids. The distance from the head of the longest branch of the river to the outlet is about thirty-five miles. The highlands at this point have an elevation of about 1,000 feet above Lake Ontario, the fall in the streams being greater in the northern part of the water-shed than in the southern portion.

About two and one half miles above Weston, and ten miles from Lake Ontario, the west branch of the Humber joins the main river At Woodbridge, fourteen and one-half miles from the lake, the east branch comes in

The elevation along the river at different points is approximately as follows:

POINT.	Distance from the Lake.	Elevation above Lake Ontario.
Outlet at Lake Ontario	0 Miles.	0 Feet.
Crest of Dam, Lambton	4 "	59½ "
Crest of Wadsworth Dam, Weston ..	7 "	134 "
Junction West Humber	9½ "	169(?) "
Town Line, York and Vaughan	13 "	198(?) "
Junction East Humber	14½ "	225(?) "
Main Branch at Kleinburg	17 "	330 "
East Branch at Kleinburg	17 "	361 "
Town Line, Vaughan and King, East Branch	28 "	450 "

AREA WATER-SHED.

The official maps of the Province are so imperfect that no dependence whatever can be placed upon the topographic features as shown thereon.

In determining the area of the Humber water shed, the following maps and plans were consulted:

Fackaberry's Atlas of the Dominion of Canada
Miles' Atlas of the County of York.
Unwin and Scott's Map of the County of Peel.
Unwin's Map of the Township of Etobicoke.
Tremaine's Map of the County of York.
Hogg's Map of the County of Simcoe.

The topographic surveys made by us in 1844 and 1895 in the Townships of King, Vaughan and York have also been used for more accurately defining the water-shed between the Humber and the Don.

The total area of the water-shed of the Humber is approximately 337 square miles, which area may be sub-divided as follows:

Township of York.....	20	square miles.
" " Etobicoke 20	"	"
" " Vaughan 68	"	"
" " Gore of Toronto..21	"	"
" " Albion . .83	"	"
" " Chinguacousy....30	"	"
" " Caledon 11	"	"
" " Adjala 8	"	"
" " Mono 7	"	"
" " King 57	"	"
" " Whitchurch 6	"	"
Total . 337	"	"

The drainage area of each of the different branches is about as follows:

West Branch (above Thistleton)....	79	square miles.
East Branch (above Woodbridge)..	81	" "
Main Branch (above Woodbridge) .	112	" "

In the Townships of York and Etobicoke the surface of the country is undulating and rolling.

The greater part of King, the north part of Albion and the parts of Adjala, Mono and Caledon drained by the Humber are hilly, the summits of the hills being from 900 to 1,300 feet above the sea. There are no lakes, large ponds or marshes within the area drained by the river, and nearly all of the land is tillable, although a comparatively small portion is bush land.

RAINFALL

The following extract from a paper by Desmond Fitzgerald, Esq., M. Am. Soc. C. E., read in the Transactions of the Am. Soc. C. E., September, 1892, is a fitting introduction to this subject:

"There is hardly any phenomenon about which so many mistaken "statements are commonly made as that of the rainfall. Either the "cutting down of the forests is fast diminishing the annual precipita"tion, or else the latter is increasing rapidly from turning up of the "ground, and other causes. There are no longer such snow storms "as we used to have. The rains come now altogether in the spring. "Freshets and droughts alike come from great changes in the rain"fall. These and a multitude of other fallacies are constantly met "with. As a matter of fact the annual rainfall is such a varying "quantity that it is extremely difficult to lay down general laws in "regard to certain of its phases, even with the aid of a good rainfall "table.

"Again, the observations themselves are frequently inaccurate, "as can sometimes be told at a glance. The earlier results were "generally too small, because the gauges were placed too high and "less care was exercised to measure all the small showers and the "snow. Too often the tables issued from official sources, and "stamped with the approval of the Government, are open to this "criticism. The periods also are generally too short to build safe "theories upon and, lastly, self-interest connected with important "commercial enterprises leads to false statements.

Rainfall observations have been taken at the Toronto Meteorological Observatory from 1841 to the present time, except from August, 1844, to March, 1845, inclusive. The recorded rainfall in 1841 is given as 50.175 inches, the heaviest on record. As the two following years are not available, and this is so high, it would be safer to eliminate it from the averages.

The observed rainfall at the Toronto Observatory has been as follows:

TABLE I.

Average of 8 years, 1846 to 1853, inclusive				34.40 inches.
" " 10 "	1853 " 1863,	"	34.88	
" " 10 "	18[illegible] " 1874	"	33.46	"
" " 10 "	18[illegible] 1884,	"	31.53	"
" " 10 "	1885 " 1894,	"	31.02	"
" " 54 "	1841 " 1894,	"	34.01	"
" " 23 "	1872 " 1894,	"	32.77	"
" " 5 "	1890 " 1894,	"	33.60	"

The rainfall in the above table includes the melting snow.

Rain observations have been taken at some few points north, east and west of the Humber water-shed, sufficient to demonstrate that the annual precipitation differs but little from that at Toronto, the amount at Toronto being slightly less than at points to the north and northwest.

It is generally supposed that the deforesting of our country has contributed more than any other factor towards the gradual drying up of our streams, during the summer months especially. Farm drainage is no doubt another important factor. I am of opinion, however, that such streams as the Don, the Humber, the Thames, the Sable, the Sydenham, the Rideau, and many others in the older parts of this Province carry as large a proportion of the rainfall from their water-sheds to-day as they did twenty years ago; that the removal of the forest areas has reached its maximum limit; and that therefore the flow of these streams will remain a constant ratio to the precipitation.

Although it is generally conceded that the annual rainfall is decreasing from the effects of deforesting, this question has not been settled entirely in favor of this theory.

I am of the opinion that the quantity of water required by growing grains, grasses, roots, etc., per acre is greater than that required by forest land, during the summer months, and that therefore a much larger proportion of the rainfall and the moisture in the air is absorbed now than formerly.

It is not probable, however, that the area of the forest land within the limits of the Humber water-shed will decrease during the future.

The rainfall varies from 30 inches to 42 inches, the following being the heaviest and lightest recorded:

TABLE II.

1843	50.175 inches.	1874	24.344 inches.
1878	48.490 "	1882.....	24.837 "
1870	46.188 "	1872	25.338 "
1855	41.550 "	1877..	25 615 "
1852	40.805 "	1887.....	25.758 "
1857.....	40.585 "	1888	26.279 "
1859	39.764 "	1848.....	26 805 "
1803	39.715 "	1881	26 898 "
1869	39.642 "	1860	27 004 "
1866...	39.419 "	1850..	28.055 "

During the last ten years the annual rainfall has been less on the average than during the total period since 1843, but slightly greater than during the period of 1871 to 1880.

If each dry year were followed by a wet year it would be safe to take the average, but this is not the case. Since 1843 the precipitation in consecutive dry years has been as follows :

TABLE III.

