SEVENTEENTH ANNUAL REPORT

OF THE

COMMISSIONERS

FOR THE

QUEEN VICTORIA NIAGARA FALLS PARK

FOR THE YEAR ENDING

1902

PRINTED BY ORDER OF
THE LEGISLATIVE ASSEMBLY OF ONTARIO.

TORONTO:
PRINTED AND PUBLISHED BY L. K. CAMERON,
Printer to the King's Most Excellent Majesty
1903

WARWICK BRO'S & RUTTER, Printers,
TORONTO.

Toronto, March 4th, 1903.

The Hon. J. R. Stratton, M.P.P.,
Provincial Secretary Province of Ontario,
Parliament Buildings, Toronto.

Sir,—I have the honor to transmit herewith, for presentation to the Legislature of Ontario the Seventeenth Annual Report of the Commissioners for the Queen Victoria Niagara Falls Park, together with the appendices thereunto attached.

I have the honor to be, Sir,
Your obedient servant.

J. W. LANGMUIR, Chairman.

SEVENTEENTH ANNUAL REPORT OF THE COMMISSIONERS FOR THE QUEEN VICTORIA NIAGARA FALLS PARK.

To the Honorable Sir Oliver Mowat, K.C.M.G.,
Lieutenant-Governor of the Province of Ontario.

May it please your Honor : The Commissioners of the Queen Victoria Niagara Falls Park beg to submit their Seventeenth Annual Report (being for the year 1902), to which is appended the usual statement of receipts and expenditures, the report of the Park Superintendent and the text of several agreements which were entered into during the year, together with the expert evidence obtained in connection with some of these agreements.

The vacancy which had existed on the Board of Commissioners since the decease of Mr. B. E. Charlton was filled during the past year by the appointment of Mr. Robert Jaffray of Toronto.

Before entering on a review of the proceedings and transactions of the Commission for the past twelve months, the Commissioners may be permitted to refer to certain strictures and adverse criticisms on the Management of the Park affairs which have appeared from time to time in the press. These criticisms evidently are based upon an entire misapprehension of the facts, and if allowed to pass unchallenged may be accepted by the public as being well founded and unanswerable. The chief stricture to which objection is taken by the Commissioners is, that in order to provide revenue they have committed acts of vandalism that will ultimately ruin the scenery of Niagara Falls, and one writer goes so far as to say "that it is scarcely possible to conceive how anything short of financial interest could have persuaded them (the Commissioners) so to play false to the whole spirit of their trust."

In view of such statements it appears to be necessary that the Commissioners should again clearly set forth the policy which was adopted at the time the Park was established, and which has been consistently adhered to throughout the fifteen years which have since elapsed, and in furtherance of this reference will be made (1) to the measures authorized by the Legislature for acquiring the Park and the duty cast upon the Commissioners to provide the funds needed for the improvement and maintenance of the property, (2) The area of the property originally selected about the Falls for Park purposes and the very extended territory that has since been placed under the jurisdiction of the Commissioners and, (3) The sources from which the funds are derived for carrying on the work.

When the Government of Ontario had the Park project under consideration two general principles were regarded as indispensible to the carrying out of the project, viz.: That no financial burden should be laid upon the Province for either the purchase or maintenance of the property, and in conformity with the plan adopted on the American side of the river that the Park should be made free.

Conforming to these initial conditions, obviously the only plan open to the Commissioners for securing the funds to establish the Park was through the issue of debentures guaranteed by the Province and secured by the lands

selected for the Park. Acting therefore on the recommendation of the Commissioners the Legislature authorized an issue of forty-year four per cent. debentures to the amount of $525,000, and with the proceeds, the lands originally forming the Queen Victoria Niagara Falls Park were acquired, improved and thrown open to the public.

It should here be stated that the original design of the Commissioners was to include only the property running southwards along the bank of the river from the Clifton House to Cedar Island, about one mile in length and averaging about one-eighth of a mile in width, and comprising about 85 acres. From this territory the best views of both the American and Horse Shoe Falls can be obtained as well as the gorge of the river below the falls, while from the higher ground on the west the upper rapids can be seen in the distance. In order, however, to obtain nearer and better views of the magnificent rapids above the Falls and at the same time to secure for the Park the beautiful background and charming scenery surrounding what are now known as the Dufferin Islands, it was after careful deliberation decided to obtain an additional area extending about a mile and a half farther up the river to smooth water above the head of the rapids. For the greater part of this distance nature has provided an ideal background of beautifully wooded banks, which furnish the natural outline of a completed Park. These properties which originally comprised the Queen Victoria Niagara Falls Park cover about 154 acres. Subsequently additional lands (the property of the Crown) lying along the Niagara River were added to the Park from time to time or placed under the care of the Commissioners and the property known as Foster's Flats lying immediately north of the Whirl-pool and comprising about 100 acres of territory, unique in its unrivalled grandeur and primitive wildness, was purchased and added to the Park domain. With these additions the Park now practically extends the whole length of the Niagara River from Lake Erie to Lake Ontario and embraces an area of about 734 acres.

The acquisition of these additional lands and the maintenance and permanent improvement of this very extensive and diversified property necessitated a further issue of debentures for $75,000, making a total debenture liability of $600,000, bearing interest at 4 per cent. per annum.

Based upon the expenditures of the past fifteen years the average annual amount required for maintenance and permanent improvements has been as follows :—

4 per cent. on $600,000 debentures.....	$24,000
Permanent improvements—average per annum—.....	6,700
Maintenance and ordinary improvements.....	17,300
Or an annual charge of.....	$48,000

On the American side the lands expropriated for the purposes of the State Reservation have an area of 110 acres acquired at a cost of nearly one and a half million dollars. These lands were practically handed over to the Board of Commissioners as a gift from the State of New York, and in addition the State Legislature authorized a payment to the Commissioners of an annual appropriation sufficient for maintenance, while large sums are annu-

ally voted by the State for permanent improvements. In the case of Ontario, however, as has been shown the lands have neither been acquired, improved nor maintained by monies supplied by the Province, but the whole burden of providing for the outlay for all purposese devolved upon the Commissioners.

It now remains to show the methods adopted by the Commissioners to meet these heavy annual charges and the gravamen of the adverse criticisms referred to appear to be chiefly aimed at the principle of granting certain rights or franchises within the Park for the purpose of raising the necessary funds. The franchises granted are three-fold; viz: (1) For an electric railway (2) For a restaurant, photograph gallery and the privilege of operating an elevator to go under the Falls (3) For utilizing the water power of the falls for generating electrical energy.

These will be briefly considered in the order in which they are placed.

Owing to the great length of the Park domain extending from Chippewa to Queenston, a distance of nearly twelve miles, every portion of which is full of historic interest, and scenic grandeur, it was vitally important that all the objective points should be reached by an electric railway so that tourists might be able to visit every point at a reasonable cost. This was accomplished by inducing capitalists to construct an electric railway, the Commissioners granting the right to lay a double track through the Park and on the Chain reserve, for which they receive $10,000 per annum. This line of railway has now become part of a belt-line system, giving visitors the magnificent views from the highland of the river bank on the Canadian side, together with the Niagara Glen and Queenston Heights Parks and the intermediate gorges descending to the river all within the Park domain and returning on the American side by the Gorge Railway, thus enabling visitors to view the banks and rapids from the lower levels. Whether the granting of this charter with permission to pass through the Park can, under the circumstances stated, be characterized as an act of vandalism, the Commissioners are quite content to leave to the verdict of the millions of visitors who have passed over this railway in the past ten years. That it has been a great boon to visitors both pecuniarily and visually in enabling them to view all points of interest with ease, comfort and satisfaction is almost universally admitted.

From a financial standpoint it is satisfactory to know that up to the present time the Commissioners have received over $110,000 from this franchise.

To those who visited the Falls of Niagara under conditions existing prior to the regime of the Commissioners it will be remembered that the surroundings were disfigured by unsightly structures of various kinds, and visitors had to run the gauntlet of cab drivers and hotel runners in order to see the cataract or come within the scope of its influence. When the Commissioners assumed control of the property all these unseemly surroundings were dispensed with and visitors were permitted to roam at will throughout every part of the Park domain freed from all annoying importunities and interruption. For a great many years one of the attractions of Niagara Falls which appealed strongly to certain classes of visitors was a pilgrimage under the Falls, or sheet of water as it was then called, and

having photographs made showing the pilgrims encased in the oiled suits required for protection when under the heavy curtain of water. On the establishment of the Park, the Commissioners deemed it best to continue this interesting feature, and after providing improved means of access these privileges together with that of supplying refreshments to visitors were leased, subject to rigid regulations, for $8,200 per annum. This franchise granted directly in the interests and comfort of visitors has produced over $100,000 up to the present time.

The production of electrical power as a means of providing revenue has perhaps more than anything else been characterized as vandalistic in its ultimate effects on scenic conditions in the Park.

It should be borne in mind that at the time the Park was established the science of producing electrical energy for motive purposes was practically in its infancy, the first Electrical Street Railway in America having been put into operation in 1887. It was only when the practicability of transmitting electrical power had assumed shape that the matter was considered by the Commissioners as a possible means of obtaining revenue. The Commissioners do not claim that they acquired the portion of the Park lying south of Cedar Island looking to the utilization of this portion of the property as being eminently suited for this purpose. They do claim, however, that their recommendation to the Government which brought about the acquirement of this additional property has resulted in the greatest pecuniary advantage. Had the property not been expropriated when the Park was founded, viewing it now in the light of what has transpired on both sides of the river—that part of the property would doubtless have been acquired by capitalists and laid out as a manufacturing district without reference to its scenic environments, as has been done on the American side of the river north of the steel arch bridge, to the irreparable disfigurement of the river bank. On the other hand, had it been expropriated after its capabilities as a centre for production of electrical power on a large scale had been demonstrated, it is quite probable that the price of such expropriation instead of the original cost of $100,000 would have been many millions of dollars, determinable only by the capitalization of the revenue obtainable from possible electrical franchises.

Coming now to the charge that the Commissioners have, in granting certain power privileges, committed acts of vandalism that will ultimately ruin the scenery of Niagara Falls, the Commissioners have to state that with the exception of the Ontario Power Company's Power House in the gorge under the Falls, hereafter referred to, all the proposed works connected with the generation of electricity are practically beyond the territory originally designed for park purposes. When the electrical power works are completed, not a single view of the Falls, rapids or gorge under the Falls will be obstructed in the slightest degree. On the contrary the filling in of the shore line above the Falls by excavated material from the tunnels will increase the Park area very considerably and will permit of roads and walks being constructed on the margin of the river which will greatly improve the views of the Upper Rapids, and at the same time cover the foreshore which in some places has become exposed by the recession of the waters, owing to the breaking away of the cataract. The waters forming

the Dufferin Islands will be completely restored and improved by the construction of cascades and miniature falls, and besides, the area at that congested point in the park will be considerably enlarged. The unsightly iron and wooden bridges will be removed and solid masonry structures substituted, and when all the works are completed the Park surface from the Falls running south will all be laid out and improved to correspond with the completed Park overlooking the Falls.

Respecting the construction of the Ontario Power Company's power house in the gorge under the Falls, the Commissioners of the State Reservation made representations to the Board in July last and were granted a hearing with particular reference to the erection of the structure at that location. The contention of the Commissioners of the State Reservation being that the building would not only disfigure the landscape as viewed from several points in the American Reservation, but would also be objectionable from an aesthetic standpoint and at variance with the natural conditions desired by the Commissioners on both sides of the river.

On the other hand it was shown by the Canadian Commissioners that the location of the building in question would present no obstruction to the free views of the Falls or river from any point on the American side, and as the building would be far below the surface level of the Park, a portion of the roof and the two gable ends will be the only parts of the structure that would be seen from any point of view within the Queen Victoria Park. It was further pointed out that to make the building in any sense a conspicuous or objectionable feature of the landscape would depend solely upon the design and character given to it. Should, for instance, the building be designed upon the lines of the power house on the American side near the Steel Arch bridge, the public would have some grounds for complaint, but so far from the Commissioners sanctioning such a structure they have made the most stringent provisions to secure the highest degree of artistic treatment in outline, color and design which it is possible to secure, and they have no hesitation in asserting that upon the completion of the power house, with its facade covered by creepers and relieved by evergreens, and a roof harmonizing in color with the high limestone cliff forming the background, it will be found that not only will the structure itself be unobtrusive and entirely unobjectionable from every point of view, but that no violence will be done to the environment of the great Cataract.

The Commissioners have also arranged for the early removal of the large and unsightly building which is so conspicuous from the American side, and which was originally constructed for a museum but which has recently been used for a restaurant and shelter building. The removal of this structure which has formed quite a striking feature of the Park, and the substituting of a modern refectory near the centre of the picnic ground, will remove from the Park one of its most objectionable features, and more than counterbalance any temporary disfigurement which the construction of the power house in the Gorge may cause.

All of the works and structures connected with the electrical power projects have been designed with the object not only of doing the least possible injury to scenic conditions, but the Commissioners are confident in the belief that when the several works are completed, the concensus of opinion

by the vastly increased numbers of visitors that are expected to visit the Park will abundantly sustain them in their contention that the Park as a whole, with its wealth of electrical machinery, will then be of ten-fold greater interest to the great majority visiting it; and in addition not only will the immediate locality beyond the Park be built up into one of the great manufacturing centres of the world, but the quickening impulse and vivifying effects of the world's latest and most perfect form of energy—created and sent forth by the Falls of Niagara—will be felt from end to end of the Province.

In their annual report for 1901 the Commissioners outlined the changes which had been made in respect to the several agreements entered into whereby the Canadian Niagara Power Company and the Ontario Power Company of Niagara Falls were authorized to utilize a portion of the enormous water power of the Niagara River at the Falls for commercial purposes, and the nature and effect of the changes made in these agreements in their relation to the development of the Park design were at that time fully explained.

During the past year the Canadian Niagara Power Company have energetically prosecuted the important works connected with their enterprise and the greater part of the excavations required for the first instalment of power called for in their agreement, including the driving of the tunnel to carry away the waste water, have now been practically completed and a beginning has been made on the construction of the foundation walls of the power house. The Company has recently decided to go on and complete all the excavations necessary for the extension of the wheelpit, forebay and tunnel to the full extent contemplated for their maximum output of 100,000 electrical horse-power. The completion of this excavation will permit, greatly to the advantage of the Park, of the permanent restoration of the grounds in the vicinity of the works at a much earlier date than would otherwise be the case, or than was contemplated when the work was begun.

Under the agreement made with this company on 19th June, 1901, the Commissioners required that a forfeitable deposit of $20,000 be made by the company to be returned should the company on or before 1st July, 1902, satisfy the Commissioner of Public Works for Ontario that :

(a) The sum of $250,000 had been actually expended in the Province upon works, and in plant and materials used in carrying on the works contemplated by the agreement, and

(b) That it had expended or contracted to expend on or before 1st July, 1903, on these works, including machinery and appliances, the sum of $1,500,000.

It having been shown to the Honorable the Commissioner of Public Works that the company had fulfilled both of these conditions, the $20,000 deposited was returned to the company.

Under the agreemnts entered into with this company, provision was made for the construction of an ornamental steel truss bridge to carry the electric railway tracks and the new Park driveway over the intake leading the waters of the river to the works of the company. In preparing the designs for this bridge the commissioners considered it would be more in har-

mony with the enviroment to have a solid stone structure and to substitute arches of concrete and steel, faced with limestone, similar to the beautiful bridge erected by the Commissioners of the New York State Reservation between Prospect Park and Goat Island. The chief officials of the company realizing the importance of having the surroundings of their power station conform to the aesthetic requirements, accepted the suggestion, and this work is now well under way, although the cost to the company is considerably in excess of the original design.

A detailed statement of the works which have been carried on by this company during the year will be found in the report of the Superintendent of the Park appended hereto.

The Ontario Power Company made application early in the summer for an intake from the Niagara River above the Dufferin Islands in addition to the rights which had been granted them to conduct the waters of the Welland River by an open canal to and through the Park for the generation of electrical energy in a power house located below the Falls. Before granting any additional privileges to the company the Commissioners made a very careful survey of all the provisions of the several agreements which had been made in relation to the projects of the company with a view of securthe best possible results both in respect to the artistic features—the works being located in a public park—and to the financial position as well.

Upon mature consideration the Commissioners made the following stipulations an indispensable condition to the granting of any further rights or privileges, namely :

1. That the open hydraulic canal through the Park should be abandoned and all the works of the company north of the intake should be put under-ground.

2. That there should be no elevated forebay with gatehouse structure north of Table Rock house, but that the surface levels of this contracted portion of the Park should be restored to the original condition after the conduits or water pipes were laid.

3. That the penstocks should be carried down from the supply pipes to the power house by means of shafts and tunnels cut through the rock.

4. That the privilege of constructing a power house in the Park near the gravel pit, as provided in the agreement of 11th April, 1900, should be cancelled.

5. That the forebay works at the Dufferin Islands should be so constructed as to greatly improve and in no way mar the scenic beauty of the islands.

6. That the rental should be increased to $30,000 a year as a minimum payment for any quantity of power under 20,000 electrical horse-power with the additional payment of $1.00 per horse-power for all sold above 20,000 up to 30,000. 75 cents per horse-power for all above 30,000 up to 40,000, and 50 cents per horse-power for all power sold or disposed of above 40,000 electrical horse-power.

After protracted consideration and negotiations the Commissioners and the company reached an agreement on the 28th June embodying all of these conditions and granting to the company authority to take water for power purposes from the Niagara River near the extreme southerly limit of the Park, and by means of an intake and forebay constructed in the bed of the river east of the Dufferin Islands lead the waters of the river to a gatehouse located near Cascade Point and thence by means of conduits or pipes concealed beneath the surface of the ground conduct the water around the rear of the Park to north of Table Rock House, and from this point be distributed by means of penstocks to the water wheels in the power house under the cliff.

As the agreement could have no force or effect until approved by the Lieutenant Governor-in Council, strong opposition to its being so ratified was made by the Canadian Niagara Power Company, and a hearing was given all the parties interested before the Government on July 22nd and on the 2nd August before the Commissioners to the representatives of the Canadian Niagara Power Company. As, however, the arguments advanced in opposition to the granting of the franchise did not commend themselves to the Commissioners or the Government, the agreement was finally validated by Order-in-Council on the 7th August. The Order-in-Council imposes a condition that all plans submitted to the Commissioners for approval should be first approved by His Honor the Lieutenant-Governor-in-Council.

Shortly after the delivery of the agreement the company submitted plans for a coffer dam to unwater the river bed at the site of their intake and forebay. The construction of that work has proved of great interest to the public generally, as it demonstrates the facility with which the waters even of the Niagara River may be trained to flow in any desired direction, and some very interesting characteristics of the strata forming the bed of the stream above the Cascades have been revealed. The construction of this coffer dam has also afforded a valuable opportunity for the study of the currents of the river and the effect upon the surface levels of the water at points lower down the stream. The text of the agreement will be found in the appendix to this report.

Shortly after the granting of these additional privileges to the Ontario Power Company, application was made on behalf of Messrs. William Mackenzie, H. M. Pellatt and Frederic Nicholls for a site in the Park on which to develop electrical and pneumatic power on a large scale.

The location proposed for the works was "Tempest Point" midway between the works of the Canadian Niagara Power Company and the Ontario Power Company.

Before entering into negotiations with these gentlemen, the Chairman of the Commission prepared for the consideration of the Board a memorandum, which will be found in the Appendix to the Report, clearly setting out the questions involved, and which in his opinion would require to be settled before proceeding with the negotiations. This memorandum was submitted to the Government, and it was decided that a hearing should be given to the two companies holding franchises to develop power in the

Park in order to ascertain what objections they might have to the granting of further rights for this purpose. The interested parties were cited and the hearing given by the Government on 19th December last, when it became apparent that a great divergence of opinion existed between the hydraulic engineers of the Canadian Niagara Power Company, the International Railway Company and the engineers of the applicants.

In order to determine precisely the nature of these opinions, the several parties were invited to reduce to writing the arguments used at that meeting. Upon the reception of the written briefs the Government considered it judicious to furnish each of the parties with copies of the reports and arguments advanced by the others for such criticism and rejoinder as might be considered necessary. When all these reports and memoranda were received, the Commissioners, with the approval of the Government, engaged two eminent hydraulic experts to examine into all the questions at issue and to report fully upon the arguments set out in the respective briefs.

The engineers selected were Mr. Isham Randolph, C.E. (Chief Engineer of the Sanitary District of Chicago, a work in the construction of which over $35,000,000 has been expended), and Mr. Robert C. Douglas, Hydraulic and Bridge Engineer of the Department of Railways and Canals, Ottawa. These gentlemen visited Niagara Falls and made as thorough an examination into the physical conditions existing at the present time as was possible, and also examined the works which have been constructed up to this date for the companies to whom franchises have been given.

Upon a full consideration of the reports of these experts the Commissioners came to the conclusion that the flow of the water and the level of the river at the intakes of the Canadian Niagara Power Company and the International Railway Company would not be materially affected by the proposed works of the applicants, as these were outlined in the plans submitted, and the Government authorized the Commissioners to conclude an agreement with Messrs. Mackenzie, Pellatt and Nicholls on the same general principles as obtained in the other agreements made, and this has been concluded and confirmed by Order-in-Council since the close of the year.

The text of the agreement entered into together with the arguments and briefs of the Solicitors, and the opinion of the hydraulic experts called in by the Commissioners, will all be found in the appendix to this report.

Shortly after the completion of the agreement entered into with the Mackenzie, Pellatt and Nicholls Syndicate, the Honourable, the Premier, requested the Board to furnish the Government with a report from a hydraulic engineer of high standing upon the locations above the Falls, and also in the Rapids of the Lower Niagara, where, in addition to the rights already granted, electrical power upon a large scale could conveniently be developed.

The Premier also desired the Commissioners to obtain an authoritative report upon the cost of transmitting electrical energy to cities and towns in Ontario within a reasonable distance of Niagara Falls, showing the probable cost of constructing the lines, the estimated loss in transmission, and the

probable cost of maintenance. After due consideration and inquiry, the Commissioners decided to engage Mr. Isham Randolph, C. E., of Chicago, whose eminence as a hydraulic engineer has been already referred to in this report, and who, in order to advise the Board in respect to important engineering questions relating to power development at Niagara Falls, had carefully studied the hydraulic conditions of the river within the Park.

In order to make himself thoroughly familiar with the broader questions now submitted for his consideration, Mr. Randolph again visited Niagara Falls, and made an extended examination into the physical characteristics of the river, both north and south of the present Park limits.

Mr. Randolph's report, which will be found in the appendix, demonstrates very clearly that the available sites for water-power development on the Canadian side of the river have not been exhausted by the rights and privileges already granted by the Commissioners, but that there are several points where power may be developed upon as large a scale as the plants now under license, and at a cost not materially in excess of those plants.

One of the locations referred to in his report is quite close to the Falls, and north of the intakes of the several companies licensed, but the powerhouse is designed to be subterranean, and nothing but a small building, to enclose an elevator, would appear on the Park surface. The other locations are all south of the Park limits, and would be upon the general lines adopted by Messrs. Mackenzie, Pellatt and Nicholls for their development.

In addition to these major projects, Mr. Randolph confirms the opinion given in the Twelfth Annual Report of the Commissioners, that there are several locations along the course of the river below the Falls where water-powers may advantageously be developed, although these will necessarily be upon a less extensive scale than at the Falls proper.

Mr. Randolph's report, therefore, sets at rest the newspaper opinion that the granting of the concessions already made has exhausted the field for power development at Niagara Falls, and that municipalities and other consumers of electric power will, for all time, be at the mercy of a possible combination of the licensed companies.

The Commissioners, however, are of the opinion that further rights should not be granted until it is shown that a combination having for its object an undue increase in the cost of power is either possible or probable.

The plans of the three companies now exercising their franchises contemplate such a large output of electrical power that, as has been already shown, there is no likelihood of anything like the demand being for many years equal to the supply, and consequently the tendency will be to compete for the business offering.

As any power development at Niagara Falls necessarily involves a very great initial outlay, with consequent high interest charges per H. P. until a large amount of power is sold, the Commissioners recommend that the companies now developing under their several agreements should be given an opportunity to complete their works before other privileges on a large

scale are granted, unless it can be shown to be in the public interest to grant such additional privileges.

Respecting the selection of an electrical engineer of large experience to report upon the construction and operation of lines for the transmission of electrical energy from Niagara Falls to cities and towns in Ontario, within a radius of 100 or 150 miles from the Falls, the Commissioners decided, after careful investigation, to secure the services of Mr. L. L. Nunn, of Telluride, Colorado, to furnish them with a report upon this important subject. Mr. Nunn is the General Manager of the San Miguel Consolidated Telluride Company and Telluride Power Transmission Company; General Manager Logan Power Company, Logan, Utah; General Manager the Power Company, Logan, Utah; General Manager, the Power Company, Norris, Montana; and he is credited with being the first man to successfully demonstrate the practicability of long-distance high-tension transmission.

Mr. Nunn's report, which will be found in the Appendix to this Report, affords a very interesting statement of the conditions affecting this vastly important subject, and will be found of great value at the present time.