Two years,	1881, 1882,	average	25.87	inches.
" "	1887, 1888,	"	26.02	"
" "	1874, 1875,	"	27.04	"
" "	1873, 1874,	"	27.08	"
" "	1872, 1873,	"	28 47	"
" "	1888, 1889,	"	28.74	"
Three "	1872, 1874,	"	27.09	"
" "	1887, 1886,	"	27.75	"
" "	1873, 1875,	"	28 50	"
" "	1881, 1883,	"	28.61	"
" "	1874, 1870,	"	28 82	"
Four "	1872, 1875,	"	27 70	"
Five "	1872, 1876,	"	28.08	"
Six "	1872, 1877,	"	28.17	"
Seven "	1871, 1877,	"	28.82	"
Eight "	1870, 1877,	"	30 09	"
Nine "	1871, 1879,	"	30 81	"
Ten "	1871, 1880,	"	31 30	"

From the foregoing table it is evident that it would not be safe to use the average annual rainfall for the last 54 years in estimating the available yield of water from any given water-shed.

The flow by months, and the average for 10 years and for 54 years, is given in Table IV.

TABLE IV.

PRECIPITATION OBSERVED AT TORONTO OBSERVATORY.

	1885	1886	1887	1888	1889	1890	1891	1892	1893	1894	Average for the last 10 years.	Average for 54 years.	1874
January .	2 79	5.52	3.20	1 93	3 46	3 36	3 13	1.55	2.90	1.67	2.97	2 89	4 04
February	1 82	3 68	4 28	1 68	2 37	3 48	2 65	2.27	3.66	2.27	2.75	2 65	3.66
March ...	1 22	1 90	1 53	2.80	0.99	1 48	3.03	0 77	2 04	1 32	1 82	2 70	1 65
April.....	3 05	2 96	1.61	1 37	1.89	2 11	2 31	1 26	4 90	1.33	2 25	2.47	2.34
May.....	2 25	2 44	0 81	0.85	3 14	2 62	0.62	3 48	3 80	2.36	2.03	2 94	1 40
June	4 19	1.92	2 65	3 99	3 55	4.87	3 05	5 81	1.83	1.08	3.29	2 95	1 80
July.....	2 10	2.45	0.66	0.86	3 26	4 11	2 16	2 69	2.27	1 61	2.20	3.00	1.35
August..	3 92	2 63	2.00	2 91	0.43	3 02	4 83	3.09	5 75	0.38	2 99	2 92	0.38
Septem'r	3 62	3.85	1 20	3 59	2 08	1 85	1.70	3.12	1.25	5 46	2 74	3 15	1.55
October .	3 73	2 59	1.63	2 67	1 89	4 04	1 70	1.35	3 62	2 35	2.05	2 93	1 42
Novem'r	2 18	2.65	2.80	3 10	3 56	4 59	3 56	2 17	2 90	0.61	2.72	3 15	2.11
Decemb'r	1.98	2 01	3.41	0 83	4 00	1.94	2 88	1 24	4 60	2 41	2 62	3 31	1.16
Year	32.92	35.08	25.76	26 28	31 22	37 37	31 52	29 80	51 31	29 87	31 92	34 01	24 34

Monthly average, 2 66 2 88 2.03

From Table IV. it will be seen that the monthly rainfall varied from 5.75 in August, 1893, to 0 66 in July, 1887, during the last 10 years. The lowest recorded monthly rainfall observed during the last 54 years was 0.38 in August, 1874.

During the last 10 years there has been a greater variation in the monthly averages than during the period of 54 years, the difference in the first place between extremes being 3.29-1.82, or 1.47 or 55 per cent. of the average, while in the latter the difference is only 3 31-2 47, or 0 84 or only 29 per cent. of the monthly average.

This may be accidental. The driest months in the 10 year period are, in order, March, July and April, while in the longer period they are April, February and March.

FLOW OF STREAM.

The flow of a stream equals the rainfall, less evaporation and absorption.

There is no method of deducing the percentage of the rainfall that is represented by the evaporation or the absorption except by actually measuring the flow of the stream during the period covered by the observations of the rainfall.

In this Province no gaugings of this kind have been made of the flow of the rivers and streams, and the volume of flow as deduced from the rainfall must therefore be considered as approximate only. Such observations have, however, been made upon the St. Lawrence, the rivers connecting the Great Lakes, and upon many rivers and streams in the United States, more particularly in the New England States, the results of which may be safely applied to the Humber The rainfall, "run-off," etc., on several water sheds are as follows :

TABLE V.

OBSERVED FLOW OF SOME RIVERS IN THE UNITED STATES.

RIVER.	Area, Water-Shed. Sq Miles	Average Rain. Inches.	Average Flow or Run-off. Inches.	Per-centage of Rain-fall.	C. Ft. per sec. per Sq. Mile of Basin.	
St. Lawrence at Ogdensburg, N.Y	272.025	29.78	14.96	50.2	1 102	Cooley.
St. Lawrence at Ogdensburg, N.Y.	270 075	31 20	15.07	48 1	1.110	Crossman.
Connecticut, Conn.	10 234	44.69	25.25	56 5	1.861	
Sudbury, Mass....	76	45 80	22.07	49 5	1.669	
Croton, N. Y. ...	353	45.08	22.39	49.6	1.648	
Madison, Montana	2.000	20.00	13 00	65.0	0.958	
Rio Grande, Tex.	1 400	30.70	12.84	41.9	0 946	

The gaugings for St. Lawrence are from reports of engineers, U.S.A., those for the other rivers from a paper by C. C. Babb, Jun., Am. Soc. C. E., (Transactions May, 1893), reports and papers by Messrs L. E. Cooley, R. E. McMath, Geo. Y. Wisner, Chas. Crossman, L. Y. Schermerhorn and others, have been consulted in preparing the above table.

It will be observed that the rainfall on the water-sheds of the Rio Grande and of the St. Lawrence are about the same as the average on that of the Humber water-shed. In estimating the "run off" from the rainfall, it would be safer to take the percentage given by the flow in the St. Lawrence, 49 , than that of the Rio Grande, owing to similarities in meteorological conditions and in surface geologies of their water-sheds

Of the total basin of the St. Lawrence (above Ogdensburg), 272,000 square miles, about 95,300 square miles is in the Great Lakes.

From calculations based on observations and experiments, it is known that the evaporation from a water surface is much greater than from land. If, therefore, the Great Lakes were absent from the drainage basin and their sites replaced with land, the run-off of the St. Lawrence would be increased.

At Boston, from 1875 to 1890, the average yearly evaporation was 39.20 inches from a water surface, and on the Great Lakes the observed evaporation is known to be greater than from land surface, and about 60 per cent. of the rainfall.

We can, therefore, safely estimate that the average flow of the river Humber is at least 50 per cent. of the average rainfall, on the basin within its water-shed, or one and two-tenths cubic feet per second for each square mile, or 648,000 Imperial gallons per day.

As given on page 5, the area of the basin is 337 square miles, from which it follows that the average flow in the river is about 404 cubic feet per second or 218,160,000 Imperial gallons per day, the average rainfall being taken as 31 inches.

With sufficient storage capacity for the surplus water in years of great precipitation, the above average could be depended on.

The following table shows that the annual "run off" on the Croton and Sudbury water-sheds does not bear a constant proportion to the rainfall :

TABLE VI.

YIELD IN PERCENTAGE OF RAINFALL OF THE CROTON BASIN, 337 Square Miles, and the Sudbury Basin, 76 Square Miles

Year.	CROTON. Rainfall.	CROTON. Run-off Per Cent.	SUDBURY. Rainfall.	SUDBURY. Yield Per Cent.	Humber Rainfall.
1870	46 03	48			46 01
1871	48.94	43			32 73
1872	40.74	47	For 16 Years.		25 34
1873	43 87	04			31.01
1874	42 37	03			24 34
1875	43.66	63	45 40	44 9	29.73
1876	40.68	01	40 56	48 2	32 10
1877	46 03	48	44.02	57 9	25 01
1878	54 14	53	57 93	52.6	48.40
1879	46.08	50	44 42	45.3	29 36
1880	38 52	40	38.18	31 0	35 32
1881	46 33	44	44.47	40 5	26.00
1882	55 20	46	49 30	45.0	24 83
1883	43 15	37	32.78	34 1	34 13
1884	53.71	47	47 04	50 4	28 55
1885	45.09	42	43 55	43.4	32 01
1886	47.50	47	46 04	40 5	08
1887			42 70	50 7	76
1888			57 46	62.2	26 28
1889	For 17 Years.		49.95	58 2	31 22
1890			53.00	50 9	37 37
Averages	45.79	49 5	45.8	49 5	31.72

The above tables have been taken from the report of chief engineer, Walter S. Church, to the Aqueduct Commission of New York City, and the reports of the Water Board, Boston. It will be seen from the table that while the average yield of each has been 49 5 per cent. of the rainfall, the flow has in so many years fallen below 30 per cent., 32 per cent. on the Sudbury area, 37 per cent. on the Croton.

The minimum yield of the Sudbury during this period was 11.10 inches in 1883, not quite half the average, and the minimum on the Croton 15.32 inches or 07 per cent. of the average.

The larger the area of the water-shed the less the variation in flow. As the Humber basin is larger than the Croton, we may safely assume that the minimum yearly flow in the river will be about 70 per cent. of the average or 283 cubic feet per second, equal to 152,712,000 Imperial gallons per day.

STORAGE REQUIRED.

Assuming that the daily flow available will average 150,000,000 gallons per day, our next consideration will be the storage required to equalize the monthly flow.

No gaugings have been made of the Humber for a term of years, with which it is impossible to determine the monthly average flow in percentage of the rainfall, without which latter data the storage capacity required to make available the minimum yearly flow cannot be calculated. These observations cannot now be made, so the only thing to do is to compare the Humber with the streams where such have been made. The following table gives the average monthly flow of the Connecticut, the Sudbury and the Croton, and the flow in percentage of the rainfall.

TABLE VII.

FLOW BY MONTHS IN PERCENTAGE OF RAINFALL.

Month	Connecticut Averages. Rain	Flow	Per Cent	Sudbury Averages. Rain	Flow	Per Cent	Croton Averages. Rain	Flow	Per Cent.	Humber Average Rain 10 Years
Jan ...	3.27	1.93	59 1	4.18	2 05	49 1	3.05	2.12	58 2	2.97
Feb ...	3.10	2.04	65 8	4.06	3.18	78 3	3.30	2 47	74 9	2 75
March	3.04	3.00	70.3	4.58	5.02	110 0	4.36	3 80	89 6	1.82
April..	3.26	4.73	145 0	3.32	3.62	109 0	3.04	3.51	66.5	2 25
May .	3 17	4.10	132 2	3.20	2 00	62.5	3.28	2.44	74.4	2.93
June ..	4.00	1 46	36.5	2 98	87	29.2	3 66	1 06	29.0	3 29
July...	4 79	1.02	21.3	3 78	.34	9.0	3.92	.60	15.3	2 20
Aug ..	4.87	1.06	21.8	4.23	.55	13.0	3.76	1.05	28.0	2 09
Sept ..	3.04	.80	20.3	3.23	.40	4 2	4.00	.93	23 3	2 74
Oct...	3.93	1.11	28.3	4 41	1.02	23.7	4 00	1 01	25 3	2 05
Nov .	3.93	1.76	44.8	4.11	1.62	39 4	3.98	1 33	33 4	2.72
Dec...	3.00	2.00	66.7	3.71	1.95	52.7	3.53	2.04	57.8	2.62
Totals	44 09	25.25	56.5	45.80	22.6	49.5	45.08	22.30	49.6	31.92

In the Connecticut the monthly flow is more uniform than on the other streams, owing to its larger basin, especially in the summer season. The Sudbury being the smallest has the least summer flow, falling as low as one third of an inch or one per cent. of the July rainfall.

Applying the percentage of the Croton to the rainfall on the Humber, we get the following as the monthly flow of the Humber :

TABLE VIII.

Month.	Average for 10 Years Past 1885-1894. Rainfall Inches.	Per centage	Flow. Inches.	For 1874. Rainfall Inches.	Flow. Inches	Average for dry Years. 1887-1889. Rainfall	Flow
January	3 0	58	1 74	4 0	2 32	2 9	1 68
Feb ...	2 8	75	2 10	3.0	2 25	2 8	2 10
March	1 8	90	1.61	1 7	1 53	1 8	1 62
April ..	2 3	90	2.21	2 3	2 21	1 9	1 44
May	2 0	75	2 17	1 5	1.13	1 6	1 20
June. ..	3 3	29	.96	1 8	.52	3 4	98
July ...	2.2	15	.33	3 3	.99	1 6	24
August	3 0	28	84	0 4	11	1 7	47
Sept. ...	2 7	23	62	1 6	37	2 2	51
October	2 6	25	.65	1 4	.35	3 0	93
Nov .	2 7	33	.89	2 4	1.03	3 4	1 02
Dec	2.6	58	1.51	1 2	70	3 1	1 80
Total.	31.0		15 63	24 3	12 60	27.7	13 30
Monthly Average	2 60	40	1 30	2 03	1 05	2 31	1 13

One inch of "run off" from one square mile represents 14,520,000 gallons or 2,323,200 cubic feet, from which the average daily run off would be about 540,000 gallons per day for the three dry consecutive years, 1887, 1888, and for the dry year 1874, only 361,000, say 300,000 Imperial gallons to each square mile, that is 108,500,000 gallons per day from the Humber water-shed. This differs but little from the amount given elsewhere on this page.

In round numbers the minimum run off by months will be as follows, assuming one inch gives 14½ millions of gallons.

TABLE IX.

MONTHLY RUN OFF IN MILLIONS OF GALLONS PER SQUARE MILE.

	Inches.	Million Gallons.	Surplus.
January..	1 7	24 65	9 75
February	2 0	29 00	16 40
March.....	1.6	23 20	30 30
April.	2 0	29 00	38 60
May . ..	1 2	17 40	82.00
June.....	.6	8 70	84 30
July	.2	2 90	47 10
August	.2	2 90	35.00
September	.3	3 35	22 90
October .	.5	7 25	12 25
November ..	.8	11 60	1 50
December	1.5	21.75	1.20
	12.6	182 70	
Average.	1.05	15.22	

It will be required to utilize one-half million of gallons per day from each square mile of water-shed, or say 15,000,000 per month, storage would be required for the surplus over the average in the six wet months.

Assume reservoir empty on December 1st, the surplus at first of each month thereafter would be as in the fourth column in above Table IX.

The storage in this case required would thus be 54,300,000 of gallons per square mile of water-shed, say 54,500,000 per square mile. The total storage required on the Humber basin would then be 54,500,000 337 18,366,500,000 of gallons. This being a incomprehensible number, it can be better expressed by stating that it corresponds with a pond having five square miles of surface with a uniform depth of about 21 feet.