The various field works which have been carried on during the year are referred to at length in the accompanying report of the Superintendent of the Park.

The following statement will show the receipts and disbursements for the year :

Receipts.

The Ontario Power Company. Rental	$30,000 00
The Canadian Niagara Power Company. Rental	15,000 00
The Niagara Falls Park and River Railway Company. Rental	10,000 00
The Fort Erie Ferry Railway (Rental for 3 months)	250 00
Zybach & Company	8,200 00
Wharf privileges	422 00
Tolls	1,167 20
Sales of old materials and sundries	219 96
	$65,259 16

Expenditure.

Paid Imperial Bank overdraft for 1901	$2,704 39

Capital Account.

Paid for permanent improvement, including cost of materials	$2,055 07	
Paid wages of mechanics and laborers	2,616 46	
Paid for land purchases	917 18	
		$ 5,588 71

Maintenance Account.

Paid salaries and wages, including wages of teams, laborers, etc	$16,283 22	
Paid cost of materials	3,130 79	
Paid office expenses	289 65	
Paid Commissioners' expenses	879 72	
Paid miscellaneous	483 55	
		$21,066 93
		$26,655 64
Paid interest on Bonds and Bank Charges.		24,188 28
Balance at Imperial Bank		11,710 85
		$65,259 16

All which is respectfully submitted.

J. W. LANGMUIR, Chairman.
GEORGE H. WILKES.
JAMES BAMPFIELD.
A. W. CAMPBELL.
ROBERT JAFFRAY.

APPENDIX "A."

Report of the Superintendent of the Park, being for the year ending December 31st, 1902.

To the Commisioners for the Queen Victoria Niagara Falls Park :

Gentlemen.—The past year has been an eventful one in the history of the Park. In the report for 1901 the early operations of the Canadian Niagara Power Company were referred to as marking a new era in connection with Niagara Falls, but 1902 has witnessed the beginning of operations by the Ontario Power Company, whose works are designed upon even a larger scale than those of the Canadian Niagara Power Company. In addition to these two gigantic concerns a franchise has recently been granted to a syndicate of Toronto capitalists who purpose taking immediate steps to rival if not excel the other companies in the magnitude and completeness of its work, so that for all future time the history of the Park seems to be inseparably connected with the utilization of the water power within its borders for the creation of electrical energy on a scale hitherto undreamed of.

POWER DEVELOPMENT WORKS.

The Canadian Niagara Power Company.

During the year the Canadian Niagara Power Company have vigorously carried on their several works for the development of power. The great tunnel designed to carry away the exhaust water from the water wheels to the lower river, and which was but well begun at the beginning of the year, has been driven through from the shaft both ways to the portal below the Falls on the north, and to the wheel pit on the south, a total length of 750 yards. The contractor for the tunnel work succeeded in driving his southerly heading up to the line of the wheel pit before the latter work had been excavated down to the corresponding level. In order to expedite the work it was therefore decided to extend the tunnel in below the wheel pit excavation, and this work is now under way, the cutting being made of somewhat greater dimensions in order to form the lower part of the wheel pit. A great deal of extra work is required at the bottom of the wheel pit in addition to the simple sinking of the excavation, and it is expected that all this work will be completed by the time the wheel pit is sunk down to the level of the crown of the tunnel. The wheel pit is a great chasm, 266 feet long by 21 feet wide, cut in the rock with masonry arches, girders and other appliances for supporting the penstocks and wheels as well as the enormous electrical machines which are to generate the electric power designed by the company for commercial purposes.

As it was deemed essential that the walls of the wheel-pit should not be shaken by the effects of the explosives used, channelling was resorted to, which, although a slower process than drilling and blasting, was considered preferable. A narrow and continuous channel in the rock following the outline of the excavation required is first cut downwards and a little outwards by channelling machines running along each side of the excavation. These travel on rails and make a two-inch clean cut separating the rock walls from the mass it is desired to remove to below the level of the bench or step determined on, which in this case is six feet in depth. Holes

are then drilled from cut to cut across the 21 feet of intervening rock and the mass is shattered by dynamite and afterwards removed from the excavation. This work has made very good progress, and the sinking of the northern half of the wheel-pit has been carried down an average depth of nearly one hundred feet.

Late in the season the company decided to go on and excavate the remaining half of the wheel-pit to the full extent required for the installation of the 100,000 horse-power for which the plant is designed, and to complete the works required to make the intake and forebay of the full dimensions contemplated by the agreement instead of water connections for only one-half of the total to commence with. This decision on the part of the company is clearly of great advantage to the Park, as it insures a much more speedy and permanent restoration of the surface of the grounds contiguous to the works, which would of necessity be torn up and destroyed by any succeeding expansion. Some difficulty may, however, be experienced in finding space in the park for the large additional quantities of materials to be removed, and a considerable proportion of the rock excavated may have to be taken out of the Park, as provided in the agreement. Up to the present the material excavated has been used for various purposes, viz., to fill up the low ground west of Cedar Island, to extend the portion of the shore line shallowed by the recession of the Falls out to deep water, and to cover the exposed shale at the base of the Falls to prevent its rapid wearing away. A large quantity has also been taken off to make a filling at the crossing of the electric railway over the Whirlpool Ravine, and several thousand cubic yards have been broken to form concrete for the lining of the tunnel.

BRIDGE AT INTAKE.

By midsummer the excavations at the site of the Canadian Niagara Power Company's intake had been carried down to solid rock, and the construction of the bridge to carry the Electric Railway and the main Park driveway was begun. This bridge was first designed to be of ornamental steel trusses, supported by stone abutments with a centre pier. Acting, however, upon the suggestion of the writer, the company have substituted a concrete arch bridge reinforced by steel ribs and faced with cut stone masonry. The parapet walls are to be of rock-faced masonry, and the bridge, which will consist of five spans of fifty feet each in the clear and have a total width of about fifty feet, will when finished be a very handsome feature of the Park.

INTAKE FOR ELECTRIC RAILWAY AND TOWN WATER SUPPLY.

The filling out from the shore to deep water by the Canadian Niagara Power Company necessitated a new intake for supplying the flumes of the Electric Railway and the town waterworks. In each of these cases the supply of water has of late become quite inadequate, owing in part to the rapid current carrying stones and gravel to the entrances of the flumes, which were very contracted in area, and in part to the lowering of the margins of the river by the receding of the contour of the Horse Shoe Fall. In preparing plans for

new intakes it was deemed best by the respective parties to have one large opening from the river, instead of two small ones as before and to slow up the velocity of the water passing through to the existing flumes in order to relieve the difficulty experienced from ice. The plans approved by the Commissioners provide for five openings of 21 feet each between piers, these openings to be protected by heavy steel racks secured to the Portland cement concrete masonry piers and containing walls. The main Park driveway will be carried over this intake by a steel deck bridge with a span of about eighty feet. The Electric Railway Company are to provide the bridge ; all the other work, including the deepening of the area enclosed by the intake walls, is at the expense of the Canadian Niagara Power Company. The contractors for this work have made very slow progress, and it will not be completed until the spring.

THE ONTARIO POWER COMPANY.

Under the terms of the agreement made with this Company on 11th April, 1900, work was commenced in the Park in April last by making an initial cutting along the centre line of its proposed open canal from the gravel pit northwards to near the Electric Railway Power House. Work was also begun outside the Park and several test holes along the line of the waterway from the Welland River were put down to the required level.

NEW AGREEMENT.

Before much progress had been made on the works within the Park the company found it desirable to change its plans, and made an application for an intake and supply from the Niagara River above the Dufferin Islands. This privilege to be supplementary to the Welland River works, but development from the Dufferin Islands works to be first carried out. After negotiations an agreement was made under date of 28th June granting the desired privileges. By the terms of this agreement the right to construct an open canal through the Park was cancelled and a stipulation made that all the water required by the company from either the Welland or Niagara Rivers should be conveyed under the surface of the Park in conduits or pipes, and that no part of the Park surface should be occupied by a canal or forebay.

EXCAVATIONS AT SITE OF POWER HOUSE.

Upon the execution of this new agreement, work upon the open canal was suspended, and the Company concentrated its efforts upon clearing away the loose rock forming the talus from the site of the Power House in the lower river gorge. This difficult work proved of great interest as the rocky face of the chasm was uncovered to the level of the water in the lower river, and the outermost line of solid rock indicated where the cataract had hewn its way when some centuries younger than at the present time. The excavations for the first section of the building were completed before the close of the year, and a beginning was made upon the excavations on the upper Park level for the conduits or pipes near the Table Rock House. As this portion of the Park

is usually thronged by visitors in mid-summer, it is very desirable that as much of the work as possible requiring to be done at this point should be completed before July.

COFFER DAM.

Subsequent to the conclusion of the new agreement authorizing the company to take water from the Niagara River, application was made for approval to plans for a coffer dam to shut off the waters of the river and lay bare the river bed at the site chosen for the intake and forebay, extending from the Dufferin Islands up-stream to the southern boundary of the Park. This work was begun in August and completed by November, and it has also been of very great interest to the public generally owing to the variety in the conformation of the strata forming the bed of the stream and which owing to the swiftness of the current had been swept clean for ages. The coffer dam was commenced at the point where the easterly limit of the Park intersects the edge of the river, and running out into the stream about twenty feet turns at a right angle and runs in a direct line with the intake of the Canadian Niagara Power Company for a distance of over two hundred yards, when it curves outward and terminates near the line of the first cascade a total distance of about 250 yards. The construction of this coffer dam shut off all the water flowing in and around the Dufferin Islands, and thousands of visitors have been attracted by the strange spectacle. The company have not yet begun the permanent works incidental to the intake or forebay, but the engineers of the company expect to have these works so far completed that the waters of the river will be restored to their usual channels by mid-summer.

FORT ERIE RESERVE.

The Government of the Dominion having granted a lease to the Commissioners of the reserve of thirteen and a half acres about the ruins of Fort Erie, on condition that the property be cared for as part of the Park system, the Commissioners took possession and decided to fence off the grounds, which have been an open pasture field for many years; turned cedar posts for an ornamental wire garden fence have been set out along the front, and on the south unturned posts of cedar for a simple field fence have been placed in position. Owing to delay in obtaining the desired separating rails the fencing is not yet completed. In the spring a beginning will be made towards putting this historic ground into proper condition.

GENERAL MAINTENANCE.

The spring and summer of 1902 were characterzied by an unusual amount of precipitation, heavy snow falls in the earlier months and frequent rains throughout the summer. This climatic condition was most favorable to the Park, as in many places the soil is but a few inches in depth, and in dry weather both grass and shrubs suffer in consequence. Throughout the whole of last season, however, the verdure was remarkably fresh and the trees and shrubs were never seen to such advantage. The very heavy cartage of materials required in the new power works, owing to the excessive moisture, cut up the Park driveways and made it difficult to maintain them in good condition.

A considerable shipment of new herbaceous shrubs was added to our collection. These were put in the nursery to mature before setting out in the Park.

QUEENSTON HEIGHTS PARK.

The heavy repairs to the shaft and pedestal of Brock's Monument, which were referred to in last year's report, were carried out in the early summer, and this noble monument is now in good repair. It was, however, found impossible to take down the dwarf wall enclosing the monument, and this remains to be taken in hand.

The densely wooded background, which surrounded the earthwork redoubts, has been cleaned up, and the sunlight allowed to penetrate. Much of this undergrowth was of evergreens, and the crowding had forced the growth to the tops, with the result that any heavy snow fall lodged in the tops and bent and broke them in all directions, while the lower limbs for want of light and room to develop had perished. In a few years it is hoped that this historic ground may be restored to a Park-like appearance and every part of it made accessible to visitors.

NIAGARA GLEN.

The pathways opening up this widely diversified portion of the Park were maintained throughout the season, and new ones built in order to provide access to other points of interest. This unique glen is yearly becoming better known, and visitors in increasing numbers are availing themselves of the facilities which have been provided since the property was acquired by the Commissioners.

CHAIN RESERVE.

The Chain Reserve along the shore of the Niagara River between Slater's Point and Fort Erie continues to suffer from the eroding action of the river. The company which obtained a franchise to construct an Electric Railway along this reserve, and as compensation in part undertook to provide protecting works, has not as yet done anything in this connection. The roadway having at several points become dangerously narrow, additional lands have been secured and the driveway set back in such a manner as to afford abundant room for present requirements. There are, however, several additional points where greater width is needed, and these will require attention in 1903.

The whole respectfully submitted.

JAMES WILSON,
Superintendent.

AGREEMENT OF 28TH JUNE, 1902, BETWEEN THE COMMISSIONERS AND THE ONTARIO POWER COMPANY.

This Agreement, made this 28th day of June, 1902, between the Commissioners of the Queen Victoria Niagara Falls Park, acting herein on their own behalf and with the approval of the Government of the Province of Ontario, and hereinafter called the "Commissioners," of the first part, and The Ontario Power Company of Niagara Falls, incorporated by the Parliament of Canada, and hereinafter called the "Company" of the second part.

Whereas the company, on the 29th day of November, 1901, did obtain the sanction of the Minister of Railways and Canals to the plans and surveys of works proposed to be built by the company, of a Canal and Hydraulic Tunnel, from a certain point in the Welland River to the boundary line of the Queen Victoria Niagara Falls Park, and also, on the 20th day of February, 1902, did obtain the sanction of the said Minister of Railways and Canals to the plans and surveys of works proposed to be built by the company, of a Canal and Hydraulic Tunnel, from the said boundary line of the said Park and through the same to a point of discharge on the west bank of the Niagara River below the gorge, whereby the waters of the said Welland River can be led through the Queen Victoria Niagara Falls Park for the purposes of supplying power for use in manufacturing or any other business or purpose by means of the discharge of such water in the Niagara River, in accordance with the powers given by the Act of Canada, 1887, chapter 120, and its amendments as then enacted by the Parliament of Canada, and which said plans and surveys are filed and are of record in the Department of Railways and Canals of Canada at Ottawa.

And whereas the Lieutenant-Governor of Ontario, on the 23rd day of April, 1902, by Order-in-Council, and the Commissioners by the several agreements of 15th August, 1901, hereinafter recited, subject to conditions, provisions and stipulations, did consent that the works of which the plans and surveys so sanctioned by the Minister of Railways and Canals, as above recited, be constructed within the limits of the Queen Victoria Niagara Falls Park, and also that the powers given by the Act of Canada, 1887, chapter 120, and its amendments or any of them, to the company, as therein enacted up to the date of the aforesaid sanction by the Minister of Railways and Canals, may be exercised within the limits of the said Park, in accordance with three separate agreements heretofore entered into between the parties to this agreement, and severally bearing date as follows: First, on 11th April, 1900; second, a supplementary agreement on 15th August, 1901, and third, an Ancillary Agreement on the said 15th August, 1901, whereby the conditions, provisions and stipulations entered into between the parties with the consent and approval of the Lieutenant-Governor-in-Council as aforesaid are duly witnessed and agreed upon, as well by force of the powers vested in the Commissioners under the Act of Ontario, 1899, chapter 11, and Section 36, as by any other powers vested in the Commissioners and exercisable by or with such approval as aforesaid.

And whereas the company, on or before the 11th day of April in this present year (1902), pursuant to paragraph 2 of the said supplementary

agreement, and in observance of the terms of paragraph 31 of the agreement of 11th day of April, 1900, did begin to construct the works as laid down upon the map or plan annexed to the supplementary agreement of 15th August, 1901, entitled "Amended Map of the Ontario Power Company's Works in the Queen Victoria Niagara Falls Park" and lettered "B."

And whereas the parties to these presents have agreed that the company may take an additional supply of water to be obtained by an intake from the Niagara River under the powers contained in the before in part recited Act of Ontario, 1899, chapter 11, and Section 36, at a certain defined point, for the purpose of generating electric or other power, as in the Act of Canada, 1887, and its amendments specified, by means of the works located and defined in the aforesaid supplementary agreement.

And the parties have also agreed, as by these presents defined, on provisions whereby the supply of water for the purposes of generating electric or other power as aforesaid, whether such supply be obtained from the Welland River as already agreed, and provided by the agreements previously in part recited, or from the Niagara River as by these presents provided, shall be led through the Park by means of conduits or pipes as hereafter specified. And have also agreed for one rental being payable in manner and at the periods hereinafter specified by paragraphs 10 and 11 of these presents, for the enjoyment of all the rights and privileges by this or the previous agreements granted and conferred upon the company. And have also agreed to surrender, as by the execution of these presents it is testified are surrendered the rights of the location and construction of works relating to the "first development," as described and provided by the aforesaid agreement of 11th April, 1900, notwithstanding any matter relating thereto, contained in the supplementary agreement of 15th August, 1901, and for convenience the expression in these presents of Niagara River Intake shall mean the right granted to obtain water by these presents and the expression of Welland River Intake shall mean the rights acquired to take water as described in and by the agreements previously in part recited.

Now, Therefore, This Agreement Witnesseth, as follows, that is to say:

1. For the purpose of generating electricity and pneumatic power, or any other power within the Acts of Incorporation of the company, to be transmitted and capable of being transmitted to places beyond the Park by means of the works described in paragraph 2 of the hereinbefore in part recited supplementary agreement of 15th August, 1901, indicated on the map or plan thereto annexed, entitled, "Amended map of the Ontario Power Company's works in the Queen Victoria Niagara Falls Park," and lettered "B."

The Commissioners hereby grant to the company, subject to the consent and approval of the proper authority and save as hereinafter limited, a license irrevocable to construct upon or in the natural channel or bed of the Niagar River an intake and forebay by means of which water may be taken from the Niagara River and conducted through conduits or pipes or tunnels through the Park to or near the the point marked "L" in the map or plan hereto annexed marked "C", and from such point be continued in lines parallel with and adjacent to the conduits or pipes which may be required to lead the waters of the Welland River intake to the power house,

situate in the gorge below the Falls, in accordance with the supplementary agreement of 15th August, 1901, hereinbefore in part recited, and as located by map or plan "B" annexed to said supplementary agreement, and by means of conduits or pipes, as hereinafter more particularly specified, in lieu of the open channel and forebay as by the said map or plan "B" appears and is laid down. The works to be done in relation and to carry out the rights granted as the Niagara River Intake to be as shown in pink on the map or plan marked "C", entitled "Revised plan of works of the Ontario Power Company's works in the Queen Victoria Niagara Falls Park," and hereto annexed and subject to provisions hereinafter contained, and to all other provisions of law to be observed in exercising the said franchise or the works required for its development. Provided also that these presents are not to be construed as expressing or implying any covenants by the Commissioners for title or quiet possession.

2. The said map or plan marked "C" hereto annexed is identified by the seals and signatures of the parties hereto.

3. The several works which the Company are by these presents authorized to perform and do may be more particularly described as follows, reference being made throughout to the above described map or plan marked "C", which is attached to and forms part of this agreement ;

(1) From a point at or near (A) to a point at or near (B) to construct a permanent rack and ice fender.

(2) From a point at or near (B) to a point at or near (C) to construct a concrete wall of sufficient height to impound the water required at an elevation approximately equal to river level at point of intake.

(3) From or near (C) to or near (D) to construct an overflow dam or waste weir of capacity sufficient to draw from the forebay any ice which may pass through the rack into the headrace.

(4) From or near (D) to or near (E) to construct a headblock with gatehouse and gates to control water supply to conduits.

(5) From or near (E) to or near (F) to construct a concrete wall of sufficient height to protect the Dufferin Islands from overflow.

(6) From or near (F) to or near (G) to construct an overflow dam or sluiceway and to regulate the flow of water round Dufferin Islands.

(7) From or near (K) to or near (D) to construct a rack and screen to prevent ice or other objectionable matter entering forebay.

(8) To excavate the bed of the raceway and forebay in order to slow the speed of the water and afford sufficient hydraulic head at headgates.

(9) To construct temporary cofferdams in order that any or all of these works may be properly constructed.

(10) From the gate house (D-E) to construct one or more conduits or pipes through the Park to the point at or near (L) on said map or plan, these conduits or pipes to form a syphon under the lower channel of the Niagara River at the Dufferin Islands.

(11) To construct conduits or pipes from or near the point (I) on said map or plan "C" or where the works of the company to carry the waters of the Welland River are designed to enter the Park to or near the point (H) on plan or so far as the penstock chambers (under the agreements of April 11th, 1900, and August 15th, 1901.)

(12) To construct cascades and overflow dams in the existing channels of the Dufferin Islands to preserve the surface levels of the several streams under a restricted flow of water.

4. The works hereinafter specified and embraced in the following subsections (a) to (j) inclusive, and authorized by the Commissioners to be done and executed by the company by these presents and the manner in which the same may, from time to time, be proposed to be performed or varied shall, before being commenced, be submitted by the company to the Commissioners accompanied by suitable plans, profiles, specifications and elevations as the case may require, and the scenic and general features thereof shall be approved by the Commissioners in writing. This approval shall in no wise relieve the Company from responsibility for the stability and effectiveness of its works, but it is intended to secure, as far as possible, a degree of harmony in outline and treatment compatible with the location and with the works in a public park. The works to which such approval are required, and shall not be proceeded with without such approval, are the following :

(a) The location of the temporary cofferdam to shut out the waters of the river from the headrace and forebay during construction of the works.

(b) The outline and method of treatment proposed for the walls of the headrace and forebay.

(c) The raising of the northerly shore of the Dufferin Islands.

(d) The overflow dams, weirs, cascades, etc., to regulate the flow of water in the headrace and forebay, and in and around the Dufferin Islands.

(e) The depositing of waste materials from the excavations of the company.

(f) The design and location of the bridge required to carry the Park driveways at the Dufferin Islands.

(g) The conduits or pipes to carry the supply through the Park, including the method of concealing or covering over the same, and the method of syphoning under the lower channel at the Dufferin Islands.

(h) The works and structures for regulating the flow of water at the penstock chambers.

(j) The power house and the means of access thereto, including the filling out into the lower river in front thereof.

5. The company shall remove all good surface soil which may be found at any point where its works are to be constructed and deposit the same in heaps at convenient points as the Commisisoners may direct—this good surface soil shall be used as a top dressing for all areas which may be disturbed by the operations of the company, or for covering over any waste

material taken from the excavations of the Company in the Park. Should the quantity of good soil so obtained be insufficient in the opinion of the Commissioners to afford a proper covering for such new or disturbed areas, the company shall obtain from without the Park sufficient good soil for this purpose, but the quantity of good surface soil which the company may be called upon to bring into the Park and use as a covering or top dressing shall not exceed 10,000 cubic yards.

6. Material other than the good top soil above referred to which may be excavated from the works of the company in the Park shall be used for :

(a) Raising the northerly shore of the Dufferin Islands.

(b) Forming new land or islands at such points near the Dufferin Islands as the Commissioners may determine.

(c) Filling out into the river below the Dufferin Islands to lines and levels to be given by the Commissioners.

(d) Filling up the low ground along the line of the conduits to the finished surface level of the Park—such finished surface level to be defined by the Commissioners.

Before depositing any material other than heavy stone rip-rap in rapid water the Company shall first construct a substantial and efficient crib work, facing to the ordinary level of the river, in order to protect the filling from being eroded by the action of the current. The heights, lines, slopes and levels of all filling to be defined by the Commissioners.

7. For the purposes of construction and to remove or receive supplies of materials and machinery, the company may build, subject to the approval of the Commissioners, tramways, and such other appliances and structures as may be necessary for the prosecution of the work, but these appliances are to incommode to the least possible extent the ordinary travel in the Park, and shall be removed as soon as the works for which they are required are completed.

8. The company shall provide and construct one driveway bridge in place of the north Suspension bridge connecting the Dufferin Islands, such bridge to be of concrete steel construction of appropriate design and faced with rock-faced limestone. The bridge to be not less than twenty (20) feet in width of roadway and with a six foot pathway on one side. Should it be necessary to interfere with the present Suspension bridge before the completion of the new concrete steel structure, temporary wooden bridges are to be provided to carry the traffic.

9. The license hereby granted shall take effect and operate from the day at which these presents shall have force and effect. Under paragraph twenty hereof and for the sake of uniformity in termination of periods with the provisions of the above in part recited agreements previously made by and between the parties hereto, shall terminate on the first day of April, 1950, unless terminated by operation of law or any provisions in this agreement contained.

10. At the time of the signing and delivery of these presents the company will pay to the Commisisoners the sum of $30,000, which shall be accepted and taken as rent in advance up to 30th September, 1903.