By substituting the dry year 1874, it will be found that a storage of 60,000,000 per square mile would be required.

The following table from Mr. Fitzgerald's paper (Trans. Am. Soc. C. E., Sept. 1892), gives the storage capacity required to sustain a

constant daily draft from one square mile containing various percentages of water surface, based on Sudbury River water-shed. This is for a term of 10 years; the gallons are United States gallons, and must therefore be decreased by one-sixth to reduce to Imperial gallons.

TABLE X.

Constant Daily Draft.	0 Per Cent.	2 Per Cent.	4 Per Cent.
200,000	8,707,000	9,037,000	12,802,000
250,000	17,007,000	20,037,000	23,502,000
300,000	28,473,000	31,337,000	31,202,000
350,000	39,173,000	42,037,000	44,002,000
400,000	51,303,000	52,788,000	55,002,000
450,000	63,553,000	65,038,000	66,525,000
500,000	75,803,000	77,288,000	79,105,000
550,000	88,053,000	89,877,000	92,905,000
600,000	100,651,000	103,677,000	106,705,000
650,000	114,451,000	121,577,000	132,154,000

The above storage would tide over the deficiency of the dry years, 1875 to 1890 inclusive, and is not intended for one minimum year.

In my calculations I have assumed that the minimum flow would be the available flow, and that the storage capacity would not be sufficient to tide over the deficiency of a series of dry years, such as occurred between 1877 and 1880.

The total amount that can be made available from the Humber basin is 650,000 imperial gallons per day per square mile of water-shed, by constructing reservoirs to store the surplus water in wet years. To make available the total average flow, the storage capacity required would be about 70,000,000 of gallons for each square mile of basin, that is 23,590,000,000 of gallons, or a reservoir 27 feet in depth and five square miles in area.

The proportion of the average flow of the river that can be made available for power purposes depends upon the capacity of the storage reservoirs.

SUMMARY.

Area of basin of Humber..... 337 sq. miles.
Average rainfall last 10 years ..... 31.0 inches.
Minimum " (1874) ..... 24.3 "
Average " for 2 consecutive dry years ..... 25.8 "
" " " 3 " " ..... 27.1 "
" "run off 50 per cent. of rainfall to years. 15.9 "
" " per sec. per sq. mile ..... 1.2 c. feet.
" " " " " 3 dry years 1.0 "
" " per day " " ..... 650,000 gallons.
Minimum " " " " (1874). 430,000 "
" " " " (3 years).. 500,000 "

The above data are I believe correct, and I hope they may be useful to your Company.

Yours very truly,

WILLIS CHIPMAN, C. E.

Toronto, September 3rd, 1895.

REPORT UPON THE CAPACITY OF THE PROPOSED LAMBTON RESERVOIR.

To the President and Directors of the Georgian Bay Ship Canal and Power Aqueduct Co.:

GENTLEMEN—On September 9th I presented to you my report upon the water available from the Humber water-shed, this report being dated September 3rd, 1895.

Owing to delays in completing the surveys and plans, the computed areas of the land covered by the proposed Lambton reservoir were not given to me by the Company's surveyors until Saturday, 21st September.

The site of the proposed dam is at Baby's Point, almost mid-way between Bloor Street and the Village of Lambton.

The areas flooded at different elevations as computed by G. B. Abrey, Esq., C. E., with his planimeter, from plans made from actual topographic surveys, are as follows:

TABLE A.

Elevation Above Lake Ontario.	Areas Flooded, in Acres.	Differences in Acres.	Mean Areas Between Elevations Given. Acres.	Sq. Miles.
140 feet	1,772	240	1,652	2.58
130 "	1,532	180	1,434	2.25
120 "	1,346	217	1,237	1.93
110 "	1,129			

640 acres, 1 square mile.

A reservoir of one acre in area and ten feet in depth will contain 435,600 cubic feet, representing 2,722,500 Imperial gallons.

The total area of the Humber basin being 337 square miles, the storage capacity of the reservoir between the elevations given will therefore be as follows:

TABLE B.

Between Elevations.	Capacity in Imperial Gallons.	Gallons Per Square Mile.
140 and 130	4,407,570,000	13,315,000
130 and 120	3,917,077,500	11,625,000
120 and 110	3,367,732,500	9,993,000
140 and 120	8,115,247,500	24,071,000
140 and 110	11,782,970,000	34,964,000

The surface of the reservoir has an area of less than one per cent. of that of the water-shed of the Humber, but other ponds and the river itself may increase this somewhat, but certainly to not more than two per cent.

By referring to Table X in my first report it will be seen that this storage capacity will give above 210,000 gallons per day, constant draft, the reservoir to be lowered not more than ten feet during the year, or a constant draft of about 270,000 gallons per day from each square mile if lowered twenty feet, or 317,000 gallons per day per square mile if lowered thirty feet.

This may be shown better in tabular form, as follows:

TABLE C.

Elevations.	Constant Draft in Imperial Gallons Per Day. Per Square Mile.	From Total Water-shed.
140 to 130	210,000 gallons.	72,800,000 gallons.
140 to 120	270,000 "	93,000,000 "
140 to 110	317,000 "	106,830,000 "

From the former report the average daily "run-off" from the Humber water-shed was determined to be approximately as follows, per square mile:

For dry year 1874..... .....504,000 Imperial gallons.
For dry years 1887, 1888, 1889.540,000 " "
For average for future ..... 650,000 " "

The proposed reservoir would, therefore, be of sufficient size to conserve about one-half of the mean annual flow of the river if lowered thirty feet, 43 per cent. if lowered twenty feet, and 32 per cent. if lowered ten feet.

Assuming that the reservoir can be lowered twenty feet, 140 to 120 during the season, the daily draft possible would be one-half the mean daily flow of the river during the three consecutive dry years 1887, 1888 and 1889. With additional reservoirs of a combined capacity equal to this reservoir, the total flow of the river for those years would be utilized. Those auxiliary reservoirs, could of course, be entirely emptied.

The Thoretical horse-power produced by 90,000,000 Imperial gallons of water falling 130 feet is 2,480, or about 2,000 horse-power available for power purposes.

TABLE D.

Power available with average head of 130 feet, first, during three extreme dry years; second during average years:

Horse Power Required.	Three Dry Years. Reservoir No. 1 Only.	Three Dry Years. Double This Storage.	Average Years. Reservoir No. 1 Only.	Average Years. Double This Storage.	Complete Storage Capacity.
Constant....	2,000 H. P.	4,000 H.P.			5,500 H.P.
12hrs. per day	4,000 "	8,000 "	Same as before in		11,000 "
10 "	4,800 "	9,600 "	summer months		13,200 "
8 "	6,000 "	12,000 "			16,500 "

The last column gives the total horse-power that can be obtained at or near Baby's Point from the River Humber with storage capacity sufficient to maintain the mean daily flow, the fall available being taken as 130 feet.

At the lower ends of each of the other storage reservoirs power would be available, but the amount can only be calculated after these reservoirs have been located and designed.

WILLIS CHIPMAN, C.E.

TORONTO, 14th October, 1895.

MUNICIPAL WATER SUPPLY.

When the conduit pipe across the Bay arose to the surface in the summer of 1895, the people of Toronto were thrown into a state of excitement and consternation. The authorities had to resort to the primative watering carts as a means of distributing domestic water to the houses of the people. In the then state of public feeling it was determined to pay Mr. James Mansergh, C. E. (of London, England), $15,000, for a report upon all possible sources of water supply for Toronto.