11. On and after the first day of October, 1903, the company having duly observed and performed all the agreements and conditions by them agreed to be done and performed, the company shall pay a clear yearly rental of $30,000, payable half-yearly, on the first days of April and October in each year, and in addition thereto, payment at the rate of the sum of $1.00 per annum for each electrical horse-power generated and used and sold or disposed of over 20,000 electrical horse-power up to 30,000 electrical horse-power in the year, and the further payment of the sum of 75 cents for each electrical horse-power generated and used and sold or disposed of over 30,000 electrical horse-power up to 40,000 electrical horse-power in the year, and the further payment of the sum of 50 cents for each electrical horse-power generated and used and sold or disposed of over 40,000 electrical horse-power in the year, that is to say, by way of example, that on generation and use and sale or disposal of 40,000 electrical horse-power in any year, the gross rental shall be $47,500 for that year, payable half-yearly, and so on, in case of further development at the sum of 50 cents for each electrical horse-power as above provided, and that such rates shall apply to power supplied or used either in Canada or the United States. Such additional rentals as shall be payable for such generation and sale or other disposition as aforesaid to the Commissioners shall be payable half-yearly at the rate above specified on the first days of April and October in each year for all the power sold in the said several half-yearly periods from the day of sale, and within ten days after the said first days of April and October in each year on which such additional rentals shall be payable respectively the Treasurer or, if no Treasurer, the head officer of the company shall deliver to the Commissioners a verified statement of the electrical horse-power generated and used and sold or disposed of during the preceding half-year, and the books of the company shall be open to inspection and examination by the Commissioners or their agent for the purpose of verifying or testing the correctness of such statement, and if any question or dispute arises in respect to such return or if any statement delivered at any time by the company to the Commissioners of the quantity or amount of the electrical horse power generated and used and sold or disposed of or of the amount payable for such additional rentals, the High Court of Justice of Ontario shall have jurisdiction to hear and determine the same and to enforce the giving of the information required.

Provided always that if any part of the said rent, whether payable under this paragraph or in respect of the renewal term or terms in paragraph 15, shall be in arrear for three months, whether legally demanded or not, the Commissioners, or if not then an existing corporation the Government of the Province may re-enter on the premises or any part thereof in the name of the whole, and thereupon this agreement shall determine, and the remainder of the term then current shall terminate as well as any renewal or renewals thereof which under this agreement may be claimed.

12. And whereas the company has actually deposited to the credit of the Commisisoners in the Canadian Bank of Commerce the sum of $50,000, with the assent of the Commissioners it is hereby agreed that when the company shall have actually expended the sum of $250,000 on works upon the grounds within the Park, either on the works known as the Niagara River

intake or known as the Welland River intake and the Commissioners are satisfied of the amount of such expenditure then that the Commissioners will pay the said sum of $50,000 to the company.

13. This agreement shall be taken to complement the previous above in part recited agreements made between the parties hereto, and all the terms and provisions thereof shall so far as applicable apply to the works authorized by these presents and to the execution and carrying out thereof.

14. And for greater certainity, but not so as to restrict the generality of the foregoing, it is hereby declared and agreed that if at the end of the said period of license of fifty years as created by the agreement of 11th April, 1900, and the period of license created by these presents shall have terminated under the operation of paragraph 11 of these presents, renewal of term or re-adjustment of rentals shall be made in accordance with the provisions of paragraph 27 of the 11th April, 1900.

15. In lieu of paragraph 31 of the agreement of 11th April, 1900, so much of its provisions as are as follows shall apply not only in respect of the works authorized by these, but in respect of the works authorized by the supplementary agreement of 15th August, 1901, which have been in part begun as hereinbefore recited, the company undertake to begin the works authorized by these presents, (or by any of the agreements previously entered into between the parties and in part recited), within two years from the date of this agreement, and to have proceeded so far with the said works on or before 1st April, 1906, that they will have completed within the Park water connections (that is to say: headrace, forebay, conduits or pipes, penstocks and tailrace), for the development of 40,000 horse power, and have actually ready for use, supply and transmission 20,000 developed electrical or pneumatic horse-power by said last mentioned day, and if not then completed the Lieutenant-Governor-in-Council may declare this agreement, the liberties, licenses, powers and authorities so granted and every one of them to be forfeited and void, and thenceforth after such declaration the same shall cease and determine and be utterly void and of no effect whatever.

16. And not to restrict the generality of the foregoing it is hereby declared that the following paragraphs of the agreement of 11th April, 1900, shall apply and be taken to be inserted herein: 8, 12, except the words "in its first development" in fifth line of said paragraph, 19, 20, 23, 28, 29 30, 32, 33, 34, 35, 36, 37, also paragraphs 1, 2, 6, 7 and 8 of the supplementary agreement of 15th August, 1901.

17. And that the following paragraphs of the agreement of 11th April, 1900, be deemed to be inapplicable, namely, 10, 13, 15, 17, 18, 22, 24, also paragraphs 3, 4 and 5 of the supplementary agreement of 15th August, 1901.

18. It is further agreed that if from any cause the supply of water at the point of intake as by these presents defined be diminished the Company shall have no claim or right of action against the Commissioners, but may deepen such point of intake to such extent as to restore the supply of water to the volume or quantity necessary for the purposes of the company.

Nor give to the company any right of action against other licensees or grantees of the Commisisoners in respect of any diminution not substantially interfering with the supply necessary for the company, nor so long as such necessary supply can be obtained by means of deepening at said point of intake.

19. And the said parties hereto mutually and respectively covenant, promise and agree with each other to carry into effect, observe, perform and fulfill all the provisions and stipulations in these presents contained and to be carried into effect, observed performed and fulfilled by the said parties respectively.

20. This agreement shall have no force or effect until approved by the Lieutenant Governor-in-Council.

In Witness Whereof the corporate seal of the Commissioners has been hereunto affixed by their Chairman, who has also signed these presents in certification of due execution hereof by the Commissioners, and the corporate seal of the company has been hereunto affixed by the President, who has also signed these presents in certification of due execution hereof by the company, and on the day and year aforesaid.

(Signed) THE ONTARIO POWER COMPANY OF NIAGARA FALLS.

By J. J. ALBRIGHT, President.

ROBERT. C. BOARD, Secretary. (Seal)

Witness : JAMES WILSON.

(Signed) THE COMMISSIONERS OF QUEEN VICTORIA NIAGARA FALLS PARK.

By J. W. LANGMUIR, Chairman. (Seal)

AGREEMENT 29th DAY OF JANUARY, 1903, BETWEEN THE COMMISSIONERS AND MESSRS. MACKENZIE, PELLATT, AND NICHOLLS.

This Agreement made this 29 day of January, A.D. 1903.

Between The Commissioners of the Queen Victoria Niagara Falls Park, acting herein on their own behalf and with the approval of the Government of the Province of Ontario, hereinafter called "The Commissioners," of the first part, and William Mackenzie, of the City of Toronto, Capitalist, Henry Mill Pellatt, of the same place, Capitalist, and Frederic Nicholls, of the same place, Capitalist, hereinafter called "The Syndicate," of the second part.

Whereas for convenience and to prevent ambiguity it is agreed and understood by and between the said parties hereto and is hereby declared as follows, that is to say:

(a) The expression "The Park" whenever it occurs herein shall be understood to mean the Park proper, namely The Queen Victoria Niagara Falls Park south of its original boundary in front of the property formerly known as the Clifton House and running easterly to the Niagara River.

(b) The expression "The Commissioners" whenever it occurs herein shall be understood to mean not only the Commissioners of the Queen Victoria Niagara Falls Park,—as representing the Government of the Province of Ontario in the premises—named as parties hereto of the first part, but also their successors and assigns and those who for the time being may be Commissioners of the Queen Victoria Niagara Falls Park or other representatives of the Government in Ontario.

(c) The expression "The Syndicate" whenever it occurs herein shall be understood to mean not only the individuals above named as parties hereto of the second part, but also their and each of their heirs, executors, administrators and assigns.

And whereas the Syndicate have applied to the Commissioners for the right to take water from the Niagara River at a certain point or points in the Park in order that the Syndicate may thereby generate and develop electricity and pneumatic power for transmission beyond the Park.

And Whereas by the Act of the Legislature, 62 Victoria, Chapter 11, it is enacted as follows :—

"The said Commissioners with the approval of the Lieutenant Governor-"in-Council may enter into an agreement or agreements with any person or "persons, company or companies to take water from the Niagara River or "from the Niagara or Welland Rivers at certain points within or without the "said Park for the purpose of enabling such person or persons, company or "companies to generate within or without the Park electricity, or pneumatic, "hydraulic or other power conducting or discharging said water through and "across the said Park or otherwise in such manner, for such rentals and upon "such terms and conditions as may be embodied in the agreement or agree-"ments as may appear to the Lieutenant Governor-in-Council to be in the "public interest."

And Whereas the Syndicate desire to secure the right to construct their works in the Park and the Commissioners have agreed to permit such construction upon the terms and conditions hereinafter expressed and contained or intended so to be and in pursuance of the Statutory powers in the preceding paragraph set forth.

Now Therefore This Agreement Witnesseth as follows that is to say :

1. For the purpose of generating electricity and pneumatic power or any other power to be transmitted and capable of being transmitted to places beyond the Park the Commissioners hereby grant to the Syndicate, subject to the consent and aproval of the proper authority and save as hereinafter limited, a license irrevocable to take from the water of the Niagara River within the Park a sufficient quantity of water to develop 125,000 electrical or pneumatic or other horse-power for commercial use. Provided also that these presents are not to be construed as expressing or implying and covenants by the Commissioners for title or quiet possession.

2. For the purposes aforesaid the Commissioners further grant to the Syndicate the right to construct and build and do and perform and operate the works, as hereinafter described and located in pink lines upon the map or plan marked "N" hereto annexed and entitled "Plan Attached to Agreement Dated January 29th, 1903, made by the Commissioners of the Queen Victoria Niagara Falls Park with William Mackenzie, Henry Mill Pellatt and Frederic Nicholls for Power Privileges within the Park" and which plan is identified by the seals and signatures of the parties hereto.

3. The several works which the Syndicate are by these presents authized to perform and do may be more particularly described as follows :

Reference being made throughout to the above-mentioned map or plan marked "N".

(a) From a point at or near A, to a point at or near B, to construct a gathering over fall masonry dam, the crest of the said dam to be level with the surface of the ordinary water level of the river at the point A.

(b) From a point at or near B, to or near the points C, D, E and F successively to construct a masonry dam and overflow weir the crest of which from B to D to be approximately two feet and from D to F approximately three feet lower than the general level of the water in the forebay.

(c) At or near the point C, to construct a substantial masonry pier to direct the passage of ice from the intake to the river below the works.

(d) From or near the point H, to or near the point G, and from or near H, to or near K, to construct masonry revetment walls.

(e) From or near the point A, to or near the point R, and from or near the point H, to or near the point C, and from or near the point D, to or near J, to construct permanent masonry sheer ice booms to prevent floating ice which may enter the intake from passing into the forebay.

(f) To construct a power house with gate house, rack, screen, penstocks, wheelpit, etc., etc., within the area marked P, K, L, M. The power

house to be of size and capacity appropriate for the machinery and appliances for the generation of 125,000 electrical horse-power.

(g) To deepen the bed of the river within the area enclosed for the intake and forebay and extending to such a distance eastwards and up stream from the point A, as may be found necessary to conduct to the intake sufficient water at lowest stages of the river for the generation of 125,000 electrical horse-power in the power house of the company and a sufficient quantity of water in addition thereto to keep the weirs fro B to E full to the level of the crest of the gathering over-fall masonry dam AB.

(h) To construct a masonry lined tail-race tunnel of capacity sufficient for the discharge of the water required in the works. The tunnel to extend from the wheel pit to a point of discharge below the Horse Shoe Fall located between the points O and N on the plan.

(i) To erect a transformer house at some point east of the power house site of the dimensions necessary for the stepping up of the electric power given off by the electrical machinery in the power house to the voltage required on the transmission lines.

(j) To carry the electricity generated to points beyond the Park by means of overhead wires or cables or by means of underground conduits.

(k) To construct temporary coffer dams in the bed of the river where required in order to facilitate and permit of the construction of any of the permanent works referred to in sub-sections (a) to (g) inclusive.

4. The syndicate agree to observe and perform the stipulations contained in the agreement between the Commissioners and Sutherland Macklm so far as it relates to the supply of water from the Niagara River to the Mansion, grounds and premises known as "Clark Hill," and to the stipulations in the subsequent agreement relating to the water supply made between the Commissioners and James R. Smith, the present proprietor and his heirs and assigns.

5. The rights and privileges described in sub-sections (a) to (k) of paragraph 3 of this agreement are granted subject to the rights in the bed of the river heretofore granted to the Ontario Power Company of Niagara Falls for its power development, which said rights granted as aforesaid to the Ontario Power Company are indicated in purple lines on the map or plan marked "N" attached hereto and described as "Intake Works of the Ontario Power Company of Niagara Falls," and none of the works to be performed under this agreement either those intended to be of a temporary character, such as coffer dams or other methods of diverting the water of the river in order to facilitate construction, or those designed to be of a permanent nature, shall in any wise interfere with or incommode the Ontario Power Company in the proper and efficient construction or operation of its works as these are defined on the said map, and the syndicate shall make all such provision for the carrying off of the natural drainage water or waters which may require to be pumped by the Ontario Power Company from its excavations and works as shall place that company in as favorable a position for the execution of its works of construction as if this agreement had not been entered into.

6. The works hereinafter specified and embraced in the following subsections (a) to (f) inclusive, and authorized by the Commissioners to be done and executed by the syndicate by these presents and the manner in which the same may from time to time be proposed to be performed or varied shall before being commenced be submitted by the syndicate to the Commissioners, accompanied by suitable plans, profiles, specifications and elevations as the case may require, and the scenic and general features thereof shall be approved by the Commissioners in writing. This approval shall in no wise relieve the syndicate from responsibility for the stability and effectiveness of its works, but it is intended to secure as far as possible a degree of harmony in outline and treatment compatible with the location and with the works in a public park. The works to which such approval are required and shall not be proceeded with without such approval are the following :

(a) The location of the temporary coffer dam required to shut out the waters of the river from the space to be occupied by the works of the syndicate.

(b) The design and location of the overflow masonry dams and weirs, sheer ice booms, revetment walls and piers for impounding and regulating the flow of water to the power house.

(c) The design and location of the power house and wheelpit, including the works and structures for regulating the flow of water at the penstock inlets.

(d) The lines and levels for the filling of the grounds about the site of the power house and out into the river to the north thereof and the method of protecting the same from erosion.

(e) The tunnel for carrying away the waste water from the wheel pit, the means of access to the mouth of the tunnel below the Falls, the method to be used in disposing of the excavated rock and the supply of timber and material for the lining of the tunnel.

(f) The design and location of the transformer house and the method of conducting the electricity to points without the Park.

7. Where the high tension transmission lines are carried over the park surface to points beyond the limit of the Park, non-conducting guard wires or other means of protection shall be placed beneath the transmission lines in such manner that in case of accident to any of the wires carrying electricity all danger to persons or vehicles passing may be prevented.

8. The Commissioners will define on the ground the area of the Park surface, which may be occupied for the temporary storage of materials to be used in the construction of the works in the Park, and also for the erection of such buildings or appliances as the Commissioners may consider necessary for the uses of the syndicate or of its contractors during construction. The area to be so occupied will of necessity be limited and the period during which the Park territory may be used for this purpose shall not exceed four years from the date of agreement for the initial installation of machinery to generate 25,000 horse power, nor more than eighteen months for any subsequent partial development up to the completion of the full installation of 125,000 electrical horse power.

9. The Commissioners may require all good surface soil which may be found at any point where works are to be constructed to be removed and deposited in heaps at convenient points. This good surface shall be used as a top dressing for all areas which may be disturbed by the operations specified or for covering over any waste material taken from the excavations in the Park. Should the quantity of good soil so obtained be insufficient in the opinion of the Commissioners to afford a proper covering for such new or disturbed areas, the syndicate shall obtain from without the Park sufficient good soil for this purpose, but the quantity of good surface soil which the Commissioners may require to be brought into the Park and used as a covering or top-dressing shall not exceed 10,000 cubic yards.

10. For the purpose of construction and to remove or receive supplies of materials and machinery, the syndicate may build, subject to the approval of the Commissioners, tramways, roads and such other appliances and structures as may be necessary for the prosecution of the work, but these appliances are to incommode to the least possible extent the ordinary travel in the Park, and shall be removed as soon as the works for which they are required are completed.

11. The syndicate shall have the right to use as power in the construction of any of the foregoing works either steam, electricity, compressed air or water.

12. Any excess of waste or refuse material taken from the excavations of the forebay, power house, wheel pit and tunnel which the Commissioners do not desire to use as filling within the Park shall be taken away by the Syndicate and deposited outside the Park limits.

13. The syndicate undertake to complete all the filling up, grading, levelling, sodding or covering with good surface soil and other works affecting the surface of the Park and to have removed all tramways, buildings and other constructions, material or appliances used in carrying out their operations in the Park within one year from the time fixed for the completion of any fractional instalment under this agreement.

14. The license hereby granted is for the term of fifty years commencing with the first of February, 1903. The syndicate paying therefor a clear yearly rental at $15,000, payable half-yearly on the first days of August and February in each year, and in addition thereto payment at the rate of the sum of one dollar per annum for each electrical horse power generated and used and sold or disposed of over ten thousand electrical horse power up to twenty thousand electrical horse power, and the further payment of the sum of 75 cents for each electrical horse power generated and used and sold or disposed of over twenty thousand electrical horse power up to thirty thousand electrical horse power and the further payment of the sum of fifty cents for each electrical horse power generated and used and sold or disposed of over thirty thousand electrical horse power; that is to say, by way of example, that on generation and use and sale or disposal of thirty thousand electrical horse power the gross rental shall be $32,500 per annum, payable half-yearly, and so on in case of further development, as above provided, and that such rates shall apply to power supplied or used either in Canada or the United States. Such additional rentals as shall be pay-

able for such generation and sale, or other disposition as aforesaid, to the Commissioners shall be payable half-yearly at the rate above specified on the first days of August and February in each year for all the power sold in the said several half-yearly periods from the day of sale; and within ten days after the said first days of August and February in each year, on which such additional rentals shall be payable respectively the Treasurer, or if no Treasurer, the Head Officer of the Syndicate shall deliver to the Commissioners a verified statement of the electrical horse power generated and used and sold or disposed of during the preceding half year, and the books of the syndicate shall be open to inspection and examination by the Commissioners or their agent, for the purpose of verifying or testing the correctness of such statement; and if any question or dispute arises in respect to such return or if any statement delivered at any time by the syndicate to the Commissioners of the quantity or amount of the electrical horse power generated and used and sold or disposed of, or of the amount payable for such additional rentals, the High Court of Justice of Ontario shall have jurisdiction to hear and determine the same and to enforce the giving of the information required. The syndicate has paid contemporaneously with the signing of this agreement the sum of $30,000, being the first two years' rental in advance, being up to 1st February, 1905.

Provided always that if any part of the said rent, whether payable under this paragraph or in respect of the renewal term or terms in the following paragraph, shall be in arrear for three months whether legally demanded or not, the Commissioners, or if not, then an existing corporation, the Government of the Province of Ontario, may re-enter on the premises or any part thereof in the name of the whole, and thereupon this agreement shall determine and the remainder of the term then current shall terminate as well as any renewal or renewals thereof which under this agreement may be claimed.

15. If at the end of the said period of fifty years the syndicate desire to renew for a further period of twenty years and shall give notice in writing to the Commissioners at least twelve months before the expiration of the fifty years' period, they shall be entitled to and shall receive a further lease of such rights for the period of twenty years more at the same rental as above provided, unless the Lieutenant-Governor-in-Council shall desire a readjustment of said rent as below provided, and similarly the syndicate shall be entitled at their option to two further renewals of twenty years each at same rental, subject to the same qualifications, the object and intention of this stipulation being to confer upon the syndicate the right to an original term of fifty years at the rentals hereinbefore specified, and to three further terms of periods of twenty years each at said rentals, making one hundred and ten years in all, and the syndicate shall then give up or at the expiration of the first term of fifty years, or any subsequent term of twenty years, if unrenewed in accordance with this agreement the works, premises, rights and privileges by this agreement created without any claim for compensation with liberty to the syndicate to remove their machinery.

In case the syndicate desire to terminate the lease, they may do so during the first period of fifty years upon three months' notice in writing to the Commissioners, or in case the Commissioners are not then an exist-

ing corporation, the Government of the Province of Ontario, payment of rent up to the time of the termination of such notice being made upon the giving of such notice. At the end of said period of fifty years the same rentals as are hereby reserved shall continue to be paid by the said syndicate unless the Lieutenant-Governor-in-Council shall desire a readjustment of said rent, in which case the rentals for a further period of twenty years shall be readjusted by agreement, and in the absence or failure of agreement by the parties hereto, then the rentals for such further term shall be ascertained by three arbitrators or a majority of them, one of whom shall be named and appointed by the Commissioners, another by the syndicate, and the third by the Chief Justice or senior presiding Judge of the Provincial Court of Ultimate Appellate Jurisdiction for Ontario. The proceedings of and before such arbitrators shall be subject to the provisions of the law relating to "References by consent out of Court," contained in the Revised Statutes of Ontario, 1897, chapter 62, respecting arbitrations and references; and either party to such arbitration may appeal in accordance with the provisions of the said Revised Statutes. The Lieutenant-Governor-in-Council may in the like manner for the two further periods of twenty years each require a readjustment of said rentals. In which case the same shall be determined as aforesaid and at the expiration of such two periods of twenty years each the term so limited by these presents shall determine and end in accordance with all provisions above contained whereby the syndicate shall then give up the works, premises, rights and privileges by this agreement granted or created without any claim for compensation, but with liberty to the syndicate to remove their machinery. And it is hereby further agreed that at any time not less than three years before the period at which such third renewal of twenty year shall terminate the Lieutenant-Governor-in-Council, and notice thereof to the syndicate given, may require the syndicate to continue its operations for a further period of twenty years, to commence from the termination of such third renewal, at the same rental as shall have been paid during the said third renewal period of twenty years or at a readjustment of said last-mentioned rentals for such further period of twenty years by agreement, and in the absence or failure of agreement by the parties hereto, then the rentals for such further term of twenty years shall be ascertained by arbitration in manner and form and according to the provisions of arbitration hereinbefore contained, and in the event of such option being so exercised the terms and provisions of these presents shall extend and bind the parties hereto until the said period of twenty years shall have elapsed and expired, but the exercise of such option requiring such further renewal by the Lieutenant-Governor-in-Council shall not change, alter or affect the above provisions in respect of the termination of the liberties, licenses, powers and authorities and so declared applicable at the termination of the said last mentioned or fourth renewal.

16. The Commissioners will not themselves engage in making use of the water to generate electric, pneumatic or other power except for the purposes of the Park, provided that in case the said Commissioners shall have granted or at any time may have granted to any other person or corporation licenses to use the waters of the said Niagara or Welland Rivers, and by reason of failure of such person or corporation to carry on the works so licensed the said Commissioners find it necessary to forfeit said license

and take over said works, this clause shall not prohibit said Commissioners from operating such works for the generation and transmission, sale or lease of electricity or power.

17. And the company shall indemnify the Commissioners from all claims or demands by any person or persons whomsoever, whether arising by reason of the exercise by the syndicate of the powers, rights or authorities or any of them conferred by this agreement, or by reason of anything done by the syndicate in the exercise thereof affecting any property, rights or privileges heretofore by the Commissioners granted to or conferred upon any person or persons whomsoever or enjoyed, used and exercised by any such person or persons under the Commissioners; it being the intention of this agreement that should the syndicate in the exercise of the aforesaid powers, rights and authorities so affect any such property, rights or privileges granted by or enjoyed under the Commissioners, the syndicate shall fully indemnify the Commissioners in respect thereof.

And in the event of any claims or demands aforesaid being preferred before or in any tribunal, whether in a court of law or by proceedings of arbitration against the Commissioners or for the Commissioners or in their name, the syndicate undertake and agree to intervene on behalf of the Commissioners and defend the same or take such action in the premises at the cost and charges of the syndicate; the Commissioners thereby conferring upon the syndicate all such rights and powers to act in their name and in their behalf in the premises or to confer such other and further rights and powers as may be required by the syndicate and necessary.

18. For the transmission of electricity or pneumatic or other power to points beyond the Park in Canada or the United States, the syndicate shall have the right to convey the same by overhead high tension wires or by cables or other appliances in conduits, beneath the surface of the Park at such depth and in such locations as the Commissioners may from time to time determine, including the right to cross the so-called Chain Reserve so far as the same is within the jurisdiction of the Commissioners at any point or points approved of by the Commissioners between Fort Erie and Niagara-on-the-Lake, but subject to any rights which the Commissioners may have created or licensed or which may be created, without prejudice, however, to the exercise by the syndicate of any of its rights and powers under these presents, or which may be acquired in respect of transmission of power as by this paragraph prescribed.

19. The syndicate undertake to begin the works hereby authorized within two years from the date of this agreement, and to have proceeded so far with the said works on or before first January, 1907, that they will have completed within the Park, water connections (that is to say, head race, forebay, penstocks and tail race) for the development of twenty-five thousand horse power and have actually ready for use, supply and transmission ten thousand developed electrical or pneumatic horse power by said last-mentioned day, and if not then completed the Lieutenant-Governor-in-Council may declare this agreement, the liberties licenses, powers and authorities so granted and every of them to be forfeited and void, and thenceforth after such declaration the same shall cease and determine and be utterly void an of no effect whatever.

20. So long as this agreement is in force the Commissioners undertake and agree that the amount of rentals which may be fixed and charged for the right to use the waters of the Niagara or Welland Rivers within the Park for the purpose of generating electricity by any other company or person shall not be at less rentals than is provided and reserved by these presents, and further, that any such company shall be subject to the like restrictions, as in paragraph 21 of this agreement. Provided, however, that notwithstanding anything in this paragraph contained the rentals so to be fixed and charged against any other company or person may be reduced below the rentals provided and reserved by these presents so far only as such reduction may fairly and reasonably be allowed in respect of the increased cost of the construction of the tail race or tunnel within the Park, by reason of its greater length or other ground of expense in its or their construction, whether required for supply or waste through the Park to the point of discharge into the Niagara River in excess of the distance between the power house of the Canadian Niagara Power Company and the point of discharge into the Niagara River, such reduction not to be of an amount sufficient to give any undue advantage as against the syndicate except by reason of such increased cost of tail-race or tunnel or both, as the case may be.

21. The syndicate whenever required shall from the electricity or pneumatic power generated under this agreement, supply the same in Canada to the extent of any quantity not less than one-half the quantity generated at prices not to exceed the prices charged to cities, towns and consumers in the United States at similar distances from the Falls of Niagara for equal amounts of power and for similar uses, and shall, whenever required by the Lieutenant-Governor-in-Council, make a return of prices charged for such electricity or power, verified under oath by any Chief Officer of the syndicate, and if any question in dispute arises involving the non-supply or prices of electricity or power for consumption in Canada, the High Court of Justice of Ontario shall have jurisdiction to hear and determine the same and enforce the facilities to be given or the prices to be charged.

22. All power developed within the limits of the Park under this agreement shall be in a form capable of transmission and use outside the Park, and shall not be used within the Park except such uses as may be convenient or necessary within the buildings of the syndicate for the purposes of its power development and except such cases as may be hereafter agreed upon for railway, pumping, elevator, or other purposes within the Park. The syndicate may agree with the Niagara Falls Park and River Railway Company for the supply of electricity, pneumatic or other power to work the said railway, and with the town of Niagara Falls, Ontario, and the town of Niagara Falls South, Ontario, for the supply of power for their pumping station or stations within the Park and may also supply electricity for any other persons within the Park.

23. If the syndicate should at any time or times after the completion of its plant and power house or the first day of January, 1907, whichever shall first happen, continuously neglect for the space of one year effectually to generate electricty or pneumatic power as hereby agreed by the syndi-

cate, unless hindered by unavoidable accident, the Lieutenant-Governor-in-Council may then and from thenceforth declare this agreement, the liberties, licenses, powers and authorities thereby granted and every of them to be forfeited and thenceforth the same shall cease and determine and be utterly void and of no effect whatever.

24. The rents hereby agreed to be paid are hereby declared to be the first and preferential charge upon the said works, and the syndicate shall not have the power to create any lien, charge or incumbrance upon the said works or any of them by bond, debenture, mortgage or otherwise, which would interfere with or prevent the Commissioners from procuring payment of the rent hereby reserved or any part thereof; and no simple contract creditor or other creditor of the syndicate shall have any claim against the said works or any part thereof in priority of the claim of the Commissioners for rent.

25. The said syndicate shall not amalgamate with any other corporation or company heretofore or hereafter incorporated by or under the laws of the Dominion of Canada or by or under authority of the Province of Ontario, or which shall be hereafter licensed by the said Commissioners to take and use the waters of the Niagara or Welland Rivers or both for the purpose of generation and transmission of electricity without the consent of the Lieutenant-Governor-in-Council to such amalgamation, nor shall they enter into an arrangement or agreement for that purpose with any such company which may directly or indirectly have that effect or which may or shall have the effect of keeping up the price or prices of said power nor shall they enter into an agreement with any such company for pooling the receipts of the said syndicate or of any part thereof with those of any other company nor which shall provide for or have the effect of establishing a common charge or schedule of charges for the use of said power or any part thereof.

26. It is further agreed that if from any cause the supply of water at the point of intake as by these presents defined be diminished the syndicate shall have no claim or right of action against the Commissioners, but may deepen such point of intake to such extent as to restore the supply of water to the volume or quantity necessary for the purposes of the syndicate and that the granting or licensing of rights to the syndicate by these presents shall not give the syndicate any right of action against the Commissioners, nor give to the syndicate any right of action against other licensees or grantees of the Commissioners in respect of any diminution not substantially interfering with the supply necessary for the syndicate, nor so long as such necessary supply can be obtained by means of deepening at said point of intake.

27. The syndicate agrees with the Commissioners that within two years from the date of this agreement they will sell, assign, convey and transfer to a company or corporation formed or to be formed under proper authority, having power to construct and operate the works hereinbefore described all the rights and franchises by this agreement given and conferred to and upon the said syndicate, including the benefit of any work that shall have been done and any moneys that shall have been expended in connection with the said works prior to the organization of the said com-

pany or corporation, subject to all the provisions and conditions in this agreement contained, and by the syndicate agreed to be observed and performed, and otherwise upon such terms and conditions as shall be agreed upon between the said corporation and the syndicate.

And upon the due organization and formation of the company or corporation now existing or to be formed as above provided, and when this agreement and the rights and franchises thereby conferred, including works done and money expended as aforesaid, shall have been duly transferred to such company or corporation and it shall have assumed the same, the syndicate shall thereby be relieved from personal responsibility to the Commissioners for the performance of this agreement.

Nothing in this agreement contained shall affect any pending suit or litigation, or any contract, covenant or agreement made between the syndicate and any other corporation or individual, at the time of or prior to the said transfer.

Provided always,that any claim or right of suit or action existing against the syndicate may be urged and prosecuted against the said company or corporation as fully and effectually as it might be urged and prosecuted against the syndicate primarily bound or obliged or indebted in the premises, and the said company or corporation may be substituted for the syndicate in any pending suit or action.

28. And the said parties hereto mutually and respectively covenant, promise and agree with each other to carry into effect, observe, perform and fulfill all the provisions and stipulations in these presents contained and to be carried into effect, observed, performed and fulfilled by the said parties respectively.

29. This agreement shall have no force or effect until approved by the Lieutenant-Governor-in-Council.

In Witness Whereof the Corporate Seal of the Commissioners hath been hereto affixed by their Chairman, who has also signed these presents in certification of due execution hereof by the Commissioners, and the members of the syndicate have also hereunto set their hands and seals on the day and year aforesaid.

Witness:

(Sgd.) JAMES WILSON,
as to signature of J. W. Langmuir.

Witness:

HUBERT H. MACRAE,
to the signatures of William Mackenzie, by his Attorney A. W. Mackenzie, Henry Mill Pellatt and Frederic Nicholls.

THE COMMISSIONERS OF THE QUEEN VICTORIA NIAGARA FALLS PARK. (Seal.)

(Sgd.) J. W. LANGMUIR, Chairman.

(Sgd.) W. MACKENZIE,
Atty. A. W. MACKENZIE. (Seal.)

(Sgd.) HENRY M. PELLATT. (Seal.)

(Sgd.) FREDERIC NICHOLLS. (Seal.)

QUEEN VICTORIA NIAGARA FALLS PARK.

Memo. Prepared by J. W. Langmuir, Chairman, re Development of Electrical Power at Niagara Falls.

Presented for the Consideration of the Government, Nov. 25th, 1902.

Messrs. William Mackenzie, Henry M. Pellatt and Frederic Nicholls, of Toronto, have made application to the Commissioners of the Queen Victoria Niagara Falls Park for a franchise to take water from the Niagara River within the Park limits, for the purpose of developing electrical power, and the applicants ask for sufficient water to generate 100,000 horse power. Two franchises have already been granted for taking water on a large scale within the Park, one to the Canadian Niagara Power Company, whose works designed for an ultimate capacity of about 100,000 electrical horse power, are in course of construction, and the other to the Ontario Power Company, which has made considerable progress in its preliminary works.

In addition to these a franchise has also been given to the Ontario Power Company for bringing the Welland River waters to the Park and developing power at the Falls on a large scale, but active operations upon this work are now in abeyance pending the construction of the Niagara River works of the same company. Rights have also been granted to the Niagara Falls Park & River Railway Company to use sufficient water to generate power for the operation of its system, and to the town of Niagara Falls for water for municipal purposes and in addition to generate 100 electrical horse power for lighting the town.

Before granting any additional franchises within the Park, it becomes necessary to consider every condition, both present and prospective, relating to the use of the waters of Niagara River for commercial purposes within the Park at Niagara Falls. The conditions to be inquired into and the problems to be dealt with in this connection may be summarized as follows:

(1st) An enquiry into the estimated volume of water that at present flows down the Niagara River before any waters are diverted for the purpose of generating power.

(2nd) The estimated volume of water now withdrawn on both sides of the river for power purposes and the approximate amount that will ultimately be diverted through the full operation of franchises and rights now under construction on both sides of the river.

(3rd) The effect that such withdrawals of water for the generation of electrical power and other purposes will ultimately have on the Falls of Niagara viewed from a physical and scenic standpoint.

(4th) A consideration of the international features of the subject that may arise between the State of New York and Canada through the diversion of a large volume of water from passing over the Falls.

(5th) Whether the granting of the application asked for at the location designated will to any appreciable extent interfere with or jeopardize the rights and privileges granted to the Canadian Niagara Power Company by a change or interruption in the flow of water or through other physical transformation.

(6th) The economic or financial results that the granting of a franchise to Messrs. Mackenzie, Pellatt and Nicholls, representing as they do the largest users of power in the City of Toronto, will have on the two companies which have already obtained rights to use the waters of Niagara within the Park for the purpose of generating electrical power with a view to marketing the same in Toronto and all points within transmissable distance, and in the furtherance of which these companies have to spend many millions of dollars in capital outlay as well as the payment of large annual rentals to the Government for the rights obtained.

(7th) Whether by the carrying out of all of these great works of commercial utility the original design of the founders of Queen Victoria Niagara Falls Park will be marred or the natural scenery unduly defaced.

Considering these matters in the order in which they are referred to, the Park Superintendent has made a very carefully prepared and interesting statement respecting the conditions and questions embodied in the two first paragraphs relating to the volume of water flowing above the Falls and the present and proposed diversion of a portion of the same on both sides of the river. His statement is as follows :

"The flow of the river has usually been assumed to be not less than "250,000 cubic feet per second, or under the difference of level found between "the head of the rapids and the base of the Falls, the theoretical equivalent "of over six millions of horse-power, the U.S. Engineers finding it in 1868 "to be from 273,329 to 280,757 cubic feet, and Sir Casimir Gzowski from "observations made at the site of the International bridge in 1870, —1,—2,—3 "found a mean flow of 246,000 cubic feet. Now, however, from very careful "surveys made by the U.S. Army Engineers extending over a number of "years and recently published, the mean flow from the average levels of the "water of Lake Erie for the last forty years is stated to be at Buffalo only "222,400 cubic feet per second.

"Doubtless the Erie and Welland canals now take more water than "formerly, while the Chicago drainage canal alone abstracts about 6,000 "feet per second from the supply, but it would appear that other causes must "be found for the marked diminution of the volume. By making a slight "addition for the streams entering the Niagara below Buffalo, the result may "therefore be assumed at 223,000 cubic feet per second, which under the "total head found in the Falls and in the rapids above the Falls would be "equal to about 5,500,000 horse-power theoretical.

"From this total I estimate that to-day there is being taken from the "upper river and returned below the Falls, on both sides of the river, about "9,000 cubic feet per second, or say four per cent. of the total.

"The two large companies taking water on the American side are now bus-"ily engaged in enlarging their works. Should they each extend to the limits "engaged in enlarging their works. Should they each extend to the limits "prescribed—in the one case by statute and in the other by the measure of "its waterway—the result will be as follows :

"The Niagara Falls Power Company....	17,200 cubic feet
"The Niagara Falls Hydraulic Power & "Manufacturing Company	7,700
"Or a total on the American side of.....	24,900 cubic feet

"Upon the Canadian side of the river, the Canadian Niagara Power Com-
"pany's plans for their completed power house of 100,000 horse-power will
"require..... 8,600 cubic feet
"approximately, and the Ontario Power Company from
"its Niagara River and Welland River franchises will
"in all probability require—say..... 16,000
"Add to this the requirements for the town supply and the
"Electric Railway..... 400

"and we have a total on our side of ..... 25,000 cubic feet

"Adding these quantities together makes a grand total of about 50,000 "cubic feet, or twenty-two per cent. of the total flow. Of course this very "large amount of water will not be required immediately, nor will the maxi-"mum quantity be constantly abstracted from the river, but it is interesting "to note that the relative quantities proposed to be abstracted from each "side is nearly the same, and the output of electricity, viz., 300,000 horse-"power is also equal, or 600,000 horse-power altogether.

"But this may not be the sum total of the demands for the water. "Between the years 1886 and 1894 six additional companies obtained charters "from the New York State Legislature to take water from the Niagara "Rvier, and none of these are limited as to the amount. So far none of them "have been carried out, although one was begun some years ago but failed "of completion for want of capital."

From the foregoing figures furnished by Mr. Wilson it will be gathered that the estimated flow of water above the Falls with Lake Erie at its mean or average level of 572.86 feet above tide level is equal to 223,000 cubic feet per second, and that the present and future withdrawals of water from the river in order to meet the requirements of the companies now exercising their franchises and charters granted both in the State of New York and Canada would require about 50,000 cubic feet. Leaving, when all the works are completed, 173,000 cubic feet or about seventy-eight per cent. of the present flow to pass over the Falls.

As to the effect such withdrawals of water will have on the Falls of Niagara as viewed from a scenic and physical standpoint it is shown from Mr. Wilson's statement and figures that when the franchises and charters which are being exercised up to this time for the development of power, both in the State of New York and in Canada, are in operation to the full extent of their respective capacities that the withdrawal of water from passing over the Falls will be about equal on both sides of the river. The changes and transformations that will take place and at what points more than at others the withdrawal of this large volume of water will have on the Falls it is most difficult to imagine, let alone to determine with any degree of accuracy.

Owing to the great volume of water now drawn into the extreme point of recession of the Horseshoe Falls on the Canadian side as well as the

great depth of the water at that point and also to the filling in that is going on of the shallow portions of the shore line on the Canadian side near the Falls, it is quite possible that the volume of water flowing over the present contour of the Horseshoe Falls except at Terrapin Point will not be injuriously affected to a visible extent.

Respecting the likelihood of International questions arising from the diversion of such large quantities of water for commercial purposes; having regard to the strong currents of the river and the concave shore line within the Park forcing the main volume of the stream to the Canadian shore, it is not likely that questions or differences of a serious character respecting such diversions, and the physical or scenic changes resulting thereupon will present themselves for settlement.

Coming now to the consideration of the application of Messrs. Mackenzie, Pellatt and Nicholls for a franchise to develop 100,000 horse-power at Point Tempest, I am of the opinion that the application can only be entertained on condition that the tailrace will be carried under the river to be discharged below the Falls. To allow another discharge tunnel in the Park, even if it can be safely placed under the tubes of the Ontario Power Company, would, I fear, lead to complications either with the Ontario Power Company or the Canadian Niagara Power Company. Moreover, until the plans of the Ontario Power Company are finally settled in all respects we cannot decide as to the location of intake, forebay and power house. The most serious question, however, in connection with this application is the unknown results that might arise in granting a franchise to take water from the river at any point between the Ontario Power Company's works at Dufferin Islands and the intake of the Canadian Niagara Power Company. Should the Government favor the granting of the application of Messrs. Mackenzie, Pellatt and Nicholls for a franchise, having regard to all the circumstances now recited, it would in my opinion be desirable to have the amount of water which they would be entitled to take clearly defined.

In view of all the intricate questions involved, I am of opinion that before taking action upon the application the services of one of the most eminent Hydraulic Engineers in America should be had to report fully upon the whole subject.

Respecting the economic or financial results that the granting of the franchise applied for will have on the two companies that have already received franchises, I am of the opinion that being simply a question of policy it should be settled by the Government. If these two companies develop to their full capacity there will be sufficient electrical power produced, in all likelihood, to supply the demand in Ontario for the next quarter of a century. If however, only one-half of the power to be generated on the Canadian side—say 150,000 horse power—is offered to consumers in Ontario as the agreements provide for the demand may overtake the supply in a much less period. Perhaps the most serious view of this phase of the question is that the present applicants represent the largest consumers of power in Toronto, who under other circumstances would likely become customers of one or other of the chartered companies. The whole question, however, is one of policy and expediency, and therefore can only be decided by the Ontario Government.

In respect to the probable scenic effects upon the Park of the carrying out of these several power projects, it may be noted that all that portion of the Park which lies north of the picnic ground and where the chief works of restoration and improvement have been carried on, will be unaffected by the construction of any of these projects, and between the picnic ground and Table Rock none of the works will be of a conspicuous character, the power house of the Ontario Power Company in the Gorge being below the line of vision of the Falls from any point within the Park proper. At Table Rock point the recession of the Falls has of late years bared a large area of the river bed, and advantage has been taken of the surplus material from the works in progress to reclaim all this area, and provide a new and most attractive point from which to view the Falls and gorge. South of Table Rock, after the completion of the works now in progress, all of the unfinished portions of the Park including the low lying reach behind Cedar Island, will be graded and planted, and the area of the Park considerably increased by reclaiming the low lying foreshore of the Niagara. At the south end of Cedar Island will stand the power house of the Canadian Niagara Power Company. This building will be of an imposing character and contain the largest electric machines so far constructed, and it is believed that it will be considered a most interesting feature of the Park. Beyond this point there will be no permanent works of construction above the Park surface, excepting at the Dufferin Islands where the intake of the Ontario Power Company will be placed. The plans of the company for this portion of the work have not yet been presented but the Commissioners have taken every precaution possible to have the works of the company so constructed as to very greatly improve and enhance this attractive feature of the Park. The granting of the additional franchise as asked for by Messrs. Mackenzie, Pellatt and Nicholls will of course involve additional changes, but the nature of these cannot be determined until their plans are submitted.

Respectfully submitted,

J. W. LANGMUIR, Chairman.

MEMORANDUM OF THE COMMISSIONERS OF THE QUEEN VICTORIA NIAGARA FALLS PARK.

Submitted to the Government on the occasion of the hearing given the Canadian Niagara Power Company, and The Ontario Power Company, in respect to the application of Messrs. Mackenzie, Pellatt & Nicholls at the Council Chambers, Dec. 19th, 1902.

Messrs. Mackenzie, Pellatt & Nicholls have made an application to the Commissioners of the Queen Victoria Niagara Falls Park for a power site within the Park together with the right to take sufficient water from the Niagara River to construct the necessary works for the generation of 100,000 electrical horse-power.

When the plans of the works were submitted by the applicants, the Commissioners carefully examined them, first from the standpoint of how the proposed works would affect the Park surface, and secondly whether they would interfere with the rights and privileges already granted to other companies to generate power within the Park. The first phase of the matter need not at present be referred to, and as to the second, certain amendments and modifications were suggested by the Commissioners and accepted by the applicants.

In order that the locations in the Park of the various power companies, including the site now asked for, may be clearly shown, the Commissioners have had prepared by the Park Superintendent a surface plan which is now submitted. This plan shows (1) The location of each site and the relationship or contiguity of the one to the other—(2) The intake from the river and forebay connected with each site—(3) The situation of the respective power houses, and—(4) The location of the discharge tunnels. The method proposed by the applicants for the generation of electrical power is the same as that of the Canadian Niagara Power Company, viz., by a wheelpit, power house and forebay ; the discharge tunnel to be constructed under the bed of the river.

It will be seen from the map that the Ontario Power Company site is the most southerly location and therefore cannot be affected by the granting of the application now asked for. It therefore only remains to consider the rights and privileges that have been granted to the Canadian Niagara Power Company which is the most northery location and the one nearest to the Falls. That location was so well and carefully selected by the Engineers of the Canadian Niagara Power Company, both in respect to depth and volume of water, natural currents and other important physical conditions that its intake of water cannot be interfered with unless the rights granted to the Ontario Power Company and those proposed to be granted to the presents applicants are in terms of their respective agreements exceeded beyond the limits provided by such agreements respectively. The plans of the Ontario Power Company and those of the present applicants as approved in accordance with the outline of their present proposals by the Commissioners are such that the natural flow into the intake of the Canadian Niagara Power Company will not be diverted or the volume of water injuriously reduced by the withdrawal of water through the operations of the other companies.

The Commissioners are strengthened in this view by the opinion of one of the most eminent hydraulic Engineers in America, Mr. J. James R. Croes, who at my request has answered the questions which I submitted to him as follows :

"Toronto, Canada, December 18th, 1902.

"J. W. Langmuir, Esq.,

"Chairman Queen Victoria Park Commissioners, Toronto.

"Dear Sir,—I have your letter of even date containing the following two "questions in regard to the proposed power development by the Toronto "and Niagara Falls Power Company.

"Question No. 1. Will the building of the proposed works of the "Toronto and Niagara Falls Power Company tend to divert the waters of the "Niagara River away from the intake of the Canadian Niagara Power Com- "pany ?

"Question No. 2. Will the subtraction of 11,200 cubic feet of water per "second from the Niagara River as proposed by the Toronto and Niagara "Falls Power Company affect the elevation of the water surface at the intake "of the Canadian Niagara Falls Power Company, and if so to what extent ?

"I have made the examinations referred to in your letter and beg to reply "as follows :

"In reply to Question No. 1, I am of the opinion that the building of the "works proposed by the Toronto and Niagara Falls Power Company will "not tend to divert the waters of the Niagara River away from the intake "of the Canadian Niagara Power Company.

"In reply to Question No. 2, I am of the opinion that the subtraction "of 11,200 cubic feet of water per second at the location and in the manner "proposed will not appreciably lower the elevation of the water at the intake "of the Canadian Niagara Power Company.

"Very respectfully, your obedient servant,

"(Signed) J. JAMES R. CROES, Consulting Engineer."

The Commissioners, therefore, subject to detailed plans and specifications of the various works in accordance with the outline of the present proposal being submitted for their approval and the execution of an agreement containing all necessary provisions and terms and conditions contained in the agreements with the other power companies are prepared to recommend the application of Messrs. Mackenzie, Pellatt and Nicholls to the favorable consideration of the Government.

ARGUMENTS AND BRIEF OF THE SOLICITORS AND THE OPINIONS OF THE HYDRAULIC ENGINEERS RESPECTING THE APPLICATION OF MESSRS. MACKENZIE, PELLATT, & NICHOLLS FOR WATER POWER RIGHTS WITHIN THE PARK.

PETITION OF COUNSEL FOR MESSRS. MACKENZIE, PELLATT & NICHOLLS.

To the Honorable the Commissioners of the Queen Victoria Niagara Falls Park :

Your petitioners, William Mackenzie, Henry M. Pellatt and Frederic Nicholls, as supplementary to the application already filed for a power site in Niagara Falls Park, beg leave to submit for your consideration, in order to exemplify and illustrate the same, drawings 1, 2, 3, and 4.

Your petitioners pray, subject to the plans of future permanent works being approved by your honorable body.

1. The irrevocable right to take from the waters of the Niagara River for power purposes for the generation of hydraulic or pneumatic power, a sufficient quantity of water to develop 125,000 (one hundred and twenty-five thousand) net electrical horse power for commercial use ; said water to be applied to turbines located in suitable wheelpits to be operated under a head of not less than 140 feet.

By the use of the term "net" above, we desire to express that the water shall be sufficient for the actual generation of 125,000 electrical horse power after the necessary waters are supplied for excitation, and the operation of other auxiliary apparatus incident to the development of 125,000 electrical horse power.

2. For the purpose of securing the water necessary for the power mentioned in petition No. 1, your petitioners request the right to build upon the river bed of the Niagara River a gathering overfall masonry dam, the approximate general outline of which is shown on drawing No. 2 from G to S and S to Q.

We request further the right to excavate the bed of the river above the end of the overfall dam to such depth as may be necessary to secure a minimum depth of ten feet below the bed of the river at the end of the overfall dam and not less than six feet at any point leading thereto and the width and alignment of such excavations to be determined by the Engineer of the applicants. Providing always that the permanent works to be constructed shall always be contained within the line A.B. shown on the plan.

The maximum height of this overfall dam to be not less than elevation 533 above the sea level, and that your petitioners may have the right to vary the elevation of the parts G R, R V, V S, and S P, and the lengths of the same, as further surveys may render necessary.

3. We ask for the right to construct from U to V and T to S and at any other points our Engineer may determine as necessary, and all within the boundary line mentioned in paragraph 2, masonry sheer ice booms, the length of the said ice booms and their dimensions and construction to be determined upon by the Engineer of your petitioners after the completion of further surveys.

4. Also for the right to build masonry retaining walls from G to W and a fender wall from T to E and from T to Z as shown on the plans the elevation of which fender wall will approximately agree to elevation 540; all other dimensions to be determined by the Engineer of the applicants upon the completion of further surveys.

5. For the right to perform such excavation above the overfall dam G S and S Q and within the same as will permit of the delivery of the necessary amount of water to the turbines, at such velocity of approach as the Engineer of the applicants may deem proper, after the completion of further surveys. It being the declared purpose of the gathering works shown on plan No. 2, both as to masonry and excavations above Q L, to divert a sufficient amount of water for the supply of the power asked for in paragraph No. 1, as well as a sufficient quantity of water to keep the spillways P S, S V, V R, and R G always full to elevation 533.