The report is now lying dormant, no action having been taken by the city with a view to carrying out its recommendation.

When another disaster happens the present system or when the condition of the public health or other event forces the authorities to action, then the people will be called upon to adopt a permanent policy.

In the meantime there is no reason why the two systems (pumping *vs.* gravitation), should not be laid before the people, and when the public mind shall have been aroused from the sense of false security into which it has been lulled, the people (all the people) will then be in a position to give a rational verdict and make a wise and final choice.

Mr. Mansergh's report is a complete vindication and corroboration of the position contended for in connection with power development and water supply by gravitation. The gravitationists have always contended that Lake Simcoe water was at least equal, if not superior to Lake Ontario water. Mr. Mansergh endorses that position most completely in the following words:

"On the question of quality, nothing more need be said than to repeat in a sentence that if the Simcoe water is dealt with as I have just described, and if Ontario water drawn from the present intake is filtered, both of them, as delivered to consumers, will be high-class waters of unimpeachable character, with practically nothing to choose between them."

In other words Mr. Mansergh says that Lake Simcoe water unfiltered is equal to Lake Ontario water after filteration. This is in harmony with the finding of Messrs. Hering & Gray, which cost the city about $10,000 in 1889.

Mr. Mansergh and Messrs. Hering & Gray all agree that Lake Simcoe water is superior to Lake Ontario water, but they recommend the latter, **solely on account of the great cost of procuring a supply from the former source.** Mansergh makes the cost of carrying out the Lake Simcoe plan (on account of capital) to be $12,000,000. In order to get Mr. Mansergh to report this fabulous sum as the probable cost (so that he could condemn it), the Yonge Street route was adopted, which, according to his report, entails 34 miles of tunnelling. Had Mr. Mansergh adopted a route by way of Peterboro' or Hamilton he could have made the cost $50,000,000 or even more. The route approved by Hering & Gray and adopted by the Aqueduct Company only involves a tunnel or open cut of seven miles, against Mansergh's 34 miles. Mr. Mansergh helps to make up his estimated cost of $12,000,000 by allowing a trifle of $1,500,000 for engineering expenses. Presumably he is under the impression that Toronto is going to employ a hundred Manserghs, at $15,000 each. That certainly would consume the million and a half allowed for engineering expenses. Hering & Gray reported that the Lake Simcoe scheme would cost about $7,500,000. The work can be done now for a little under one half the latter sum.

The Company have in view, one absolutely sure and certain source of revenue, namely: contracts to supply the reservoirs of the City of Toronto and other municipalities with water. This will yield the Company a minimum revenue of $210,000 per annum, which will pay interest on a capital of about $3,500,000 at 4 per cent. The extra cost of completing the water supply system will be less than $3,500,000. The reason why the work can be done at this low figure is that it will be done in connection with the power development feature of the enterprise, which will reduce the cost to less than one half.

The citizens of Toronto and vicinity are preeminently a practical and common sense people and the Company will inevitably secure these profitable contracts, profitable alike to the Company and the public. No false artificial sentiment can delay the operation of the immutable laws of commerce and the survival of the fittest for any considerable time. The laws of commerce and sanitation alike demand that Lake Ontario be abandoned as a source of domestic water supply, especially since the high priced expert has so clearly demonstrated the absolute superiority of Lake Simcoe water. The condemnation of Lake Ontario water is most complete, and its use for domestic purposes ought to be prohibited by the Provincial Board of Health, unless it be first thoroughly filtered, as recommended by Mr. Mansergh.

The following offer was submitted to the Corporation of Toronto:

Toronto, May 5th, 1896.

"*To the Council of the Corporation of the City of Toronto.*

GENTLEMEN,—I am instructed by the Directors of The Georgian Bay Ship Canal and Power Aqueduct Company to submit to your honorable body on the Company's behalf, the following offer:

1. The Company will supply to your corporation thirty million imperial gallons of water daily for $210,000 per annum, and one cent per thousand gallons for all that may be required over thirty million gallons daily, the consideration to be payable monthly.

2. The City may deduct from any monies that may hereafter be due the Company for water any sum that may be necessary not exceeding $220,000 to be expended in the purchase and laying of new feed mains as heretofore recommended by the City Engineer, such mains to be the absolute property of the City.

3. The water to be delivered to the present City reservoirs, or the Company will construct an additional reservoir or reservoirs (not more than two), at any elevation or elevations that the City may require, not exceeding 400 feet above the level of Lake Ontario, and deliver the water to such new reservoir or reservoirs as the City may require, such new reservoir or reservoirs to remain the property of the Company.

4. The Company at its own cost to lay all pipes and make all connections between the several reservoirs and your distribution mains at the City limits.

5. The water to be procured from Lake Simcoe by means of gravitation, and to be of the best quality obtainable from that source, such water to be specially reservoired as recommended by Mr. Mansergh, (see page 28, original report), before delivery to any of the city service reservoirs.

6. The whole water works system for supplying water to Toronto, including all reservoirs, intakes, conduits, pipes and tunnels, to be at all times under the direction and control of the City Engineer.

7. The Company to have the new system in operation, and the City supplied not later than the 31st day of December, 1898, provided the agreement be entered into not later than the 1st day of March, 1897.

8. The agreement to be for a term of 50 years from the 31st day of December, 1898, the City to have the option of terminating the contract, or having the rates and charges readjusted by arbitration at the expiration of the said term.

The Company respectfully requests that should the Council not be inclined to accept this offer, then that it be submitted to the electors entitled to vote for Mayor and Alderman, for their approval or otherwise, not later than the first Monday in January next. The Company will pay the cost of such submission, and will give security satisfactory to your honorable body for the due performance of the proposed contract. J. V. MACDONALD, *Man. Dir.*

Before sending the above to the Corporation it was submitted to Mr. Arthur Harvey, the well known Actuary, and that eminent expert reported as follows:

Gentlemen, —Pursuant to your instructions I have made careful calculations and comparisons as to the annual loss and gain to the City of Toronto in the event of that Corporation procuring a supply of water from Lake Ontario, as per Mr. Mansergh's recommendation; and also in the event of the city procuring a supply of 30 million gallons daily from your Company, by means of gravitation from Lake Simcoe, for $219,000 per annum (2 cents per thousand gallons), and one cent per thousand gallons for all that may be required over and above 30 million gallons daily. The results are as follows: —

1	2	3	4	5	6	7	8
YEAR.	Annual Payment to the Aqueduct Co. for water to be supplied according to Mr. Mansergh's estimate of "Daily Demand," at $20,000 for 2,000,000 gallons daily, and 1 cent per 1,000 gallons for all over that amount.	Annual charge upon the City for interest on the capital to be spent according to Mr. Mansergh's report (4 per cent. See his table No. 5 B, column 20.	Annual working expenses at the High Level and the Main Pumping Stations, and Filtration, as per Mr. Mansergh's report. See his table No. 5 B, Column 10.	Total of Two Previous Columns.	Saving in the initial stage by adopting Mr. Mansergh's plan.	Saving in the later stage by contracting with the Aqueduct Co.	REMARKS.
1899	219,000	107,582	76,601	184,183	34,817	.....	
1900	219,000	107,582	78,234	185,816	33,184	.....	
1901	219,000	107,582	79,907	187,489	31,511	.....	
1902	219,000	120,212	70,562	202,774	16,226	.....	
1903	219,000	120,212	78,402	204,614	14,386	.....	
1904	219,000	120,212	80,334	206,546	12,454	.....	
1905	219,000	120,212	82,180	208,392	10,608	.....	
1906	219,000	135,067	84,130	219,197	.....	$ 197	
1907	219,000	135,067	86,114	221,181	.....	2,181	
1908	219,000	135,067	88,212	223,279	.....	4,279	
1909	219,000	135,067	90,209	225,276	.....	6,276	
1910	219,000	135,067	92,316	227,383	.....	8,383	
1911	219,000	135,067	94,469	229,536	.....	10,536	
1912	219,000	135,067	96,738	231,805	.....	12,805	
1913	219,000	135,067	98,894	233,961	.....	14,961	
1914	219,000	135,067	101,171	236,238	.....	17,238	
1915	219,000	135,067	103,496	238,563	.....	19,563	
1916	219,000	135,067	105,959	241,026	.....	22,026	
1917	219,000	143,022	108,296	252,218	.....	33,218	
1918	219,000	143,022	110,767	254,689	.....	35,689	
1919	219,000	143,922	113,286	257,208	.....	38,208	
1920	219,000	143,922	115,945	259,867	.....	40,867	
1921	219,000	143,922	118,465	262,497	.....	43,497	
1922	219,000	143,922	121,152	265,074	.....	46,074	
1923	220,708	173,362	115,926	289,288	.....	68,580	
1924	223,243	173,362	118,340	291,702	.....	68,459	
1925	225,201	173,362	120,607	293,969	.....	68,768	
1926	227,515	182,217	123,020	305,237	.....	77,712	
1927	229,875	182,217	125,479	307,696	.....	77,821	
1928	232,018	182,217	128,094	310,311	.....	77,693	
1929	234,738	182,217	130,552	312,769	.....	78,031	
1930	237,247	182,217	133,163	315,380	.....	78,133	
1931	230,708	182,217	135,806	318,023	.....	78,225	
1932	242,768	182,217	138,655	320,872	.....	78,104	
1933	245,062	191,072	141,313	332,385	.....	87,323	
1934	247,773	191,072	144,146	335,218	.....	87,445	
1935	250,538	191,072	147,022	338,094	.....	87,556	
1936	253,753	191,072	150,083	341,155	.....	87,402	
1937	256,230	200,702	152,964	362,666	.....	106,430	
1938	259,171	200,702	156,019	365,721	.....	106,550	
1939	262,104	200,702	159,141	368,843	.....	106,679	
1940	265,644	218,557	162,458	381,015	.....	115,371	
1941	268,332	218,557	165,574	384,131	.....	115,799	
1942	271,500	218,557	168,882	387,439	.....	115,930	
1943	274,749	218,557	172,258	390,815	.....	116,066	
1944	278,516	218,557	175,849	394,406	.....	115,890	
1945	281,425	227,412	179,101	406,513	.....	125,088	
1946	284,863	227,412	182,802	410,214	.....	125,351	
1947	288,371	227,412	186,460	413,872	.....	125,501	
1948	292,448	227,412	190,346	417,758	.....	125,310	
	$11,850,295			$14,554,294	$153,186	$2,857,215	

In the 50 years there would be $2,704,029 more paid by the City for interest on capital expended and expense of pumping, etc., than would be paid under the method proposed by the Aqueduct Co.

No account is taken in these tables of interest to be paid under Mr. Mansergh's plan, during 1896, 1897 and 1898, on the $2,689,562 to be expended in those years. Mr. Mansergh states that this, at 5 per cent. for interest and redemption, would be $256,083, so that the interest may be taken to be $204,867 (4 per cent.) and added to the saving given in column 7 of the table.

ARTHUR HARVEY,
Actuary.

Toronto, May 7th, 1896.

If the City retain Lake Ontario as a source of supply a trunk sewer will have to be constructed, which (according to the report of ex City Engineer Mr. W. T. Jennings), will cost $1,632,538, the interest alone on this sum at 4 per cent. would be over $63,300 per annum. The trunk sewer would be quite unnecessary if the water supply be taken from the North.

Another item of advantage that would accrue to the people by reason of a supply from the North, would be greatly **reduced fire insurance rates** owing to the practicably illimitable water supply at a greatly increased pressure; it is impossible to estimate accurately what this saving would amount to, probably upwards of $250,000 per annum, certainly not less than $100,000; add the interest on cost of trunk sewer to the estimated saving in fire insurance rates, and we have an annual saving of $165,300 which ought to be included in column No. 7 of Mr. Harvey's table.

Including these two items the citizens would during the 50 years save a total of $10,869,029 by procuring a supply from the Company as against Mansergh's Plan.

If the saving thus shown should be invested each half year at 4 per cent., the value of the savings alone with interest compounded half yearly, would be over $35,000,000 at the expiration of the proposed contract.

A contract on the above basis would give the Company a minimum revenue of $219,000 per annum, a sum nearly sufficient to pay interest on $5,500,000 at four per cent.; this sum would increase with Toronto's growth, it would be greatly augmented in the immediate future by reason of similar contracts with many other local municipalities from the same system, without any further expenditure, except for the making of connections with the Company's works.

MANSERGH'S FINDINGS.

1. Mr. Mansergh reported Lake Ontario water from our present intake, to be unfit for drinking, unless it be first thoroughly filtered.

2. He further declared that Lake Simcoe water unfiltered is equal to Lake Ontario water after the later is filtered.

3. According to Mr. Mansergh's own figures this Lake Ontario water will cost Toronto over two and a half cents 2·54 per 1,000 gallons (on the average for a supply of water, if his recommendations be adopted).

And yet the Company offers to supply the City reservoirs with Lake Simcoe water at the rate of **two cents** per 1,000 gallons for the first thirty millions, and **one cent** per 1,000 for all over thirty millions per day.

ADVANTAGES OF GRAVITATION.

1. The adoption of the Gravitation System would give the people an abundant supply of water for all purposes.

2. The purity of the supply would be beyond question.

3. It would facilitate the total abolition of water rates by reason of the cheap and abundant supply.

4. It would obviate the necessity of a trunk sewer.

5. It would greatly reduce fire insurance rates, by giving a volume and pressure that could be procured in no other way.

6. The danger of the System breaking down would be reduced to a minimum.

7. It would add value to all public and private property.

8. It would tend to promote the cleanliness, health and beauty of our City.

9. Under the proposed agreement the City would exercise the same absolute supervision and control over the entire water supply system that it does now

THE SHIP CANAL.

This part of the great enterprise is grossly misunderstood. The idea of constructing a ship canal from Georgian Bay to Toronto was first considered in the early part of this century. It took more definite form in the late forties and the early fifties.

The Toronto *Globe* of July 19th, 1886, speaking of the deep waterways, said

"There is no question about the enormous value of the great navigable highway that flows from the heart of the continent to the Atlantic Ocean. The question is merely one of capacity—what should be the depth of this waterway at its shallowest part."

The *Globe* is right as to the enormous value of such a highway to the sea, but the question is not "merely one of capacity" as indicated by "depth at its shallowest part." It is also a question of route; for instance, the adoption of the Georgian Bay route would shorten the distance by [illegible] per round trip between the east and west, as against any other route. Surely that feature is of the greatest importance.