6. For the right to fill in all of that shaded portion between the letters T Z Y X J W M and F to the elevation approximately 540 and as the Commissioners may direct.

7. For the right to sink a wheelpit at some location inside of the space marked "Outside limits power house and gates" in plan No. 2, and that such wheelpit shall be of a size to be hereafter determined by the Engineers of your petitioners, and sufficient in all dimensions in his judgment for the development of 125,000 electrical horse power, specified in paragraph No. 1.

8. For the right to connect the bottom of the wheelpit mentioned in petition No. 7, with the Niagara River below the Horseshoe Falls, by the construction of a tailrace tunnel; the point of discharge of such tailrace tunnel to be at a point below the crest of the Horseshoe Falls and between the letters O and N on drawing No. 4.

For the further right in the construction of this tailrace tunnel to prosecute its construction from the exit under the Falls by the building of a construction tunnel under the brow of the Falls, which shall connect the end af the tailrace tunnel with a point of discharge for debris, to be hereafter determined, at some location between the letters O and approximatly N on the map.

9. Referring to drawing No. 2, your petitioners ask for the right of use of such portions of the property inside the boundaries shown by the letters S T Z Y X J W back to S and of the lands in the river bed bounded by the letters Q S T and Z as may be required by the Engineer of the applicants for permanent works and subject to the approval of your honorable body.

10. For the right within the limits of Drawing No. 2, marked "Outside Limit Power House and Gates," to construct a suitable power house and

suitable gate house, which shall in the opinion of your Engineer be sufficient and proper for the housing and operation of the apparatus necessary for the generation of 125,000 electrical horse power.

11. The right to construct upon the river bed of the Niagara River a temporary construction coffer dam for the uncovering of the river bed, at least within the limits described in petition No. 2, the design of such construction coffer dam, and its actual location to be determined by our Engineer upon the completion of further surveys.

12. For the right to erect upon the property marked T Z Y X F back to T a transformer house of such dimensions as may be determined by the Engineer of the applicants and a suitable high tension transmission tower both to be of such dimensions as may be determined by the engineer of the applicants and subject to the approval of the Commissioners.

And also the right to carry high tension wires from the top of such transmission tower in a single span across the property of the Park Commission to some point outside the Park to be hereafter determined.

13. For the right in the construction of the foregoing works to construct such surface or overhead construction tracks and works as may be necessary for the delivery of any surplus excavated material that may be encountered, to the Niagara River below the Horse Shoe Falls, also that the right be granted permitting of the temporary construction and use of such cable-ways, derricks, engines and other apparatus as may be found necessary and expedient, for the rapid construction of the proposed works.

14. Also for the right to use the highways of the Park for the delivery of materials to and from the said construction works above referred to.

15. We further ask for the right to occupy the necessary lands in the Park and situated in the immediate vicinity of the above works for construction purposes, the buildings and constructions necessary to be erected on said property and the machinery necessary to be installed thereon, all to be removed immediately upon the completion of the works and the property to be restored, at the expense of the petitioners, to its original condition and under regulations to be made by your honorable body.

16. We also ask for the right in the construction of the foregoing works to use as power, either steam, electricity or compressed air, or water or any one or more of the above.

And your petitions will ever pray.

Dated December 17th, 1902.

(Signed) H. H. MACRAE, for the Applicants.

To the Honorable the Premier of Ontario, and the Members of the Cabinet :

MEMORANDUM OF ARGUMENT.

Submitted by Counsel for the Applicants for the Proposed Site at Niagara Falls.

It is not disputed that the Commissioners have the absolute right in their discretion to grant a license to the applicants, this authority is by Statute of the Province of Ontario, 63 Vic., Chap. 11, Sec. 36.

The position has been advanced that the Government is in a fiduciary relationship towards, and are in fact trustees for, the Canadian Niagara Power Company; this is erroneous, as will appear from what follows:

The Canadian Niagara Power Company had the exclusive right to take water within the limits of the park : they surrendered and abandoned that right for valuable consideration, and the Legislature cancelled it, and granted the Commissioners power to license other persons.

The Canadian Niagara Power Company are constructing their works under their license from the Commissioners with the knowledge that the Commissioners reserved to themselves the right to grant licenses to other persons.

Not only are they doing this, but they entered into an agreement which expressly contemplates by its terms the subsequent licensing by the Commissioners of other persons.

For proof of this see paragraph 5 of the Canadian Niagara Power Company agreement, 15th July, 1899, which provides: "That in case the said Commissioners shall have granted to any other person or corporation license to use the waters of the said Niagara River," etc., etc.

Also see paragraph 7 of the same agreement, which provides : "That the amount of rentals which may be fixed and charged for the right to use the waters of the Niagara or Welland River for the purpose of generating electricity by any other company or person shall not." etc.

And paragraph 11 provides with reference to "any right of action against other licensees or grantees of the Commissioners in respect of any diminution," etc., etc.

Special attention is called to the full reading of the above paragraph.

The Canadian Niagara Power Company therefore hold their license and are constructing their works, subject to the acknowledged right of the Commissioners to license other persons.

The legal position between the Commissioners and the Government on the one side, and the Canadian Niagara Power Company on the other side, is defined by the agreements which have been made between them : The Commissioners and the Government grant the license to take the waters pursuant to the plans, and the company agree to pay the rentals—both subject to the expressed conditions of the contract. In the contract there is no covenant or clause which restricts the Commissioners or the Government in the free exercise of their power to license.

There is no fiduciary relationship and there is no obligation cast upon the Commissioners or the Government, other than that arising directly from the provisions of the contract.

The applicants have made out their case through Mr. Cooper and Mr. Croes to the satisfaction of the Commissioners that there will be no substantial interference with the works of the Canadian Niagara Power Company, and the Commissioners have recommended the granting of the petition.

With regard to the evidence of Mr. Croes, see copy of letter to the Premier hereto annexed.

The Government after receiving the recommendation of the Board of Commissioners, granted a hearing to the Canadian Niagara Power Company for the purpose of giving to that company the opportunity of showing that physical injury would result to their works by the licensing of the applicants' proposed operations.

If the Canadian Niagara Power Company can demonstrate that the taking of water in the manner proposed by the applicants will cause physical injury of a substantial kind to their licensed works, the Government would be justified in refusing the applicants' petition, but the burden of establishing this injury rests upon that company. If they fail in convincing the Government that this injury will reasonably and naturally result, the Government need not, and ought not, to deny to these persons the license which they are privileged to ask, and which the Commissioners have the undisputed right to grant.

To suggest that the proposed works may injure the works of the Canadian Niagara Power Company is not sufficient, neither is the burden of proof cast upon the company met by the opinion of one or more engineers that such injury will result; more is required, the Canadian Niagara Power Company must show by reasons sufficient to satisfy the Government, founded on hydraulic facts and formulas, that this injury will flow from the projected works.

The Hon. the Premier remarked to Mr. Herschel on the argument before him, that he gave no reasons for his opinion that the level would be reduced four feet, it is these reasons which the Premier then sought, which must now be forthcoming, and which must be established before the Government can properly be asked to withhold the license petitioned for.

The opinion is again to be found in the written submission of Mr. Herschel, but he fails to give any reasons why the current should be diverted by a wall which in its hydraulic nature is not a diverting but a receiving wall.

The reasons why there will be no substantial interference with the level by the proposed works are to be found in the briefs of Mr. Croes and Mr. Cooper already submitted.

The responsibility of decision rests upon the Government, and it is submitted that their duty and obligation if they should consider it in the public interests to do so, is to grant the petition of the applicants unless constrained to believe upon the evidence before them, that a substantial injury

would be done to the Canadian Niagara Power Company by the proposed works.

The suggestion of an alternative site to avoid the dam is not a fair one, for neither at the point proposed by the applicants nor at any other available point above the intake of the Canadian Niagara Power Company is there sufficient depth of water to produce the necessary supply without a gathering dam, which is not included in the alternative scheme proposed by that company, and when this statement is fully understood, it includes the proposition, which is true in actual fact, that unless this site and proposed works are available, the Commissioners have now exhausted their power to license, and the existing companies have secured licenses which will forever prevent the operations of any other sufficient power development upon the Canadian side of the Niagara River.

SECTION II.

No argument for the Canadian Niagara Power Company can be founded upon paragraph 11.

It was inserted in the wisdom of the Government for its protection against any possible liability in respect of the proposed works of other licensees up the river, so that if the supply of water were diminished, still the Canadian Niagara Power Company should have no claim either against the Government or against such other licensees. But if any substantial interference were caused by subsequent licensees, which could not be remedied by deepening at the point of intake, then any claim on the part of the Canadian Niagara Power Company is not interfered with.

The section does not in any way restrict the right of the Government to grant, or of any applicant to receive a license, but it says that if the interference should turn out to be substantial, and without remedy by deepening, then if the Canadian Niagara Power Company has a claim for damages they may enforce it.

This section is relied upon by the applicants to prove :

1. That subsequent licensees were then contemplated by the Canadian Niagara Power Company.

2. That the Canadian Niagara Power Company were then content to make no claim against subsequent licensees for any diminution in the supply of water which would not cause a substantial interference or which could be remedied by deepening at the point of intake.

3. A lowering of the level of the water was clearly intended to be covered, because the words are "if from any cause the supply of water, etc., be diminished" ; and lowering the level is a cause which would diminish the supply the reduction in the supply absolutely calls for a reduction in the level, and this can be taken care of by deepening. And

4. If the applicants admit a slight difference in level which can be remedied by deepening, then this difference is not such a one as will affect the granting of the license, for the section imposes the obligation upon the company to deepen for its own protection.

The above grounds are submitted by counsel for the applicants.

(Signed) C. ROBINSON.

(Signed) H. H. MACRAE.

The Hon. the Premier of Ontario :

Re the Application of William Mackenzie, H. M. Pellatt and Frederic Nicholls to the Board of Commissioners of Niagara Falls Park.

Sir : I desire to call the attention of the Hon. the Premier and the Members of the Cabinet to the following facts in connection with the report of J. James P. Croes, submitted herewith.

The petition of the applicants having been filed, Mr. J. W. Langmuir Chairman of the Board, appointed Wednesday, the 10th December, for the hearing of the same, and on that date Mr. Mackenzie, Colonel Pellatt, Mr. Nicholls and myself attended before the Commissioners—Mr. Langmuir in the chair, Mr. Jaffray and Mr. James Wilson.

Mr. Hugh L. Cooper, hydraulic engineer for the petitioners, submitted his plans and explained the details of the proposed works, and gave it as his opinion in answer to Mr. Langmuir, that the taking of the water would not materially reduce the level of the water at the intake of the Canadian Niagara Power Company.

Mr. Langmuir then addressed Mr. Cooper, saying that it might be so, but could Mr. Cooper produce before him the first hydraulic engineer in the United States to say the same thing.

The case of the petitioners was complete at this time before the Commissioners, but in view of Mr. Langmuir's expressed desire for the highest independent testimony, Mr. Cooper obtained the opinion of Mr. Croes and offered it to Mr. Langmuir on the 18th inst.

The positions held by Mr. Croes are on record now with Mr. Wilson, and are sufficient evidence of his standing.

I have the honor to be, sir,

Your obedient servant,

H. H. MACRAE.

ARGUMENT OF HUGH L. COOPER, ENGINEER FOR THE APPLICANTS

In the matter of a certain application to the Lieutenant-Governor-in-Council of the Province of Ontario by William Mackenzie, Frederic Nicholls and Henry M. Pellatt, all of the City of Toronto, in the County of York in the said Province.

Mr. Hugh L. Cooper, hydraulic engineer for the applicants above mentioned, availing himself of the permission given to him by the honorable the members of the Cabinet of the Ontario Legislature, begs to submit the following answers to the objections taken by Mr. Herschel, C.E., on behalf of the Canadian Niagara Power Company to the works of the applicants on the Niagara River.

The Honorable the Premier having expressed his desire to have before him in writing the engineering reasons from the standpoint of the applicants why the objections taken by Mr. Herschel are not entitled to prevail, the writer understands that he is expressly desired to confine his statements to the arguments advanced by Mr. Herschel at the time of the hearing before the Members of the Government.

It should not be understood, however, that a simple reply to the arguments of Mr. Herschel in themselves constitute all of the reasons why the location proposed by the applicants should be adopted. Mr. Herschel's objections all had to do with the questions; First, of a reduction of level at their intake; second, the great cost that will be entailed upon them as a result of the change in this level; third, the action of the ice.

The opening statement of Mr. Herschel was to the effect that the construction of the temporary diverting coffer dam of the Ontario Power Company had produced a great change in the level of the water at the intake of the Niagara Power Company, and he announces that this change in level was so great as one foot.

In the consideration of the subject matter of this report the writer specially desires that the report of Mr. Croes, his associate, should be first read and understood, for the reason that the entire question of the effect upon the Canadian Niagara Power Company hinges upon the kind of works proposed by the applicants.

The report of Mr. Croes plainly shows that the works proposed both by the Ontario company and the applicants' company are neither of them in any sense in the nature of diverting works, for the specific reason that both over-falls in their final position are parallel to the direction of the approaching current, and because they are parallel they cannot divert, but can only receive, and it will aid your honorable body if in a consideration of this question you will call the structures placed in the river receiving dams, which they properly are.

The temporary construction dam which Mr. Herschel says changed their level one foot, is a diverting dam in the fullest sense of the definition offered you by Mr. Croes, and it is a fact that the diverting dam built by the Ontario company and now in place, diverts from its natural course a quantity of water more than twice as great as the total of the sum of waters

involved in the power developments of the Ontario company and the applicants' company.

Mr. Herschel thinks that the reduction in level is one foot.

The writer will bring upon request to the notice of the Commission absolute proof that Mr. Herschel is in error in this statement, and that this reduction, instead of one foot, as claimed by Mr. Herschel, has not been six inches.

Now, then, if the coffer dam above referred to is diverting twice as much water from its natural flowing tendency as is required by the Ontario Company and the applicants' company, and the present reduction in level is only six inches, then the greatest reduction in level that can be suggested as possible when both of the companies above referred to are in full operation will be a reduction of level of three inches at the intake of the Canadian Niagara Power Company.

A strict analysis of the conditions existing when you come to consider that the coffer dam above referred to is a diverting dam and entirely discharges and displaces the natural flow, would suggest to a reasoning mind that this three inches would be more like one and a half inches.

The investigations have been made and based upon actual facts pertaining to the particular river under consideration and results have been found which have been dictated by undisputable mathematic hydraulic formulae.

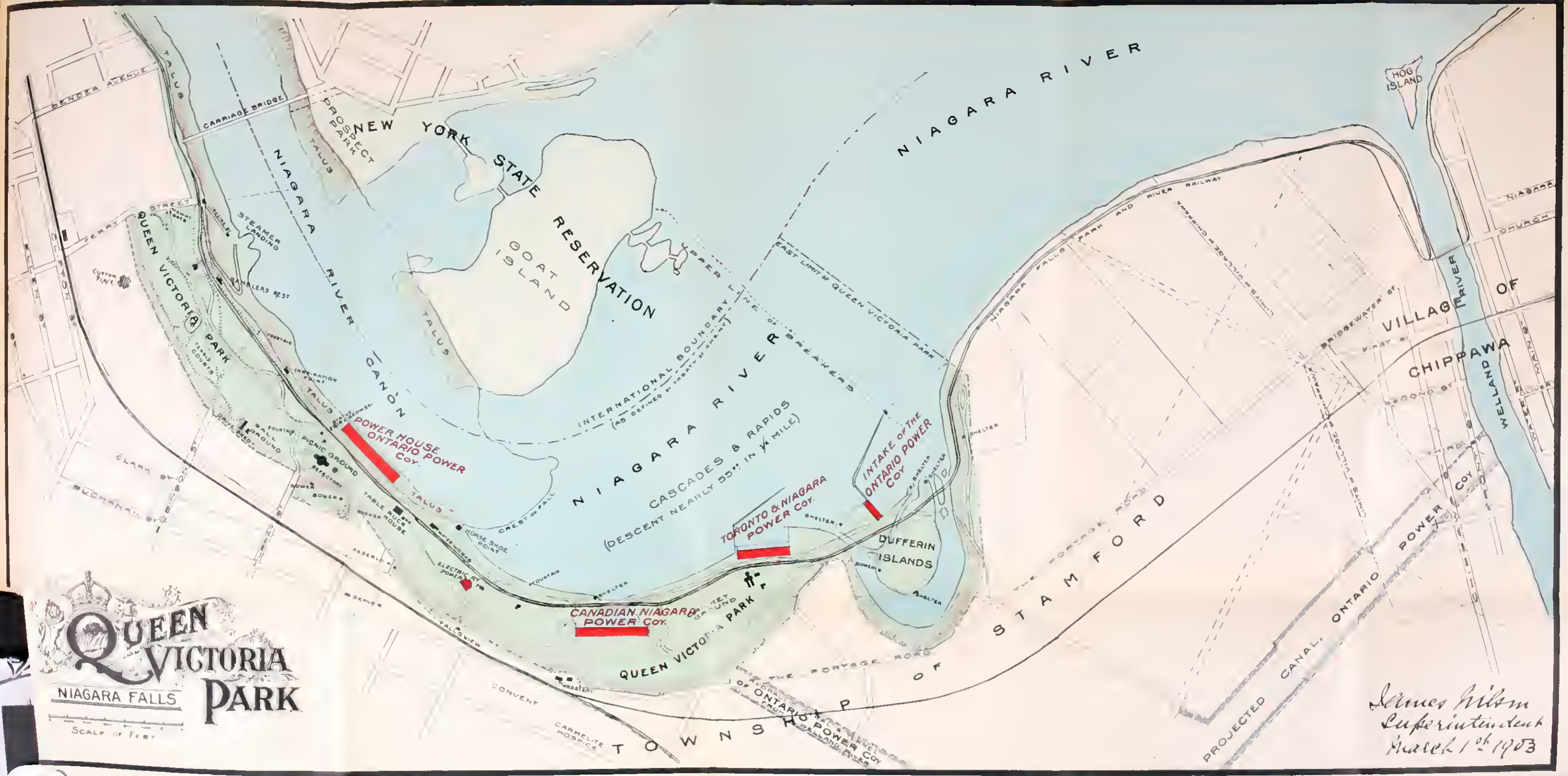
A calculation as to what the effect would be at the intake of the Canadian Niagara Power Company by the subtraction of 11,200 cubic feet of water per second, based upon standard hydraulic engineering formulae, shows that the maximum reduction that could be expected would be three and one-half inches, and in order to be entirely safe and that no possible close decisions could be offered to your honorable body, this three and one-half inches has been increased 100 per cent. and called seven inches.

The engineers of the War Department of the United States Government in their part 8 report of the year 1900, publish an exhaustive report upon the flow in the Niagara River covering a term of years at the International Bridge and below it.

The minimum flow of the Niagara River, as per the above report, is 10,000,000 cubic feet of water per minute, and the total quantity of water which the applicants propose to use when their entire development is complete is but 7 per cent. of this vast quantity, and this ratio of 7 per cent. should always be borne in mind when this report is being considered.

The report above referred to shows that a reduction of 7 per cent. of the quantity of water in the Niagara River results in a reduction of the level of the water surface of 2 per cent., where the percentage is applied to the average depth of the water at the point at which the measurements are taken.

At the Canadian Niagara Power Company's intake the average depth of water is 96 inches, and 2 per cent. of this quantity would mean a reduc-


QUEEN VICTORIA PARK
NIAGARA FALLS
SCALE OF FEET
NIAGARA RIVER
NEW YORK STATE RESERVATION
GOAT ISLAND
NIAGARA RIVER CAÑON
CARRIAGE BRIDGE
PROSPECT PARK
BENDER AVENUE
FERRY STREET
STEAMER LANDING
RAMBLERS REST
CLIFTON PLACE
INTERNATIONAL BOUNDARY (AS DEFINED BY TREATY OF GHENT)
UPPER LINE OF BREAKERS
EAST LIMIT OF QUEEN VICTORIA PARK
CASCADES & RAPIDS (DESCENT NEARLY 55 FT. IN ¼ MILE)
CREST OF FALL
HORSE SHOE POINT
TABLE ROCK HOUSE
PICNIC GROUND
BALL GROUND
POWER HOUSE ONTARIO POWER COY.
CANADIAN NIAGARA POWER COY.
TORONTO & NIAGARA POWER COY.
INTAKE OF THE ONTARIO POWER COY
DUFFERIN ISLANDS
SHELTER
HOG ISLAND
VILLAGE OF CHIPPAWA
WELLAND RIVER
NIAGARA FALLS PARK AND RIVER RAILWAY
BRIDGEWATER ST
THE PORTAGE ROAD
TOWNSHIP OF STAMFORD
PROJECTED CANAL, ONTARIO POWER COY
CONVENT
CARMELITE HOSPICE
FALLS VIEW
CLARK ST
BUCHANAN ST
TALUS
James Wilson
Superintendent
March 1st 1903

tion in level of approximately two inches, allowing for the quantity of water that is discharged over the American Falls.

Taking into consideration all of the foregoing there can be no questioning this statement, that the maximum possible effect that can result to the Canadian Niagara Power Company's level by the subtraction of our quantity, namely, 11,200 cubic feet per second, cannot be a greater amount than seven inches, and it should be borne in mind that this seven inches is fully 100 per cent. more than the best calculations and previous measurements show that it will be.

The question then comes as to what the effect will be of a reduction of seven inches in the level of the water at the intake of the Canadian Niagara Power Company ?

In consideration of the question "of water level" in front of the Canadian Niagara Power Company's intake, it must be borne in mind that the level of the water in front of this intake, whether any works are built above the intake or are not built, is an exceedingly variable quantity, owing to the directions of the winds at the head of the river, and that under present conditions, uninfluenced by any intakes whatsoever, the variations in the level of the water are frequently as great as 2 1-2 feet in 24 hours.

This feature of the present existing conditions is important and should not be lost sight of.

It should also be further borne in mind that in all hydraulic power constructions the machinery used is always designed to take care of large variations in level, and that turbines are provided with regulating gates within themselves, while under the influence of the machinery employed automatically take care of changes in level.

The maximum range of variation in level that can be spoken of here, or has been spoken of by Mr. Herschel or by ourselves, is 3 per cent. of the total head, whereas it is a fact that fully 80 per cent. of the water powers on the American continent have their turbines built to take care of variations in level of 35 per cent., instead of 4 per cent., and no important water power can be referred to in the United States or elsewhere, where the variations in level are less than 3 per cent.

The foregoing statement is exceedingly important in the consideration of this question, and the facts stated above should be thoroughly understood and remembered.

For the information of the Commission, it may be further stated that all properly designed turbines, and including the designs of Mr. Herschel of this particular plant, provide that the maximum power shall be given off by the turbines when the turbine gate is practically seven-eighths open, and the reason that the turbines are so designed is to take care of the variations in level and their consequent influence upon speed.

No water power plant can be instanced by Mr. Herschel, or by any other person, where the value and efficiency of the plant is affected or controlled or restricted by variations in the level of 3 or 10 per cent.

In practically all of the water power plants that are now in commission the element of a flooded season as compared to a minimum period, has always to be contended with, and in a majority of cases, the range between high water and low water is often 50 and 60 per cent. instead of the 3 per cent. in the case under consideration.

The reason that flood waters do not influence the plant we are speaking of, is because the vast areas of the lakes serve as an equalizing storage reservoir.

All of the foregoing facts point to one absolute condition existing at Niagara Falls, namely, that the taking of water out of the Niagara River upon the plans that obtain in the construction of the Canadian Niagara Power Company, follow conditions that cannot be paralleled elsewhere, and these conditions are conditions of exceptional value.

Finally in the above it should be noted that all of the comparisons have been made upon the basis that the actual conditions in level have been made. because of the work of the applicants has been 3 per cent., whereas this variation will be less than one-half of 1 per cent.

The contention has been made that the reduction in the level would cause necessarily a great change in the design of the works of the Canadian Niagara Power Company, and the waste of a "large heap of cut stone."

I have seen the plans of the intake of the Canadian Niagara Power Company, as well as the plans of their ice runner, and am familiar with the general construction involved in the works of the Canadian Niagara Power Company. From such examination I am able to say that the depth of water figured at the intake of the Canadian Niagara Power Company is taken at 15 feet, they having made excavations deepening the river at the intake from eight to fifteen feet, in order that the velocity of the water through their works may be reduced to a speed easier of manipulation.

Assuming that the petition of the applicants is granted, and assuming that the Ontario Power Company and the applicants' company were both taking their maximum power, and assuming finally that the Canadian Niagara Power Company under these conditions had not made any change in their present works, then and in that event, a reduction even of 7 inches (and we claim that it is only 3 1-2 inches) in the level would cause the following result:

The turbines of the Canadian Niagara Power Company are figured to work upon a nominal head of 136 feet, then if this head should be reduced 7 inches, in order to supply the same amount of power at 135.4 feet head that was originally called for at 136 feet head, we would require an increase in the amount of water delivered to the turbines, which percentage of increase would be represented by the ratio between 7 inches and 136 feet, which is less than one-half of 1 per cent.

In order that the turbines might still deliver the full amount of power as originally designed, and when operating under a reduced head of 7 inches in order that the quantity of water might be sufficient, it would be necessary to increase the velocity of the water of the intake by 3 1-2 per cent.

The demands of these above two necessities would add up less than 4 per cent., which increase in velocity is an amount that is imperceptible to the eye, is incapable of practicable measurement or discovery with the best measuring devices now known to the engineering profession. When we realize that practicaly all the power plants in the United States have to contend with differences in volume and in water levels where the ranges of these differences are usually from 30 per cent. up, this proposal, even if it involved a change of 4 per cent. (which we deny) prohibits criticism.

Supposing that the Canadian Niagara Power Company take the arbitrary position that they do not choose to indulge this four per cent.—what is the remedy ?

Based upon an examination of the plans of this company the remedy that will cure the proposed increase in velocity would be by deepening the intake, a condition which has been contemplated by section 11, invoked by Mr. Nesbitt.

The contention has been made that in order to provide for a change in level great changes would have to be made in the design of the present works, and the waste of a large amount of cut stone in the above works. It was stated before the members of the Government that it would entail the expenditure of a very large sum of money to make the necessary changes in the present works to allow for any change whatever in the level, but upon examination and calculation I have found and estimated that the extra expenditure, if any, which would be occasioned to the Canadian Niagara Power Company would be as follows:

For the deepening of the intake the necessary amount that would require to be excavated would be 650 cubic yards of lime rock, in the bed on the intake, which at $1.50 per yard would make $975.00. Then with reference to the ice run, it is a fact that the elevation of the top of this ice overfall, which is only 40 feet long, could be lowered to suit the new conditions, by the removal of six cubic yards of masonry, which at $15.00 per yard would be $90, making a total with the amount mentioned above, of $1,065.00 to correct all the evils which are predicted by Mr. Herschel, and which evils we deny can possibly ever exist.

It must be borne in mind with reference to the masonry in this ice run that none of it is now laid, and that the alteration of the level in the intake does not involve any interference with any masonry that is now in place or is hereafter contemplated to be placed.

With reference to Mr. Herschel's second suggestion, that we should have our building across the tracks within the main body of the park, we reply that such a plan would involve the building of the same gathering dam upon the river bed as is provided for in the present plans, for the reason that in order to enable the applicants to successfully handle approaching ice, and to successfully provide for permissable velocities in the necessary volume of water for the operation of our plant, it will be necessary for us to construct a gathering over-fall dam, the elevation of the top of which is approximately elevation 533, and the length of which is determined by the two points, where this level line of elevation 533.00 intercepts the bed

of the river, and where it intercepts the present bank of the Queen Victoria Park. The above works would be necessary in any design, and by placing our power house behind this work we obviate the necessity of burdening the space in the body of the park with power house structures and locate them in the position where they would cause the least possible interference with the rights and privileges of every person interested.

It had been suggested that instead of building a gathering dam that the bed of the river should be excavated and deepened. In reply to this we state, what must be apparent to every person, that in order to successfully handle the ice that may be forced upon us, we must have slow velocity and a uniform level from the surface of which to divert the ice, and that these conditions cannot possibly be obtained except by the construction of the works proposed.

The building of works of the kind proposed was not necessary at the intake of the Canadian Niagara Power Company because there the surface of the water is practically level as compred with the surface of the water at our intake, and the water at their intake has the necessary depth, none of which conditions exist naturally at our site petitioned for.

With reference to the claim of Mr. Herschel that the works as proposed would operate to change the quantities of ice going by the intake of the Canadian Niagara Power Company, we reply as follows :

The direction of the current in the Niagara River carrying ice towards the Canadian Niagara Power Company's intake is formed, and its course is fully established by natural slopes in the river bed and by contour of the shore long before the waters of the Niagara River reach any of the works proposed by the applicants.

Therefore, inasmuch as the works of the applicants are wholly receptive, instead of diverting, the quantity of ice that will come to the plant of the applicants will be no different in any sense than would be the case were the plant never constructed. Therefore it must be admitted that the discharge of ice by the proposed plant of the applicants can be no greater under the proposed conditions.

A casual glance at the plan map would make all of the foregoing immediately apparent, and when we come to consider that the direction of the currents in the Niagara River above the intake of the Canadian Niagara Power Company is all toward the shore line just above the intake of the Canadian Niagara Power Company, the question of a change of the action of the ice in front of Mr. Herschel's intake by the works proposed by the applicants is entirely out of reason.

In conclusion the following facts cannot be denied by hydraulic mathematics or reason :

First : That the subtraction of 11,200 cubic feet of water per second at the site of the applicants will not appreciably reduce the level, or have any perceptible effect upon the installation of the Canadian Niagara Power Company, and will not entail upon them the necessity of changing in any particular whatever any part of their plans.

Second : For the reasons above given that there can be no legitimate reason advanced for the transfer of the power house site that they propose to a place further within the park and on the opposite side of the street railway tracks.

Third : Under the plans proposed, because of natural conditions that now exist, and which cannot be interfered with by any of the works proposed, there will be no change in the action of the ice at the intake of the Canadian Niagara Power Company.

Respectfully submitted,

(Signed) HUGH L. COOPER,
Consulting Engineer, 29 Boardway, New York.

New York, December 23rd, 1902.

OPINION OF J. JAMES R. CROES, CONSULTING ENGINEER.

To the Honorable the Premier of the Province of Ontario and Members of the Cabinet :

Gentlemen,—Having been requested by the Honorable Premier to submit my reasons for the opinions expressed in my letter to John W. Langmuir, Esq., Chairman of the Queen Victoria Park Commission, dated December 18th, 1902, I have the honor to say :

"First. The proposed works of the Toronto and Niagara Falls Water Power Company will not tend to divert the waters of the Niagara River away off the intake of the Canadian Niagara Power Company."

Walls built in the channel of a swiftly flowing stream may be of three kinds ; diversion walls, or training walls, or obstructing walls.

A diversion wall may be defined as one built diagonally to the course of the stream at such an angle that the current striking it will be deflected from its course at an angle about equal to that at which it impinges against the wall. After passing the wall its course will not be parallel to the wall.

A training wall may be defined as one nearly parallel to the course of the current, and at such an angle that the water impinging against it will follow the course of the wall and not be deflected, but wil continue on the same course as the wall after leaving it.

An obstructing wall is one built nearly transversely to the course of the current, so that the current is checked and broken up and divided each way from the point of intact and in a rapid current is heaped up against the wall at that point.

In a very swift current, the angular difference between an obstruction wall and a diversion wall at one extreme; and a diversion wall and a training wall at the other extreme, may be very slight.

In the case now under consideration, there is at this time a diversion wall at the east boundary of the Queen Victoria Park, extending down stream 800 feet in the form of a coffer dam built by the Ontario Power Company.

The current at that point sets in naturally towards the receding river bank. It is deflected by the dyke away from the shore and towards the apex of the Horse Shoe Fall, 3,200 feet down the stream. The extreme end of the dyke is bent to the east for 100 feet, making it practically a training wall in the direction of the deflected current.

The natural result is seen in the diversion of water from the elbow around Dufferin Island, where the bottom is laid bare and the lowering of the water level along the west shore of the river all the way down to the Canadian Niagara Power Company's intake opposite the apex of the Horse Shoe Fall.

This dyke is a temporary structure and when it is removed the current will resume its normal course, and the elevation all along the shore will be restored.

At the farther end of the dyke the current, the course of which has naturally been deflected somewhat to the left, as is evidenced by the conformation of the shore line, will encounter the training wall of the Ontario

Power Company, 700 feet long, built on the axis of the original current and terminated by the obstruction wall of the waste weir and gate house. The water flowing in the channel to the left of this wall will pass, some of it through the elbow around Dufferin Island, some will be carried off through the conduit of the Ontario Power Company and the rest will flow over the waste weirs and into the natural channel below Dufferin Island. That passing to the right of the training wall will follow its natural course, which the contour of the adjacent shore shows to be in a direction towards the intake of the Canadian Niagara Power Company.

It must be borne in mind right here that the direction of the current which shapes the shore of this, or any other, river is parallel to the general shore line. Bays and indentations cause fragmentary aberrations, but the general contour of the shore shows the true course of the current, which in this case is from the point designated as "Tempest Point" and down to the power house of the Electric Railway Company; a very regular curve of about 2,700 feet radius.

A shore distance from the shore opposite "Tempest Point" observation shows the course of the current to be directly towards the intake of the Canadian Niagara Power Company. To preserve this direction and accentuate it and lessen if possible the deflection which is apparent in the current 400 or 500 feet from the shore to the right, and in the direction of the Horse Shoe Fall, it is proposed by the Toronto Niagara Falls Power Company to build in the bed of the river about 400 feet from the shore a training wall some 650 feet long on the axis of the current, the upper end of the wall being entirely submerged and the top of the wall level, while the bed of the river falls several feet in the length of the wall. The last 200 feet of this wall will be built up to above the surface of the water. The water flowing to the left of this wall will partly be diverted into the company's wheelpit and partly will flow over an obstructing wall or waste weir at the down-stream end of the training wall. The water flowing to the right will be given a direction which will lead it directly towards the intake of the Canadian Niagara Power Company, 1,200 feet distant.

Inasmuch as the walls proposed to be constructed are all west of a straight line drawn from the east line of the Victoria Park to the intake of the Canadian Niagara Power Company and are so aligned as to attract the current shoreward rather than towards the centre of the river, I am of the opinion that these works will not tend to divert the waters of the river away from the intake of the Canadian Niagara Power Company.

Second. "The elevation of the surface of the water at the intake of the Canadian Niagara Power Company will not be appreciably lowered by the subtraction from the river of 11,200 cubic feet per second at a point 1,200 feet distant."

By the term "not appreciably" is meant that the difference of elevation of the water at the intake under the conditions of subtraction or non-subtraction of the specified amount of water could not be detected by the ordinary observer, and could only be determined by a long and carefully conducted series of observations. The conditions existing may be thus stated; taking a straight line from the southerly shore of the river at the east limit of Queen Victoria Park to the Canadian Niagara Power Company's intake, a distance of about 3,700 feet, there is to the northeast of that line a body of

water 1,200 feet wide flowing towards the intake, and its surface ordinarily falling in that distance about forty feet. On one side of this stream there would be a body of comparatively still water between it and the river bank, the fall and velocity being checked by training walls and obstruction walls. On the other side there would be a mass of swiftly flowing and turbulent water moving in the same general direction. Ripples and rapids and swirls, caused by irregularities in the river bottom, disturb the surface of these swiftly moving waters and cause surface cross-currents and fluctuations of level, but the general mass of the stream we are considering moves on towards the intake. On arriving at the intake the west side of this stream encounters the river bank through which the intake is constructed, while the east side of it reaches a precipitous gorge, the brink of which curves in across the stream and then down in its general direction for about 1,000 feet, meeting there the west shore, which has curved around to that point; down this gorge the whole mass of water is precipitated, forming the Horse Shoe Fall.

At about 1,400 feet up stream from the line drawn from the intake to the crest of the Horse Shoe, the Toronto & Niagara Falls Power Company propose to take from the west side of this stream a volume of water amounting to 11,200 cubic feet per second. At this point the water in the centre of the channel is several feet higher than it is along the shore. The abstraction of 11,200 cubic feet per second will tend to lower the water level close to the shore and the training wall erected on the west edge of the stream. The lowering of the water at this point will tend to produce a cross current in the stream setting towards the west shore, so as to equalize the level of the water. The direction of the line of shortest descent in the surface of the stream will be changed so that the surface current will flow in a more northwesterly direction than before to fill up the slight depression in the surface caused by the removal of the above named amount of water on the west side of the stream. This action will continue along down the stream until the level of the water surface near the shore is restored to its original conditon. The distance within which this action may take place is fully a quarter of a mile, and at the point of intake of the Canadian Niagara Power Company, where the energy of this whole mass of water in the stream has been exerted in producing such a condition that the water which comes down on one side of a trinagle is checked by another side of the triangle and precipitated over a cascade on the third side of the trinagle. The cross section of the area of the stream on the up stream side of this triangle is adjusted by the action of the natural forces, so that all the water that comes down must be precipitated over the fall.

The exact shape of the upper surface of this cross section varies with the amount of water flowing in the stream, it fluctuates every day and every hour, and it is impossible that such a slight variation as would occur from the abstraction of a very small proportion of the volume of water flowing down this stream at a point more than a quarter of a mile away can make such a difference in the surface elevation of the water from crest of fall to bank as to be appreciable by the senses.

All of which is respectfully submitted.

(Signed) J. JAMES R. CROES.

New York, Dec. 22, 1902. Consulting Engineer.

REJOINDER OF HUGH L. COOPER TO ARGUMENTS OF CANADIAN NIAGARA POWER COMPANY'S ENGINEERS.

To the Premier of Ontario and the Members of the Cabinet:

On behalf of the applicants William Mackenzie, Henry M. Pellatt and Frederic Nicholls, I beg to present the following answer to the memorandum of objections embodied in the letter of Clemens Herschel and Cecil B. Smith, under date of December 29th, all having to do with the grant of a power site to the applicants at or near Tempest Point.

The first assertion that the Niagara River above and below Tempest Point is a "series of rapids, ridges, channels, flat shoals, covered by a small depth of water," is admitted. An examination of the site on the ground absolutely demonstrates that the piling up effect at the intake of the Canadian Niagara Power Company and due to above admitted conditions, is caused by water almost wholly entirely outside of the line A. B. shown on our map.

The configuration of the banks of the Niagara River at Tempest Point is such that the water striking its bank, whether works are built there or not, do not add to the tendency of the river to pile up in front of the intake of the Canadian Niagara Power Company because this shore is not parallel to the shore below. The fact that there is this great natural tendency of the waters of the Niagara River to pile up six feet higher than a level line in front of the intake in question, is one of the strongest arguments why the subtraction of 7 per cent. of the waters will be inappreciable. If the water were level opposite the intake of the Canadian Niagara Power Company, the subtraction of 11,200 cubic feet per second at the proposed intake must affect the level to a greater extent than where, as the fact is in the present case, the torrent behind is crowding the water against the bank and in natural opposition to any reduction of level whatsoever. The works proposed by the applicants do not in any sense tend to divert water from the intake of the Canadian Niagara Power Company; on the contrary, the drawing out of 11,200 cubic feet per second at Tempest Point will create a tendency of the river to flow toward the river bank above the intake of the Canadian Niagara Power Company, and this tendency will extend beyond the limits of the line A B, and towards the centre of the stream, and be of value to the contestants in this case, as explained by Mr. Croes. In view of the above, and bearing always in mind that the proposed works do not divert water, the claim that a subtraction of 7 per cent. of the water of the river is going to result in the remaining 93 per cent seeking a new path toward the centre of the Horse Shoe Falls cannot prevail.

Action of Ontario Power Company Coffer Dam.

Messrs. Herschel and Smith overlook the fact that this coffer dam of the Ontario Power Company is a diverting dam in the fullest meaning of the words, and that it diverts from its natural tendency more than twice the amount of water than is involved in the ultimate necessities of both the Ontario Power Company and the applicants' company, and they overlook the fact that the diverting towards the centre of the river of 50,000 cubic feet of water per second is a vastly different condition than the subtraction of 25,000 cubic feet per second through works that are receiving and not diverting.

It follows therefore that the admission by Messrs. Herschel and Smith that if the present effect of the coffer dam of the Ontario Company is only a reduction of "2.3 of a foot" or 8 inches at their intake, this admission must also carry with it the further admission that when natural conditions are restored, and the Ontario company and the applicants' company should be both in full commission, that the maximum effect at the intake of the Canadian Niagara Power Company could not be more than one-half of eight inches, or four inches. In view of the foregoing it is not understood how Messrs. Herschel and Smith can sign so impossible a statement that "at the intake of the Canadian Niagara Power Company the water level will be permanently lowered by several feet."

General Denial.

We deny absolutely that any of the works proposed by the applicants either of a permanent or temporary construction kind, can ever have any appreciable effect upon the contestants' company, and our reasons therefor are set forth above, and in our original brief, and the statement that the Canadian Niagara Power Compny will be by any of our works prevented or hindered from the completing of their plant for two years or any other period, is not correct.

We deny for reasons previously set forth that the Canadian Niagara Power Company is in any sense called upon by engineering necessities to protect itself from any conditions whatsoever, that may result by the granting of the petition of the applicants.

We deny that we can build works "by placing their power house back against the bluff." The reason we can't go "against the bluff" is because: First, we could not get by the pipes of the Ontario Power Company, neither under them, over them, nor behind them. Second, because this plan, even if the Ontario Power Company were out of the way would involve a needless expense of from $450,000 to $550,000, and the plant when so built would not be as useful as the one proposed by the applicants.

Arguments on Water Level.

The contention that "To lower the natural level of the Niagara River one inch would inflict serious damage," means that if it is a fact, then the works in question have been most seriously mis-designed.

The river level varies from day to day from 6 inches to 36 inches, influenced by the wind at the head of the river. This level may further vary in the future by subtraction of further waters for a deep water way canal, by the granting of further water power rights on the American side, by the taking out of more water at Chicago for drainage or navigation purposes—all or any of which probabilities will have in their consummation a much greater influence than one inch, and the sum of them might be 18 inches, and if this plant has been designed up to so close a point that one inch is a factor on one side and the wind and the possibilities above mentioned on the other, then we submit that the designers of this plant have been guilty of oversights for which the Commissioners of the Victoria Park cannot be held responsible.

It must be remembered that the probabilities above referred to have always existed, and before the filing of the application of the applicants. It is here contended that in no way is it a possibility for the Victoria Park Commissioners to guarantee any particular level of the water at the intake of the Canadian Niagara Power Company because of the volume of the influence outside of the jurisdiction of the Park Commissioners.

Wing Dam.

We deny the necessity of the proposed wing dam at the intake of the Canadian Niagara Power Company, and referred to in the legal submission section D, for reasons plainly evident in the first brief filed by the writer.

If, however, the contestants under the dominion of the same kind of advice that designs a plant on a margin of 1 inch where the total head involved is 1,632 inches, desire to build a wing dam at the lower end of their intake, such wing dam can be built without "hurt" to the affiliated company, the International River Railway Company, but the suggestion that the expense of this useless undertaking should be ever brought to the attention of the applicants should not prevail.

Ice.

We deny that the works we propose add to the ice quantities that are to be contended with by the contestants. First, because the area to be occupied by the proposed plant is so situated that even with the works not built the tendency of the river at that point is to pile up the ice on and toward the receiving bank at Tempest Point, and all such ice must pass close to the intake of the Canadian Niagara Power Company. The plan shows that, and an examination of the site shows the same thing; therefore, we do not increase the ice that would otherwise come, because the ice so thrown against Tempest Point would have to travel on toward the intake in question. Second, our first discharging weir or chute for ice, discharges away from the bank, not towards the bank, and the action of our works will be to relieve the contestants of ice instead of to oppress them.

Section 11.

Messrs. Herschel and Smith assert that in their respective experiences they have never known of changes in level not being objected to. This is no argument, because conditions parallel to those here existing, do not exist elsewhere even in an approximate degree. Section 11 says, if the supply of water is by any means reduced, the Canadian Niagara Power Company may deepen. This statement compels the admission that a reduction in level is contemplated and provided for, as otherwise you could not reduce the quantity without artificially choking up the intake with added works therein, a condition impossible in these premises.

We are shown exhibit "A" and as to this my brief already filed dealing with Mr. Herschel's second suggestion that the applicants should build across the tracks, shows conclusively why any instalment which does not include a gathering dam must be valueless, and no experienced hydraulic engineer could properly approve of the plan marked exhibit "A" and signed

by Mr. Smith. Furthermore, even if there were no hydraulic objections to this plan "A" it could not be made available because the properly approved plans of the Ontario Power Company show their steel conduits passing through the centre of forebay and power house of the works shown on exhibit "A."

No reason is offered by the Canadian Niagara Power Company for the original preparation and filing of this plan.

Conclusion.

We submit the foregoing brief reply feeling assured that the first briefs filed by Mr. Croes and the writer themselves constitute a general answer to the brief in question. We are gratified in the knowledge that the various engineering problems which are the points at issue in this case, will receive at your hands a full and impartial judgment, and we beg to assure you of our belief that the most critical examination of the facts in this case will result in the granting of the petition we have filed.

All of which is respectfully submitted.

(Signed) HUGH L. COOPER.

LETTER OF COUNSEL FOR CANADIAN NIAGARA POWER COMPANY.

Toronto, December 29th, 1902.

Hon. G. W. Ross, Parliament Buildings, Toronto:

Application of the Toronto and Niagara Power Company.

Dear Sir,—Herewith we beg to send you (a) memorandum of objections by the engineers and (b) memorandum presented upon behalf of the Canadian Niagara Power Company, as a supplement to that of its engineers.

On the 27th inst. we wrote to Mr. Macrae, solicitor of the applicants, the letter of which we enclose a copy, and to-day we received a letter from Mr. Macrae refusing to comply with our request.

As we have not been given an opportunity to read the report of the engineers of the applicants or the argument presented upon behalf of the applicants, we are obviously at a disadvantage in replying thereto, and we therefore beg to say that, if anything contained in the papers submitted upon behalf of the applicants is not replied to in our memorandum we shall be happy to deal with such point upon being advised by you that you desire a reply thereto.

Certainly, we must not be held to concur in any statement in the applicants' papers which we have been refused an opportunity to consider.

Respectfully yours,

(Signed) WALTER NESBITT
A. MONRO GRIER
of counsel for the Canadian Niagara Power Company.
27th December, 1902.

Enclosed.

(Copy.)

H. H. Macrae, Esq., Barrister, etc., Toronto, Ont.:

My Dear Mr. Macrae,—I have communicated with Mr. Nesbitt and he informs me that the Premier has intimated to him that the engineering argument upon behalf of the applicants should be put in, so that our engineers may be able to frame their rejoinder, and in like manner that such rejoinder should be put in so that it may be answered by your engineers.

In order that a course in keeping with the above may be followed, perhaps you will kindly let me have the memorandum or argument by Mr. Croes and Mr. Cooper in order that I may be in a position to send to you the rejoinder of Mr. Herschel and Mr. Smith. If you so desire I can ask the railway company to send you, at the same time, the argument of their engineers.

Wishing you the compliments of the season,

Yours faithfully,

"MONRO GRIER," Secretary.
Niagara Falls, Ont., Dec. 29th, 1902.

OPINION OF CANADIAN NIAGARA POWER COMPANY'S ENGINEERS.

The Canadian Niagara Power Company, Niagara Falls, Ont.:

Gentlemen,—We beg to present the following memorandum of objections to the plans of the Toronto and Niagara Power Company, as shown on a tracing presented by the Commissioners of the Queen Victoria Niagara Falls Park, December 19th, 1902, at a hearing by the Government of Ontario, held at the Parliament Buildings in Toronto on that day.

The Niagara River at Tempest Point, in the Park as well as both up stream and down stream therefrom, is a series of rapids, low water falls, ridges, channels, flat shoals covered by a small depth of water, and ledges of rock, making a stretch of river totally unlike an ordinary length of river in its formation as a channel for water, and subject to effects from disturbances placed in it totally unlike those that by the same causes would be produced in the ordinary river.

The configuration of the river is such that the water near the shore where the applicants' power house is proposed is some eight or nine feet lower than the water in the river 700 or 800 feet distant therefrom, and at right angles to the shore line. This inequality in the level of the water caused by the existence of rock ledges in the river creates a unique rush of water towards the Canadian shore at the intake of the Canadian Niagara Power Company, the result being that the water at that point is some 5 or 6 feet higher than it is in the centre of the river above the Horse Shoe Falls. Should a still-water basin be constructed in the river at the point shown on the plans filed, the level of which would be as high as or higher than that of the water in the centre of the river, the result would be that the main flow of the river would direct itself towards the centre of the Horse Shoe Falls, lowering the water in front of the Canadian Niagara Power Company's intake by several feet—exactly how much it is impossible to calculate—but in our opinion it would be at least 3 or 4 feet. Experience has amply shown these effects may be looked for.

At Tempest Point the water level is now, since the cribs were put in the river, 1,800 feet up stream from Tempest Point, about 2 feet lower than it was during the same stages of the river before the said cribs were put in by the Ontario Power Company.

At the intake of the Canadian Niagara Power Company, 1,400 feet down stream from Tempest Point, this same lowering of the water by the said cribs, which are over half a mile up stream from the intake, has amounted to about two-thirds of a foot.

Under the circumstances the proposed permanent structures of the applicants' in our opinion will cause the water level of the river at the intake of the Canadian Niagara Power Company to be permanently lowered by several feet, and any coffer dam to be built by the applicants will lower the river water levels still more at the intake of the Canadian Niagara Power Company and thus totally prevent the operation of the company's works while the coffer dam stands. That is, for a period of very likely two years.