The *Globe* goes on to say

"The enlargement of the canals is the key to the whole western transportation problem, and it will never be brought down to a satisfactory basis on this northern half of the continent until a magnificent highway of rivers and lakes is made as efficient as man's contrivances can make it.

The policy thus laid down by the *Globe* will meet with the hearty endorsation of all true Canadians, irrespective of political predilections. The article continues

"It may be expected that there will always be a measure of opposition to the work. Large interests are arrayed against it. Cheapening of transportation will not be popular in certain quarters. The shifting of commercial centres will not be popular in some places. Buffalo is doubtless quite content with present conditions, although the whole west has to be made tributary to its prosperity.

The *Toronto World* of July 18th, commenting on the *Globe* article of the 16th, says

"The natural obstacles that the *Globe* refers to in connection with the deepening of the St. Lawrence route are not the most serious ones that will have to be overcome before the proposed deep waterway from the Great Lakes to the Ocean is completed. The greatest of all obstacles is the friction that is continually disturbing the friendly relations of the nations on either side of the international boundary. Once that friction is removed, all the obstacles opposed by nature will disappear as it by magic. We agree with our contemporary that **the construction of a deep waterway to tide water is the next great enterprise to claim the attention of the people of this continent.** The construction of such an outlet would do more to populate the Canadian Northwest than any other remedy that we could suggest. The prospects for securing united action on the part of the two nations interested, however, are not at all reassuring. It seems to be the settled policy of the United States to do nothing that has a tendency to establish the independence of this country. If we decided to throw in our lot with the people to the south of us, we could, no doubt, make one of the conditions of the amalgamation the deepening of the St. Lawrence system in the same way as the Maritime Provinces made the building of the Intercolonial Railway a condition of Confederation. From the present attitude of the United States towards this country, we doubt very much if the two countries can be brought closely enough together to undertake the work as a joint enterprise. * * * We feel certain the only way they can remove it (the difficulty) is through the sacrifice of our national existence—and that is a price which the people of Canada are not prepared to pay."

There is no need of the co operation of the United States, nor is there any need of sharing with them the control of an all Canadian deep waterway to the sea. The natural laws that regulate commerce will compel United States vessels to seek their destination by the way of the least resistence — the Georgian Bay route — there is no reason why such vessels should not use this canal upon the same ordinary commercial principles as will be imposed upon water craft of our own and those of any other nationality.

VOLUME OF TRAFFIC.

In 1855 the total traffic of the great lakes was 2,500,000 tons. In 1895 it was approximately 60,000,000 tons, or an increase of 2,400 per cent. in forty years. The present rate of increase is much greater, being about 800 per cent. in twelve years for Lake Superior and Lake Huron. If the canal be completed, in say six years, the traffic will be 90,000,000 or 100,000,000 tons, at the present rate of increase.

It is safe to estimate the tonnage that would use the canal ten years hence at 100,000,000 tons, which at 10 cents per ton, would yield a revenue of $10,000,000 per annum, a revenue which, if capitalized at 4 per cent., would represent a value of $250,000,000, but the gain is not only in the increased traffic, but in the increased facilities for the construction of a deep waterway that would accommodate the largest vessels that can navigate the great lakes such a canal can now be constructed for less than one third of the cost of the same work fifty years ago.

Traffic would pay a toll of 10 cents per ton via the Georgian Bay route, as against any other route free of tolls.

The construction of a canal by means of which hundreds of miles would be saved to shipping on the great lakes, would bring to the city of Toronto a large proportion of the commerce of those

VAST INTERIOR SEAS.

It would place Toronto in such an advantageous position that every mine developed, every forest despoiled and every new section of territory cultivated in the vast region tributary to the lake traffic would add to Toronto's wealth and make her one of the greatest cities in the world. Few have any idea of the magnitude and extent of the commerce of the great lakes, with their 3,500 miles of shoreline. The commerce on these lakes is five times as great as that which passes through the Suez Canal. In fact, the tonnage passing the locks of the Sault Ste. Marie alone each year exceeds that passing Port Said, on the Suez Canal. The traffic on these lakes exceeds by no less than 2,000,000 tons the combined foreign and coastwise commerce of the Atlantic, Pacific and Gulf seaboards of the United States. It must be remembered that thirty-five millions of people — over half the population of the United States — live in the territory tributary to the Great Lakes. So wonderfully resourceful are these lake regions in products that vessels plying between the various ports obtain cargoes both ways — a most important point in the making of cheap transportation. The market for western grain is in the east, while the west demands a vast quantity of manufactured products. Pennsylvania alone sends over these lakes annually over five million tons of coal.

There is no doubt in the world that Toronto's position in relation to lake navigation, in conjunction with the great power mentioned, would make it the most important interior city on the North American continent, and its growth would be more rapid and secure than that of any other city with such immense resources to rely upon. At present Buffalo, N.Y., holds this important position the key to a vast continent and the percentage of growth in that city was over 200 per cent. between the years of 1880 and 1890, all of which increase was due, without any doubt, to the lake traffic in relation to its position at the head of lake navigation in the east. Witness Chicago's phenomenal growth, which, owing to its position as the head of western navigation, has grown faster and shows more progress than any other city in the United States.

OVER 600 MILES SAVED.

A glance at the map tells the whole story. It will be seen that if this route were followed by vessels, Lake Huron and Lake Erie would be saved in distance. This would save over 300 miles each way, or over 600 miles per round trip.

The dangers of navigation on Lake Erie owing to the shallowness of that lake would be eliminated by the substitution of deep and safe Georgian Bay and Lake Ontario. The advantages of being able to navigate such a lake as Ontario in preference to these two perilous waterways is evident. Besides, under present conditions, vessels of over fourteen feet can go no further than Buffalo, at which point their cargoes have to be transferred. For small vessels, of course, the Welland Canal affords access to Lake Ontario, and thence eastward; but the small vessels on the lakes are disappearing and the present tendency is for the building of large vessels on account of the cheaper rate to be obtained from large shipments by means of heavier capacitied conveyances. The Welland Canal is not deep enough for these vessels.

As to Lake Ontario's status as a shipping thoroughfare at present, it is practically a dead letter It is estimated by Mr. Chauncey N. Dutton, the well known canal expert and engineer, that not 2 per cent. of the vast traffic of the lakes enters Lake Ontario, and not 1 per cent. into the St. Lawrence River. This river should, from the nature of things as anyone can see from a glance at the map of the North American hemisphere — be the principal waterway for all traffic from the region of the Great Lakes; but it is absolutely cut off from all this. Many undertakings have been projected for bringing this waterway into use, the most advanced thought realizing that the only financially possible and commercially satisfactory route is via Lake Ontario. The advantages of this course over all others are maintained by such men as General Poe, Mr. E. L. Corthell, Lyman E. Cooley, Hon Smith M. Weed, Captain Alexander McDougall and others. There is no doubt that the route which gives the greatest percentage of open water is the best; and this route is the only one answering the requirements. It is the natural channel of trade. A project that would open up this great natural highway would be of vast benefit to commerce.

The Western producers who pay freight are conscious of the fact that the existing transportation conditions do not meet the requirements. They pay yearly $75,000,000 more for freight, and an equal amount for commissions and rehauling more than they need to pay. These rates prevent them from getting the best out of their lands, as they have to sell locally on account of the freight being against their moving the bulk of their farm output. At the same time the price of their necessities is raised to them by the exceedingly long rail haul.