The Canadian Niagara Power Company cannot now protect itself against effects from either the temporary or permanent works proposed. the works of the Canadian Niagara Power Company are built or contracted for to fit the natural water levels of the Niagara River; artificial interferences with these water levels could not have been foretold either in extent or in form. Their extent could not have been anticipated or prophesied or estimated, nor could the works to be built have been fitted to the water levels of futurity, and this cannot be done even to-day.

The most that could now be done would be for the Government or the applicants to build wing dams out into the river from a point down stream from the intake of the Canadian Niagara Power Company, and thus restore the river water level to its natural state.

The applicants can build works of the same class as those building by the Canadian Niagara Power Company without changing the natural levels in the Niagara River, by placing their power house back against the bluff opposite Tempest Point prallel to the river shore and about the same distance from the river shore as is the power house of the Canadian Niagara Power Company.

The sensitiveness of hydraulic works to a change of water levels is no new thing. The present case is wholly of this sort, and is not one of a slight diminution of head to act on the wheels or of a slight diminution of the total volume of water passing down the river. It is, to state it again, a case where owing to the configuration of the river bed even distant structures produce unusualy great changes in water levels along the shore, and thus inflict great damage to works already planned and built.

To lower the natural level of the Niagara River one inch would inflict serious damage on the operation of the works of the Canadian Niagara Power Company, and the lowering of such level by a foot or more would so affect the operation of that company's works that the wing dam above referred to would become an absolute necessity.

During the terms of our respective experiences in water power construction we have never known a case where an attempt to change the natural water levels of a stream in any such manner as here has been suggested has been allowed against the protest of others having rights in the premises.

A harmful effect of the applicants' works will be the taking of ice from the river, which otherwise would pass on down stream and outside of the intake of the Canadian Niagara Power Company and the throwing of it again into the river along the shore, and in the line of the Canadian Niagara Power Company's intake, but if the applicants' works are built inland as suggested above the applicants can run their ice into their channel as is now done in other plants.

Section 11 of an agreement between the Commissioners and the Canadian Niagara Power Company has been alluded to. This section treats of remedies against a diminution of the supply of water at the point of intake and not with lowering of the water level of the river. The remedy open to the Canadian Niagara Power Company under this section is a "deepening at said point of intake," a course that would not remedy the

artificially produced water levels in the river in the slightest though possibly affect in helping to restore the volume of water. The remedy contemplated by the section, therefore, is of no avail against the injury which the works of the applicants as at present proposed would inflict.

Respectfully submitted.

(Signed) CLEMENS HERSCHEL,
Consulting Hydraulic Engineer.

(Signed) CECIL B. SMITH,
Resident Engineer.

RE APPLICATION OF THE TORONTO & NIAGARA POWER CO.

Memorandum presented upon behalf of the Canadian Niagara Power Co.

A.

1. This matter comes before the Government as an entirely open matter. The Commissioners always maintain that, as a body, they do not pass upon expert engineering questions. Now that the Commissioners have learned that the gentlemen, whose judgment they relied upon, represents the applicants—one of the parties to the present controversy—they will retire as of course from the position that the point at issue is concluded so far as they are concerned. It is not the practice of our tribunals to base a judgment upon the ex parte statements of one side in a contestation. The matter is therefore an open one.

2. The Canadian Niagara Power Company is not seeking to prevent the Toronto and Niagara Power Company from getting the right to develop power or, in other words, to prevent competition, but it is seeking to protect itself from physical damage.

B.

1. The Canadian Niagara Power Company obtained its charter in 1892. It has paid in rentals, up to date, the sum of $215,000. It has obeyed consistently the Commisioners' directions as to its works, whether in respect of location or otherwise, and is in its present position of vulnerability with reference to physical hurt by reason of such obedience.

2. In law, the Commissioners are in a fiduciary position towards the Canadian Niagara Power Company, and in law and in equity that company looks to them and also to the Government to see that it is protected.

Apart from the provisions of section 11 of the agreement of 15th July, 1899 (which section wil be dealt with below), the Commissioners are in duty bound to see that they do not impair the value of their grant to the Canadian Niagara Power Company. The like duty rests upon the Government.

3. Therefore if to grant the present request would hurt physically the development of the Canadian Niagara Power Company the request must be refused.

4. If it be said that it is impossible to demonstrate that the proposed development would or would not hurt physically the development of the Canadian Niagara Power Company, the duty of the Commissioners and the Government is clear. Reputable experts for the Canadian Niagara Power Company assert so strongly that hurt would follow that a reasonable doubt must be held to exist and any reasonable doubt must be resolved in favor of the Canadian Niagara Power Company.

This is not the case of a controversy between two parties as to the construction of rights already granted, but it is an application upon the part of one seeking for privileges which (upon the assumption of there being a doubt) may or may not do injury to another, who has received certain rights, for which he has duly paid. It is not a case where the question

can be tested physically, because if the view of the party who has paid for and has received the rights is correct, the granting of the privileges asked for by the one who has no rights, up to the present, would irremedially damage the party who has paid for and has already received rights in the premises.

5. The proposition contained in the next preceding paragraph would be sound, even if alternative methods were not open to the applicants, but in view of the fact that at least one alternative method of development is open to the applicants, the plea of the Canadian Niagara Power Company must be listened to by any tribunal, which desires to deal justly between the parties. The Canadian Niagara Power Company not only points to an alternative method of development, but hands to the Government and the Commissioners a plan (exhibit "A" to this memorandum), which has been in existence in the exact condition in which it is at present, ever since the month of July, 1902. If the Canadian Niagara Power Company were to start to develop to-day near the proposed site of the works of the applicants, the method of development to be followed would be that indicated in the attached plan, which was made without reference to any possible application by the Toronto and Niagara Power Company and at a time when it was confidently thought that the applicants, instead of developing power themselves, would take power from the Canadian Niagara Power Company. No better evidence of the good faith of the Canadian Niagara Power Company, in the suggestion of an alternative method, could, by any possibility, be obtained.

6. To sum up, it is abundantly clear, that the present application should not be granted, but that the Toronto and Niagara Power Company should be asked to develop along lines which would not hurt physically the development of the Canadian Niagara Power Company, which is already in an advanced stage, and upon which large sums have been spent and still larger sums contracted to be spent, in reliance upon the good faith of the Government of Ontario and the Commissioners of the Queen Victoria Niagara Falls Park.

C.

Reference has been had to section 11 of the agreement of 15th July, 1899, which reads as follows :

"11. It is further agreed that if from any cause the supply of water at the point of intake as by these presents defined be diminished, the company shall have no claim or right of action against the Commissioners, but may deepen such point of intake to such extent as to restore the supply of water to the volume or quantity necessary for the purpose of the company, and that the granting or licensing of rights to the company by these presents or the agreement of the seventh day of April, 1892, as hereby extended, shall not give the company any right of action against the Commissioners, nor give to the company any right of action against other licensees or grantees of the Commissioners in respect of any diminution not substantially interfering with the supply necessary for the company, nor so long as such necessary supply can be obtained by means of deepening at said points of intake."

1. As pointed out more fully below this section does not relate at all to such a hurt as is complained of by the Canadian Niagara Power Company, namely, a lowering of the water level, but assuming for the moment that it does relate to such a hurt the following consideration is pointed out:

If the section is not wide enough to protect the Canadian Niagara Power Company, in case its intake is in fact interfered with, then the Government and the Commissioners in the carrying out of the trust reposed in them in respect of the Canadian Niagara Power Company as a purchaser of rights from them, are bound to see that no rights are granted which are calculated to interfere with the supply necessary for the Canadian Niagara Power Company since (upon the hypothesis of this present paragraph) the Canadian Niagara Power Company would have no recourse, in the event of hurt being suffered. In other words, the more it is insisted upon that the Canadian Niagara Power Company is not given any remedy for damage inadvertently caused to it, the more emphatically does it become the duty of the Government and Commissioners to protect the Canadian Niagara Power Company in advance by refusing to grant privileges which might hurt its development.

2. The above section 11 does not relate to a lowering of the water level, which is the hurt complained of by the Engineer of the Canadian Niagara Power Company. The hurt contemplated by the section is merely a diminution in the volume or quantity of the supply. This is not objectionable if the water is not taken by obstructions placed in the river which substantially lower the water level. The language of the section when dealing with the hurt itself makes this point clear. It is made still clearer when we turn to the remedy suggested : "deepening at said point of intake". That remedy might be effectual to restore the volume of water but has nothing to do with the restoration of the water level. The water level changed to the detriment of the Canadian Niagara Power Company would remain so changed, and the harm done to the Canadian Niagara Power Company would remain unredressed.

Referring to that portion of the Engineers' memorandum which deals with the question of remedy it is obvious that if the applicants are permitted by the Government to erect the proposed works in spite of the protest of the Canadian Niagara Power Company the construction of a wing dam at a point down stream from the intake of the Canadian Niagara Power Company must form a portion of the works to be constructed by the applicants and that the Canadian Niagara Power Company must be indemnified by the applicants against any claim for damages suffered by the International Railway Company or others by reason of the construction of such wing dam.

(Signed) WALLACE NESBITT,

A. MORNO GRIER.

Of Counsel for Canadian Niagara Power Company.

29th December, 1902.

Niagara Falls, Ont., January 5th, 1903.

The Honorable Geo. W. Ross, Parliament Buildings, Toronto.

Dear Sir,—We have now the honor to present to you a memorandum containing the observations of our Engineers by way of reply to the briefs of the Engineers of the applicants.

In submitting this memorandum, permit us to point out that the briefs presented upon behalf of the applicants, so far from lessening our fears for the safety and well-being of our works have served to increase them.

We beg to emphasize the fact that, in the deplorable event of the request of the applicants being granted, there will arise the necessity to endeavor to protect our development, and we shall desire to lay before you the safeguards which in addition to those adverted to by our Engineers, would be necessary in such effort to protect our works.

It has been stated that the Government purpose invoking the aid of independent experts. If such a statement is correct, we wish to say that our Engineers are entirely at the service of the Government and their experts, to furnish plans or information or to aid in any other way which may be desired.

We have the honor to be,

Your obedient servants,

CANADIAN NIAGARA POWER COMPANY.

(Signed) W. H. BEATTY,

(Signed) W. B. RANKINE,
Vice-President.

REJOINDER OF ENGINEERS OF CANADIAN NIAGARA POWER COMPANY TO ARGUMENTS OF ENGINEERS FOR THE APPLICANTS.

Niagara Falls, Ont., January 3rd, 1903.

Canadian Niagara Power Company, Niagara Falls, Ontario :

Gentlemen,—Since sending to you our report of December 29th, 1902, containing our objections to the plans of The Toronto & Niagara Power Company, we have been allowed an opportunity to read the briefs of Messrs. J. James R. Croes and Hugh L. Cooper, Consulting Engineers of the applicants, and we beg to submit respectfully, for transmission to the Premier, the following observations by way of reply :

1. We call attention to the fact that the illustrations and arguments in the briefs of Messrs. Croes and Cooper are based upon theories in regard to the Niagara River which, however applicable to streams of ordinary character, do not apply to this river at the points under consideration. At these points, this river is not an ordinary stream-flow channel, one permitting the free interchange of water and a full and complete re-adjustment of water levels throughout its length and breadth. For this reason their illustrations and arguments should be disregarded.

(a) Personal observation and actual experiment show the error of the statements that the water now flows directly towards the intake of the Canadian Niagara Power Company and that it will be drawn in that direction by the proposed wing dam of the applicants. One of the statements of Mr. Croes in this regard is correct—"That the direction of the current which shapes the shore of this....river is parallel to the general shore line." and that the deflection which is apparent.....is in the direction of the Horseshoe Fall." During the construction of the Ontario Power Company's cofferdam, a section of crib, which broke away and floated downstream, was carried over the Horseshoe Fall near the centre, without approaching the intake of the Canadian Niagara Power Company. This result demonstrates the incorrectness of the statement in Mr. Croes' report that "observation shows the course of the current to be directly towards the intake of the Canadian Niagara Power Company." and justifies his other statement that the current is in the direction of the centre of the Horseshoe Fall.

(b) A calculation which must be disregarded is that of Mr. Cooper when he speaks of "what the effect would be at the intake of the Canadian Niagara Power Company by the subtraction of 11,200 cubic feet of water per second based upon standard hydraulic engineering formulae." It is evident that a "standard hydraulic" formula cannot be applied properly to a length of river so unlike a "standard hydraulic" river as the rapids and series of cataracts here under examination. For instance, assume a ridge of rock parallel to the shore and distant 250 feet from it and an average depth of water between it and the shore of five feet—a not inapt or unfair description of the existing conditions—and we have the subtraction of 11,200 cubic feet per second exhausting the whole flow of the river between the ridge and the shore.

(c) The computation following the statement that the Engineers of the War Department of the United States have reported the minimum discharge of the Niagara River to be in the vicinity of 167,000 cubic feet per second, leads to another erroneous conclusion; the rules formulated by the

United States' Engineers having been based upon observations made at the deep water portion of the river under the International Bridge near Buffalo, and not at points where the discharge of the river is in the form of turbulent rapids.

(d) Another erroneous conclusion is the one based upon the assumption that "at the Canadian Niagara Power Company's intake the average depth of water is 96 inches," because the river between Goat Island and the Canada shore is composed of a number of channels and shoals and rapids, and the average of their aggregate cross-section has no such bearing or weight as has been given to it in the briefs and, even if accurately guessed at, is of no use whatsoever in the present examination.

2. In the arguments of Messrs. Croes and Cooper, it is suggested that the effect of the proposed works will be to lessen rather than to increase whatever deflection of the current towards the centre of the river may exist at the present time. Obviously, the proposed construction, by means of the piling up of the water inside the intake, will create a marked deflection towards the centre of the river. The absolute disregard by Messrs. Croes and Cooper of any consideration of this piling up of the water destroys the validity of their conclusion on this point. A notable instance of this disregard is to be found in Mr. Croes' statement that the "abstraction of 11,200 cubic feet per second will tend to lower the water level close to the shore." This entirely ignores the fact that the wing dam to be constructed is designed to raise the level of the water some twelve feet at the downstream end, so that there will be no lowering by any such abstraction of water as is referred to.

3. Messrs. Croes and Cooper have omitted apparently any consideration of the injurious effect upon intakes of water downstream from the proposed works of their company by reason of the temporary cofferdams to be constructed by the applicants for the purpose of building their permanent works.

4. Messrs. Croes and Cooper assert that the intake of the Canadian Niagara Power Company is a good intake in itself and better than the intakes of other power developments elsewhere in respect of the limited range of head water levels. It is true that these works have been built with proper provision for the normal range of variation on this river, but not with a view to the allowance above the intake of structures in the river which produce still water pond effects and totally disturb and derange the natural conditions. The comparison should be with all regulated power plants where, by means of head gates, the water levels in the canal are so controlled that in the operation of the plant the head water level is not allowed to vary over one inch.

5. The evil resulting from the diversion of water by the proposed obstructions of the applicants is an evil which is calculated to increase rather than to diminish as time goes on. This calculation is based upon the fact that the breaking away of the Falls at or about their centre is tending constantly to deepen the channel thereabouts, the deepening of which increases the difficulty of bringing water back to the shore line when once it has been diverted into the centre channel.

We confirm, therefore, the views expressed in our report to you of 29th December, and advise you, in the interests of your investment and the operation of your plant, to resist to the utmost the granting of the right to construct the applicants' works as at present designed.

If, in spite of the very grave and serious objections which have been pointed out, the request of the applicants should be granted, we feel it our duty to impress upon you the absolute necessity of insisting upon the construction for your company of the wing dam indicated in our former report, for the purpose of lessening, so far as may be, the damage which is certain to be done to your water levels and to your whole plant and property by the construction of the projected works of the applicants.

Respectfully submitted,

(Signed) CLEMENS HERSCHEL,
Consulting Hydraulic Engineer,
M. Inst. C.E. M. Sm. Soc. C.E.

(Signed) CECIL B. SMITH,
Resident Engineer,
Ma E. M. Can. Soc. C.E.

ARGUMENTS AND OPINIONS SUBMITTED BY THE INTERNATIONAL RAILWAY CO.

Toronto, January 5th, 1903.

Hon. G. W. Ross, Parliament Buildings, Toronto.

Dear Sir.—I have the honor to submit the report of Mr. John Kennedy and Mr. P. A. Peterson, of Montreal, who have been retained by the International Railway to give their opinion as to whether the proposed works of the Toronto & Niagara Power Company will lower the level of the river at the point where the railway company takes water.

In submitting this report I call attention to the following statement contained in the memorandum of the Engineers of the Canadian Niagara Power Company dated 29th December, 1902 :

"To lower the natural level of the Niagara River one inch would inflict serious damage on the operation of the works of the Canadian Niagara Power Company, and the lowering of such level by a foot or more would so affect the operation of that company's works that the wing dam above referred to would become an absolute necessity."

Any lowering of the water level at the intake of the Canadian Niagara Power Company will affect injuriously to an intensified degree the intake of the railway company as users of the water at a point downstream from the intake of the Canadian Niagara Power Company, and everyone can appreciate how serious a matter the lowering of the water level at the intake of the railway company to the extent of six inches would be, when it is borne in mind that the "head" of that company is only, say, one-third of that of the Canadian Niagara Power Company.

The Interntional Railway Company adopts, mutatis mutandis, the observations and conclusions contained in the several memoranda presented up to this date upon behalf of the Canadian Niagara Power Company.

Should the Government override the objections which are raised and allow the application, this company desires to have then the opportunity to point out the protection which in its judgment would be absolutely necessary to mitigate, if possible, the harm done to it.

Yours faithfully,

(Signed) THOS. GIBBS BLACKSTOCK,
Of Counsel for The International Railway Co.

Montreal, Que., January 2nd, 1903.

To The International Railway Company, Niagara Falls, Ont.:

Messrs.—We are desired by you to give an opinion as to whether or not the works proposed to be built by the Toronto and Niagara Falls Power Company for taking water from the Canadian side of the Niagara River a short distance above the Niagara Falls, will lower the level of the river at the points where the International Railway Company now takes water from the river for developing power, and where the Canadian Niagara Power Company is now making a headrace to take water for developing power at its adjoining works under construction.

We understand from plans and information furnished us by your representatives :—

1. The Toronto and Niagara Power Company (hereinafter called the Toronto Company) proposes to draw water from the Niagara River at Tempest Point about 2,400 feet above the brink of the Falls, to the extent of about 11,200 cubic feet per second.

2. That the Toronto Company proposes to take the water from the river by means of a wing dam which will be built out from shore just below Tempest Point, a distance of about 400 feet, and thence upstream in the direction of the outer end of the Ontario Power Company's new cofferdam, a distance of about 650 feet, where it will terminate at a distance of about 600 feet from the adjacent shore line. It is proposed that the upper half of the wing dam would be of such height as to hold the water in the space enclosed by it at about 13 feet above its present natural level, and that the lower half of the dam is to be about two feet lower so as to allow an overflow of water and sufficient to carry away the floating ice which may enter at the upper end of the dam.

3. At the lower end of the space enclosed by the wing dam and about the present shore line, the Toronto Company proposes to place its power house, and to supply it with water caught by the wing dam.

4. The lower end of the Toronto Company's proposed wing dam will be about 1,250 feet distant from the centre of the headrace being constructed by the Canadian Niagara Power Company (hereinafter called the Niagara Company) and about 2,300 feet from the headrace of the International Railway Company (hereafter called the Railway Company.)

We have examined the shore line and strength and direction of the currents of the rapids in the vicinity of the works in question, and the effects of the Ontario Power Company's temporary dam already built about 2,200 feet above Tempest Point, and after carefully considering the whole question we are of opinion that the effect of the proposed wing dam of the Toronto Company would be to lower the surface of the river about a foot at the intake being constructed by the Niagara Company, and about half as much at the existing intake of the Railway Company.

Yours respectfully,

(Signed) JOHN KENNEDY, M. Inst. C.E.

(Signed) P. A. PETERSON, M. Inst. C.E.

REPLY OF HUGH L. COOPER TO RAILWAY COMPANY'S ENGINEERS

J. W. Langmuir, Esq., Chairman of the Commissioners,
Queen Victoria Niagara Falls Park.

Dear Sir,—I have read the report of Messrs. Kennedy and Peterson on behalf of the International Railway and dated January 2nd, 1903, and enclosed to you by Mr. T. G. Blackstock, counsel for that company.

This report contains no new engineering feature and the statement therein regarding the level being changed "about a foot" has been answered in previous briefs. I beg to remind the Commissioners that although it is proved in my brief that this reduction in level cannot be greater than three and a half inches we based our arguments on a supposed reduction of seven inches and demonstrated that such a difference was inappreciable in results. The above seven inches and the "about one foot" of Messrs. Kennedy and Peterson contain no differences that can be used as a basis of an argument. This report says the reduction of level in front of the International Railway Company's intake will be about six inches. We deny that this will be six inches and assert that while it may be as much as two inches, that any reduction such as contemplated by the building of the applicants' works should have been anticipated in the designing of the Railway Company's works. This principle and the reasons therefor are both fully set down in former briefs and need not be here repeated.

Respectfully submitted,

(Signed) HUGH L. COOPER.

Toronto, January 7th, 1903.

LETTER OF PARK SUPERINTENDENT SUBMITTING ARGUMENTS FOR CONSIDERATION OF EXPERT ENGINEERS.

Niagara Falls, January 7th, 1903.

Isham Randolph, Esq., C.E., Chief Engineer, Sanitary District of Chicago, Chicago, Ill.

Dear Sir,—I am directed by the Chairman of Commisisoners for the Queen Victoria Niagara Falls Park to submit to you the following opinions and memoranda in respect to an application made by Messrs. Mackenzie, Pellatt and Nicholls, of Toronto, for a water power privilege on the Niagara River near Tempest Point within the Park, viz.

(1) (a) Application of Messrs. Mackenzie, Pellatt and Nicholls, together with plans submitted by them.

(b) The written statement made by Messrs. Robinson and Macrae and their Hydraulic Engineers, Messrs. Cooper and Croes.

(c) The rejoinder of Mr. Hugh L. Cooper to the written statement of the Solicitors and Engineers of the Canadian Niagara Power Company.

(2) (a) The written statements of the Solicitors and Engineers of the Canadian Niagara Power Company and the plan accompanying the same.

(b) Their rejoinder to the written statements of the Solicitors and Engineers of the applicants.

(3) (a) The written statements of the Officials and Hydraulic Engineers (Messrs. Kennedy and Peterson) of the International Railway Company.

(b) The rejoinder of Mr. Hugh L. Cooper thereto.

And to request that you will examine into the several questions involved, and furnish the Chairman with your views in respect to the engineering features which are referred to at the earliest moment consistent with a proper investigation.

The principal questions at issue are :

(a) Will the works projected by the applicants, Messrs. Mackenzie, Pellatt and Nicholls, tend to divert the waters of the river from the intakes of the Canadian Niagara Power Company and the International Railway Company ?

(b) To what extent, if any, will the withdrawal of the amount of water proposed, viz., 11,200 cubic feet per second, lower the water surface at the intakes of these two companies ?

You will also be good enough to furnish the Chairman with any observations you may deem essential to the consideration of the subject by the Commissioners and the Government.

I am, sir, yours very truly,

(Signed) JAMES WILSON, Superintendent.

Note. A duplicate of this letter was sent to Robt. C. Douglas, C.E., Hydraulic Engineer, Department of Railway and Canals, Ottawa. J.W.

REPORT OF ISHAM RANDOLPH, C.E.

Chicago, January 12, 1903.