Outlets for products via the Hudson Bay route have been

discussed, but that route, though short, is too cold. By way of the Mississippi and New Orleans the way is too long and too hot.

OF INCALCULABLE VALUE.

The adoption of the Georgian Bay route would benefit traffic immeasurably. One of the greatest obstacles in the way of navigation reaching Lake Ontario from the other great lakes is a tremendous drop of 326 feet from the level of Erie to Ontario. With the present system of locks it would be impossible to overcome this difficulty for large ships, the cost being simply prohibitive, as a series of twenty four locks would be needed. It will be remembered that present locks are only for barges. It would be utterly beyond possibility to install so many locks of size sufficient to pass large vessels without involving such a vast expenditure that it would pay better to take freight by rail at more than passenger rates. It is strange that until quite recently no improvement has been made in the system of barge locks in any important detail, since it was invented by Leonardo da Vinci, about the time of the discovery of America by Columbus.

THE CHICAGO DRAINAGE CANAL.

The past twenty years has witnessed marvellous development in the traffic of the Great Lakes. The next ten years has greater wonders in store. The City of Chicago has expended about $25,000,000 in the construction of a drainage canal from that City to Joliet.

This canal, although called a drainage canal, and built primarily for that purpose, is really a great modern ship canal. It will serve to keep the source of Chicago's water supply Lake Michigan pure by conveying the sewage of the metropolis into the Mississippi.

It will also be the means of multiplying the traffic of our great lakes. Carriage by water is many times cheaper than by rail, and the drainage canal will make the great lakes accessible to the innumerable fleets that ply upon the Mississippi and her tributaries.

GREAT SHIP LOCKS.

But the recent invention of the pneumatic lock by Mr. Chauncey N. Dutton makes the overcoming of the 326 feet drop a mere bagatelle. Mr. Dutton shows that with but five of these locks vessels can be brought down 572 9-10 feet - the level of Erie above tide water - these five locks taking the place of thirty-five or forty locks of the present style.

The principle on which the pneumatic locks operate is the familiar one of weighing in a scale, the locks representing the scale pans and the compressed air replacing the scale beam. The motion is due to a small difference in the total weights of the water in the two locks, just as the motion of a scale is caused by a smaller difference between the weight and the object weighed. The locks move oppositely and synchronously, like scale pans, one ascending while the other is descending. The depressed lock contains the normal depth (26 feet) of water and floats like a pontoon, its air connection being closed and its hydraulic system by passed to that end.

Mr. Dutton says of these locks :

"The peculiar utility of compressed air, as applied to lift ships in dry docks and locks, consists in that it gives an elastic support directly beneath the load, and consequently the structure is very simple and cheap. It makes the pressure independent of the height through which the lift operates, so that the pressure and strains are no greater in a lift of 100 feet than in one of 10 feet, and it flows with twenty-eight times the velocity of water, and thus makes it possible to operate high lifts in about the same time as low lifts.

A SPECIAL FEATURE.

One most remarkable feature of the Georgian Bay Ship Canal, as compared with other artificial commercial water ways, consists in the fact that the construction of the power aqueduct from the present navigable portion of the Humber River at Lake Ontario, to the Holland River (twenty seven miles) will complete, including the Holland River and Lake Simcoe, over seventy miles of the ship canal, with the exception of the putting in of four locks at the four dams, leaving about twenty-three miles of the minor part of the work to be done, including the construction of another lock - making five locks in all.

PARLIAMENTARY AID.

Application will be made to the Dominion Parliament for aid in the form of a special money grant toward the completion of the ship canal. It is the well established policy of the Dominion and Provincial Parliaments to render substantial aid to works of this character. It cost the Dominion over $28,000,000 to construct and enlarge the Welland Canal, although it is now but fourteen feet deep, and quite inadequate to meet the requirements of the ever increasing traffic. A grant of like amount would enable the Company to construct the greatest, most complete, modern artificial commercial waterway in the world.

In the meantime, it is entirely optional with the Company whether they proceed with the construction of the ship canal part of the enterprise or not.

It is the fixed policy of the Company to first complete the Power Aqueduct in order to secure its vast revenues, leaving the Ship Canal in abeyance until Parliament shall have granted such substantial aid as will justify the Directors in proceeding with that part of the undertaking without any risk to the shareholders.

The construction of the power aqueduct will virtually complete the ship canal (with the exception of the locks) from Lake Ontario to the Holland River, between which points the two projects are identical in their very nature. In fact, the three great undertakings of the Company, namely, the development and sale of power, the supplying of municipalities with water and the ship canal, are all kindred works. Indeed, they are one work, and any work done upon any one of these undertakings is, with few exceptions, advantageous and applicable to the other features of the enterprise.

The plan for bringing vessels through Georgian Bay would, besides cutting off a great distance, form the safest means of reaching Ontario. As has been seen, the very development of the water power of the Humber Valley would create a great ship canal for about twenty three miles. To connect this canal with Lake Simcoe it would be necessary to cut a channel through a rising ground between the Holland River and the Humber for a distance of seven miles. This work will be done by the modern system known as hydraulic excavation - the action of water being brought into play, and the canal, in fact, will be made to literally dig itself, at a mere fraction of the cost of the same work by the old methods.

ADVANTAGES REVIEWED.

1. The Georgian Bay route is at least 600 miles shorter (per round trip) between the east and west, than any other route.

2. The Georgian Bay Canal (as it is proposed to construct it) will be from 300 to 400 feet wide at its narrowest parts, and will (except at the locks) offer no greater impediment to navigation than the level stretches of an open navigable river of equal depth such as the St. Lawrence or Mississippi.

3. The locks (5 in all) will be constructed on the patent pneumatic plan, and will lock the largest vessels through at the rate of 15 minutes per lock, or an hour and a quarter for five locks. This locking will be accomplished at no greater loss than 2½ per cent. of the water required under the old system.

4. Seventy five per cent. of the freight carried on the great lakes has for its ultimate destination some point east of Buffalo.

5. All freight destined for any point east of Buffalo would be carried via Georgian Bay route.

6. The Georgian Bay route would be preferrable with tolls at 10 cents per ton, to any other route free of tolls.

7. The construction of the Georgian Bay Canal would extend deep and continuous inland navigation from Collingwood to Ogdensburg. The latter is 150 miles nearer New York than Buffalo, and 200 miles nearer to Liverpool than Buffalo. Rochester, Oswego or Ogdensburg would be reached via the Georgian Bay Canal with a saving of 600 miles per round trip, or at net advantage over Buffalo of 750 miles per round trip.

"With cheap electricity everyone could have a telephone and every house an elevator. Thus saving stair climbing. We could wash our clothes and dishes and do a good share of housework by electricity, if it were cheap enough. All our cooking and heating could be done by electricity.

"There would be no more dirty coal to be put in every Fall. No more steam heaters or furnaces. No more cooking in stoves heated with coal. No gas stoves nor gasoline. No more ashes nor dirt, nor soot. We could abolish chimneys. Electric fans could run in every room.

"The Kitchen would be as clean as the Parlor and housekeeping made a delightful occupation."

WHISTLER, in New York Herald, Sept. 2nd, 1884.