Hon. J. W. Langmuir, Chairman Queen Victoria Park Commission,
Toronto, Canada :

Dear Sir,—In compliance with the request contained in yours of Dec. 30, 1902, I left Chicago on Monday evening the 5th inst. for Niagara, where I arrived at the office of your Commission on the morning of the 6th. Mr. Wilson at once proceeded to place in my hands such data as he had, and to procure, for the joint use of Mr. Robert Douglas and myself, as far as lay in his power, such additional data as we deemed essential to a proper understanding of the grave questions submitted to us. He was able to secure the services of the engineers employed by the Ontario Power Co., and the Canadian Niagara Power Company, respectively, to note and determine instrumentally the courses taken by certain barrels, nine in number, which he caused to be cast off, three from the end of the Ontario Power Company's cofferdam and six above the rapids. These barrel floats we watched with particular interest, as they afforded the only approximate idea, from actual observation, of the courses of the currents through the rapids. These observations and data derived from published reports of the flow measurements of the Niagara River made by the United States engineers, which gave corresponding stages of Lake Erie. The report of the New York Niagara Park Commissioners for the year 1894; information derived from the engineers of the American Niagara Falls Power Company, The Canadian Niagara Falls Power Company; and the Ontario Power Company, coupled with visual observations taken from every available point of vantage overlooking the reach of the river involved in the controversy now pending, relative to the plans of the Toronto & Niagara Falls Power Company cover all of the knowledge that I have been able to avail myself of in reaching the conclusions at which I have arrived. It seems entirely proper for me to state here that I have never before been called upon to reach conclusions in such grave engineering questions upon so meagre a basis of fact. To start out with the question the volume of flow in the Niagara River seems conclusively settled by the work of the engineers of the United States Engineer Corps, for that reach of the river between the International Bridge and the mouth of the Chippewa River; the increment from which river being unknown, is not considered in what is hereafter said about volumes of flow. We find in the report of the Secretary of War for 1900, on page 5360, that the lowest lake level was 570.25 on November 23, 1899, and the corresponding discharge was 165,340 cubic feet per second. That the highest lake level was 573.12, on June 29, 1900, with a corresponding discharge of 231,350 cubic feet per second, and on page 5,361, the mean lake level is given as 572.86, and the discharge as 222,400 cubic feet per second. From the eleventh Annual Report (1894) of the Commisisoners of the New York Niagara Park Reservation, I learned that the capacity of the American Niagara Falls Power Company's tunnel is 516,000 cubic feet per minute (8600 cubic feet per second), that the Niagara Falls Hydraulic Company's open channel then had a flowage capacity of 231,000 cubic feet per minute (3,850 cubic feet per second), and that it was being enlarged to accommodate a flow of 462,000 cubic feet per minute (7,700 cubic feet per second). This report claims for the American channel, east of Goat Island, 20 to 25 per cent. of the total discharge of the river. As against this last claim, Mr. Wilson gives as his judgment, that the channel in question carries but 10 per cent. of the total flow. I incline

to Mr. Wilson's belief, but for use in this discussion shall use 15 per cent. as the quota for the American Channel. It also seems proper to use the minimum volume of discharge for our computations. This minimum volume being 165,340 cubic feet, we shall have, after making deduction for the American Channel, 24,800 cubic feet, for the American Niagara Falls Power Company, 8,600 cubic feet; for the Niagara Falls Hydraulic Company, 7,700 cubic feet; aggregating 41,100 cubic feet, available for the Canadian Channel 124,240 cubic feet per second. The element of conjecture in these results cannot be eliminated, however. I have read carefully the application of the Toronto & Niagara Falls Power Company, the protests of the Canadian Niagara Falls Power Company, with arguments advanced in support thereof; the arguments in rebuttal presented by Messrs. Cooper and Croes, and also the protest of the International Railway Company, with the assertions submitted in support thereof by Messrs. Kennedy and Peterson.

From all of the admissions of the protesting company, backed by my interpretation of the contract existing between themselves and your Honorable Commission, I assume that there is, and can be, no objection to the abstraction of the volume of flow asked for by the Toronto Power Company, namely, 11,200 cubic feet per second; and hence that the only basis for protest by the Canadian Niagara Company, must be sought in the form of works proposed by the Toronto Company. The outline of these works is well shown upon the map submitted by that company, and their scope and method is clearly described in the written discussion by Mr. Hugh L. Cooper, their engineer. Hence the question to which I must address myself is a very grave one of the effect of these works, as designed, upon the efficiency of the Canadian Power Company's works as now designed and in process of construction.

In taking up the arguments of Mr. Hugh L. Cooper, we find that he is both resourceful and aggressive, and has a forceful way of presenting his case. I cannot, however, acquiesce in his view that the hydraulic elements of this stretch of the Niagara River can be computed by any known hydraulic formula. This is manifest when we are faced with the following facts :

Distance.....—Z, is derterminable.
The quantity of water.....—Q, is conjectural.
The slope.....—S, is chaotic.
The velocity.....—V, is inconstant.

The area of cross section—a, is unknown, and unknowable, and without knowing that the hydraulic radius—r, cannot be determined.

Coefficient of roughness—n, is composite, and hence C, coefficient of mean velocity, cannot be computed.

Mr. Croes presents certain axiomatic statements covering various forms of dams and a comprehensive description of the lay of that reach of rapids coming within the scope of the three several power plants, proposed, and in process of construction.

Observations on Flow.

To state that in flowing streams the natural direction of current, unobstructed, is along straight lines, is a fact only to be qualified by the further statement that the flow is on the line of least resistance, is only asserting a truism known to all who have occasion to observe the habits of streams. It is further true that where a stream departs from a straight line, the water is higher on the concave bank than it is on the inner, or con-

vex, bank; this difference is scarcely to be detected where velocities are low, but under high velocities the piling up on the concave shore becomes a marked effect. Between the south end of Queen Victoria Park and the chasm which makes the cataract, the shore curves to the right (or east) through, probably, 80 degrees of central angle, and the onrush of the current, with inconstant velocities varying between 8 and 17 feet per second, piles the water up on the concave shore to a considerable height. The effect of this has been to erode the deepest channel on the westerly side of the centre of the stream. So markedly is this true, that to wade out from the easterly shore at Terrapin Point, just above the Falls, for a distance of several hundred feet, does not seem to me to be a venture fraught with much peril; whereas on the opposite shore, even to fall off the bank would mean almost sure destruction for the unfortunate who did so. The building of the cofferdam by the Ontario Power Company, as shown upon the maps on file with your Honorable Commission, has served to shut off all of the water which formerly flowed around Dufferin Islands and to lay bare all of the area lying between it and the shore and a line drawn from the downstream end of the cofferdam to a point about 400 feet southerly from the south end of the Suspension Bridge crossing the north channel around Dufferin Island. Notwithstanding this radical diversion of an immense volume of flow from its normal course, the pitch toward the west shore is so tremendous that the water against the crib on Tempest Point (as indicated by water mark on the timbers of the crib), is scarcely two feet lower now than it was before the diversion took place and the readings on guage No. 4, which is about 950 feet northerly from Tempest Point, and 450 feet south of the southerly end of the Canadian Niagara Falls Power Company's crib, taken before the building of the cofferdam, and regularly since, show an average reduction of level for corresponding stages of water, as determined by the readings on guage No. 1 at Chippewa, based on monthly means, of about 65-100 of 1 foot. Hence, it seems reasonable to believe that the change of level at the intake of the Canadian Niagara Falls Company, 500 feet lower downstream, will be nearly what it was before the building of the cofferdam by the Ontario Company. Strangely enough, there is no positive information to support or rebut this assumption.

The charted courses of the several barrels cast off at varying distances from the shore on January 6th, for the purpose of gaining information as to trend of currents, has a strong bearing on the questions at issue, as they afford the largest amount of knowledge upon this subject which is now available. Prior to the building of the Ontario Company's cofferdam, that company caused five (5) barrels to be cast off from a trestle which it had constructed near the Southern limits of the Park domain. The courses taken by these barrels are shown upon the chart, and it is a significant fact that the three barrels cast off from the end of the cofferdam on the 6th inst. were driven shoreward until they nearly reached the path of the previous barrels, which path they thereafter followed substantially. The barrels cast off in the upper river (numbered consecutively from the first one cast off from the cofferdam), showed the following results :

No.	Crossed line of upper reef.	Passed Canadian Niagara Falls cofferdam.
4.	270 feet from north end of cofferdam.	215 feet from its face.
5.	540 feet from north end of cofferdam.	325 feet from its face.
6.	350 feet from north end of cofferdam.	40 feet from its face.
7.	380 feet from north end of cofferdam.	175 feet from its face.
8.	1200 feet from north end of cofferdam.	1400 feet from its face.

The ninth barrel was carried into the American shore above the rapids. Crude as these experiments for determining the direction of currents were, they are yet the most positive indications bearing upon the subject of which I have been able to gain any information, and they serve to confirm the impressions made by purely visual observation of the currents.

The purpose of the Ontario Company, as it has been explained to me and as is indicated by the plans of their proposed work, in your possession, is to divert from the channel of the river toward the intake of their conduits a water volume of more than twice the capacity of their said conduits and to waste the surplus over a spillway or submerged wier lying between the wing dam and their intake. Assuming the works of the Toronto Power Company to be built as shown upon the plans accompanying their petition to your Honorable Commission, the overfall from the works of the Ontario Company would closely approximate to the 11,200 cubic feet per second asked for by the Toronto Company. The additional volume entrained by the partially submerged training wall, provided for in the plan of the petitioners, would be superfluous water, could the waste from the Ontario Power catchment basin be made available without the construction of works to hold the water, approaching the intake of the petitioner, up to the proposed level of 533. These works, however, are necessary for the reasons set forth by Mr. Hugh L. Cooper, engineer of the petitioner. The entrained and impounded water being greatly in excess of the needs of the petitioner, provision is made for the return of the surplus to the river channel over ample waste weirs. The entraining wall being well within the limiting line, prescribed by you, drawn from the intersection of the south boundary of the Park to the southeast angle of the cofferdam of the Canadian Niagara Falls Power Co., it is manifest that no water east of its line of direction will be diverted from its course toward the intake of the objecting company. It is further manifest that the tendency of the water flowing along the easterly side of the entraining wall, will have a tendency to sweep shoreward around the northwesterly end of this wall where it joins onto the overfall dam extending out from the petitioner's power house to meet it, and that this tendency will give a shoreward impulse to the water escaping over the crest of the overfall dam.

ICE.

I do not believe that the ice problem is one which need cause the objectors any serious apprehension. From conversations had with gentlemen, whose personal observations entitled them to speak with knowledge on the subject, I learned that the ice run on the Canadian side of Goat Island is inconsiderable, as the prevailing winds drive the ice to the American shore. Should there come an exception to this habit of the ice on the river, the effects could not be worse than those which would obtain if the works of the objectors were the only works between the south end of Queen Victoria Park and the Cataract.

Channel Contraction.

In considering the question of water levels, the effect of channel contraction must not be lost sight of. The work of the objecting company has tended to narrow the channel by encroachment thereupon, by filling out from the old river margin to the new shore line established by your honorable Commission. What the effect of this construction must be, I cannot state upon any basis of actual knowledge, but that will be an appreciable element in the readjustment of levels, is beyond cavil, and it may even

correct any small depression in levels feared as a result of the execution of the plans of the petitioner.

I wish to express my appreciation of the courtesies extended to me and the aid afforded by the officers and engineers of the Canadian Niagara Power Company and the Ontario Power Company. These gentlemen permitted me to examine their plans and gave me oral information which has been of great value to me in reaching the conclusions at which I have arrived. The plans of the Canadian Niagara Power Company show their intake grade as 501.5; width of intake, 250 feet, clear of obstructions; depth of water through intake, 15 feet maximum; 13 feet minimum, corresponding to elevations, 516.5 and 514.5 respectively. Elevation of bottom of tunnel, at north end of wheelpits, 353.00, height of tunnel 25 feet, hence elevation of intrados will be 378. By deductions from these elevations it is evident that the head of 136 feet used in these discussions is predicated upon the minimum water surface (514.5), with a margin of half a foot for good measure. With this exhibit to sustain me, I am able to felicitate the men who are putting up the money for this development, upon the fact that their engineers have designed their works upon a reasonable margin of variations, and not upon the theoretical exactitude for which they argue so strenuously in their protest against the Toronto Power Company's proposed development. In this connection it is instructive to note that the intake of the American Niagara Falls Power Company, designed to supply the same volume of flow as its Canadian counterpart, is 250 feet wide, clear of obstructions; was designed for a depth of 12 feet, and has a normal variation in depth of three (3) feet and an abnormal variation several feet in excess of that, and yet that plan is effectively workable under all conditions.

Map of July 16th, 1902.

The Canadian Niagara Power Company has submitted a map with the official certification of its resident engineer to the effect that the plan shown thereon "was completed on or before July 16th, 1902," and that the same "is now exactly as it was at that time." The location of the plant which they are now building is shown in black, and in red ink is shown a duplication of same at Tempest Point occupying the river front at the site selected by the present applicants, but extending back into the Park grounds. This plan and statement I accept as proof positive that the protesting company does not regard the taking of a volume of water sufficient to operate such works as a damage to the plant which they are already constructing. After giving my best thoughts to all of the matters and things which have come before me, bearing upon the grave questions at issue, I now sum up my conclusions :

Conclusions.

First. That the plan and form of construction proposed by the petitioners will not lower the level of water in front of the intake of the Canadian Niagara Power Company, to a greater extent than that which has resulted from the construction of the coffer dam of the Ontario Power Company, which lowering, if any, is not now ascertainable, as the only reliable observations bearing upon the effect of said coffer dam were taken 500 feet south of the intake of the objectors.

Second. That a lowering of a few inches is not a matter which deserves serious consideration in a water supply subject to fluctuations of at

least two feet; which fluctuation has been recognized and provided for in the plans of the objecting company.

Third. That what has been said with regard to the works of the Canadian Niagara River Company objectors, applies with even greater force to the conditions obtaining at the intake of the International Railway Company objectors; for the experts, whom they employed to present their cause, assert that the lessening of head at their intake will be just one-half of the loss of head of the intake of the Canadian Niagara Power Company (their assertion being that said lowering in the two cases would be one foot and six inches respectively), which assertion is unsupported by any sustaining data.

As an appendix to this report, I submit the letter of reference addressed to me by James Wilson, Esq., Superintendent of the Queen Victoria Park Commission.

Holding myself subject to further interrogation by you, I have the honor to be. Yours very truly,

(Signed) ISHAM RANDOLPH,

Advisory Engineer.

REPORT OF ROBERT C. DOUGLAS, C.E.

Ottawa, Canada, January 20th, 1903.

J. W. Langmuir, Esq., Chairman Queen Victoria Niagara Falls Park Commissioners, Toronto, Ontario :

Sir,—In answer to your communication of the 30th December, 1902, stating that the Commissioners of the Queen Victoria Niagara Falls Park desired certain opinions upon several questions in connection with water power privileges, also refering me to Mr. Wilson, the Superintendent of the Park, for particulars and information, I have the honor to report as follows :

By letter of January 7th, 1903, reference was made by Mr. Wilson, (in summary); an application of the Toronto Niagara Power Company for a concession of water-power privileges. The reports of Hydraulic Engineers in support thereof with statements of Solicitors.

The reports and statements of Engineers and Solicitors of the Canadian Niagara Power Company in opposition to the application of the Toronto and Niagara Power Company.

The report and statements of Engineers and Solicitors of the International Railway Company, who adopt the observations and conclusions presented by the Canadian Niagara Power Company. The principal questions referred to were :

To what extent, if any, will the withdrawal of 11,200 feet per second lower the water levels at the intakes of the latter companies ?

Will the proposed works of the Toronto and Niagara Power Company tend to divert the water of the river from the intakes of these companies ?

Any observations that might be deemed essential to the consideration of the subject by the Commissioners.

I have made an examination of the Niagara River and its marked features, and carefully considered the various statements and reports referred; it appears unnecessary to repeat the description of works and measurements fully set forth in the numerous reports and the official plans before the Commissioners.

Taking into consideration the magnitude and importance of the various interests established, and proposed to be established, the technical data with regard to the river available is meagre. Mr. Wilson, for the information of Mr. Randolph and myself, made nine float experiments, under not favorable conditions, but with instrumental observations, which, with some similar data furnished by the Ontario Power Company, was the only material available, other than by mere visual inspection.

To answer the query, to what extent, if any, will the abstraction of 11,200 cubic feet per second from the river, lower its surface, is difficult when discussing a river of unexampled features, with its magnitude of volume of flow, broken by heavy surging water, with various velocities and courses of flow, and subject to frequent fluctuations of level and consequent variable volumes of water discharged.

The question cannot be answered upon the original normal regimen of the river, disturbed as it is, but on a new regimen, which will be created by the erection, in the bed of the river, of the structures of the Ontario Power

Company, and of the proposed works, the effects of these works upon the river being unknown, together with the limited technical data available, renders an answer to the question a matter of conjecture.

As to what extent the withdrawal from the river of the volume of water mentioned will lower the water level of the river at the intakes, it may be said the water level, theoretically, will be lowered: the number of inches below any datum plane of the river, I cannot estimate.

The Queen Victoria Niagara Falls Park Commissioners have leased to the Canadian Niagara Power Company and the Ontario Power Company some 21,000 cubic feet per second, and have recommended a further lease; what quantity is it judicious to lease without injury to the Canadian Power Company?

The minimum discharge of the river is stated to be 160,000 to 170,000 cubic feet per second. The discharge at mean level of Lake Erie 222,400 cubic feet per second; if a basis of a minimum flowage of 165,000 cubic feet per second be taken, from that amount deduct the quanitity which may be diverted for power upon the New York Niagara Falls developments, say 25,000 cubic feet per second. The approximate flowage upon the United States side of the boundary line could not be obtained.

The quantity of water, available, by an economic construction of works, to divert for the purpose of power upon the Canadian shore, could, approximately, be determined by an hydraulic survey; about one-third of the previous balance will be assumed, or say 45,000 cubic feet per second; the leasing of this additional 11,200 cubic feet per second, or in all, 32,200 cubic feet per second, would not, in my opinion, be an injury to the present lessees through loss of head to any appreciable extent.

In connection with this question, and the larger question, the effect of the construction of the proposed works by the Toronto Niagara Power Company. The statement will be taken up of the Canadian Niagara Power Company, endorsed by the International Railway Company, of the prospective injury of a loss of head of one inch, and of the serious loss to a water plant of one foot or more.

The following water-power companies for the purpose, as expressed in the lease, allow a variation of one foot,—

"To prevent disputes as to power of each privilege in the variation of the height of water from changes of season or other causes."—

The Lowell, Lawrence, Holoke, Amoskeag (Manchester) Water power Companies and the Minneapolis Mill Company.

Upon the canals, under the control of the Department of Railways and Canals, Canada, the general terms and conditions for leasing water-power, 1890, provide for a variation of head of six inches in calculating power between the level or reaches of a canal, these levels are maintained, except during lockages, constant. Between a standard level of a canal when the tail water discharges into a river, lake or water course, one foot variation is provided for.

In the power developments of the Canadian Niagara Power Company and the Allied Company upon the New York side, I am informed, a variation of levels or head of water of two and three feet respectively is provided for.

Mr. Randolph, the Engineer of the Chicago Drainage Canal, has informed me he intends to provide for a variation of three feet in head upon the prospective water-power development upon that canal.

In consequence of the variations of water levels of Lake Erie and consequently of the Niagara River, the variation of head produced by the withdrawal of the quantity of water in question, and the allowance for such variations just quoted, become a minor consideration.

To the important query, to what extent the proposed works, of the Toronto Niagara Power Company, will tend to divert the waters of the river from the intakes of the Canadian Niagara Power Company and the International Railway Company, it may be remarked,—

The Engineers of the Canadian Niagara Power Company maintain the proposed works will permanently lower the water at its intake, several feet, exactly how much it is impossible to calculate, but in their opinion it would be at least three feet or four feet.

The Engineers of the International Railway Company state the proposed works will lower the surface of the river one foot at the intake of the Canadian Niagara Power Company, and about one-half as much at the present intake of the Railway Company.

In connection with the above, the Solicitors of the Railway Company, adopt mutatis mutandis the observations and conclusions contained in the reports and memoranda presented on behalf of the Canadian Niagara Power Company. What head do the Solicitors assume in the interest of their clients ?

The Engineers of the Toronto Niagara Power Company state the loss of head will be, at the intake of the Canadian Niagara Power Company, three and a half inches, but that their arguments were based upon a loss of head of seven inches; they deny the loss at the intake of the railway company, will be six inches, but it may be as much as two inches.

In offering an opinion upon this probable loss of head, through the construction of the proposed works, it may be remarked, the information available to us, other than the personal inspection, upon which the reports of the various engineers is based, is the plan of direction and velocity of the test floats whose course was observed by us.

The plan of the proposed works of the Toronto Niagara Power Company outlines an impounding dam within the line of the principal filaments of current near it; the dam is practically parallel to the axis of the current and it may be termed as suggested in the reports of the engineers of the above company, a training wall. Training walls and training banks are terms commonly used in the improvements of rivers and are generally constructed in the direction of flowage for cutting off sinuosities or other causes.

The engineers of the Canadian Niagara Power Company maintain that the stillwater basin (it may be called a mill pond), proposed to be constructed higher or as high as the surface level of the centre of the river, would direct the main volume of flow of the river to the centre of the Horse Shoe Falls. This opinion applies in a lesser degree to the still water basin proposed to be constructed by the Ontario Power Company.

With the facts available to form an opinion upon, I cannot apprehend the grounds for this opinion, other than would apply to the impounding

dams; these basins might be termed training banks in the direction of the training wall or dam.

It is not feasible to calculate or estimate, in my opinion only the loss of head through the diversion of water from the intakes of the Canadian Niagara Power Company and the International Railway Company by the proposed works, except by a doubtful approximation.

The construction of the coffer dam of the Ontario Power Company and the consequent alteration in the regimen of the river supply a practical indication of the probable action of the river when the proposed works of the Toronto Niagara Power Company are constructed. The dam diverted, from its direction of flow, a large volume of water; 4,000 or 5,000 cubic feet per second of that volume, are stated to have been discharged around Dufferin Island.

The entire flowage diverted is mentioned by the engineers of the Toronto Niagara Power Company as some 50,000 cubic feet per second. Whatever quantity this flowage may be, it was diverted from its normal course in the line of Dufferin Island and the banks of the Park into the river on a line with an extension of the line of the proposed wing dam of the Toronto Niagara Power Company.

The engineers of the Ontario Power Company have made daily observations of the water levels at various stations, both previous and subsequent to the construction of the coffer dam. I compared, from the records, similar daily readings at the guage at Chippewa and at a guage on a point some 450 feet above the coffer dam of the Canadian Niagara Power Company, these readings embracing a period previous and subsequent to the construction of the coffer dam; there was a difference of nearly eight and a half inches, a lowering of the surface of the river to that extent, or a loss of head of eight and a half inches at this guage, caused by the construction of the coffer dam.

The level of the surface of the river below its former level at Tempest Point, some 950 feet above the guage, is stated to be two feet. Between Tempest Point and the lower guage by the depression of the river below its former level a known number of inches, at each station in a given distance, there may be estimated the present hydraulic gradient between those two points in an approximate manner.

If the depression of the river at the lower guage be termed a loss of head of eight and a half inches, the loss of head at the intakes below will be decreased in proportion to their distance from the lower guage.

I am unaware of any method by which can be determined the loss of head in inches at the intakes in question, resulting from the construction of the proposed works. There will be established another hydraulic gradient by the removal of the present coffer dam; by the construction of the impounding dam of the Toronto Niagara Power Company; by the abstraction from the river of 22,200 cubic feet per second for power; by the overflow of the weir of the Toronto Niagara Power Company into a course tributing to the lower intakes; with these elements of uncertainty and dealing with a river of the description of the Niagara River, the only opinion I can give would be that the present loss of head at the lower guage is a fair index of the future loss of head, and that the proposed works will not tend

to divert the waters of the river from the intakes to the extent of a calculable damage.

I may remark with regard to the subsidiary question, but one of importance, is the need for the construction of a wing dam below the intake of the Canadian Niagara Power Company, to maintain the level of the river at the intakes, if diverted by structures, permanent or temporary, into channels other than into the still water basins.

The engineers of the one company characterize a wing dam a useless undertaking, for which there is no necessity.

The engineers of the lower companies consider its construction necessary to maintain the head at the intakes through the apprehended diversion of water towards the centre of the river.

The Niagara River in its magnitude, its great velocity, its diverse currents of rough water, and its varying fluctuations of level, is a river to which ordinary practical engineering experience or theory cannot be applied.

Structures, erected in the beds of rivers for various objects, by able engineers of experience, have resulted in exciting energies or current and flowage unforeseen, and actions not predicated.

With the little information before me I am not prepared to call a wing dam "a useless undertaking," although it might not be an absolute necessity, its benefits might be such to the two intakes as to justify the cost of erection, which would be little in comparison with the large proposed development of power.

I might suggest that the Commissioners establish a datum plane of the river, at the intakes of the companies complaining, determine the loss of head below this plane, to which they will be subject by their agreements, set water level guages at the intakes with reference to the plane, the daily readings of which, before, during and subsequent, to the construction of works, will determine the necessity of a dam from the action of the proposed structures temporary or otherwise.

I have to acknowledge the courtesy of Mr. Wilson, the Superintendent of the Park, also that of the officers and engineers of the Canadian Niagara Power and the Ontario Power Companies, who were always ready to afford any information relative to the inquiry.

I have the honor to be, sir,

Your obedient servant,

(Signed) ROBERT C. DOUGLAS, C.E.

Toronto, January 19th, 1903.

CONCLUDING REPORT OF PARK COMMISSIONERS TO THE GOVERNMENT.

Hon. G. W. Ross, Premier, etc., etc., Parliament Buildings, Toronto :

Dear Sir,—In compliance with the request you made on the 19th December last, at the hearing given by the Government to the various companies and parties interested in the development of electrical power at Niagara Falls that they should reduce to writing the arguments used at that meeting, I now beg to report that the applicants for a franchise (Messrs. Mackenzie, Pellatt and Nicholls), the Canadian Niagara Power Company and the International Railway Company have furnished the Commission in writing with their respective arguments before the Council with such amplifications as they deemed essential to the presentation of their case.

Upon the reception of these written briefs, the Commissioners considered it judicious to furnish each of the parties with copies of the reports and arguments advanced by the others for such criticism or rejoinder as each might consider necessary. When the Commissioners received all the reports and memoranda and acting upon your instructions, two eminent hydraulic experts were engaged to examine into all the questions at issue and to report fully upon the arguments set out in the respective briefs.

The engineers selected were Mr. Isham Randolph, C.E. (chief engineer of the sanitary district of Chicago, a work in the construction of which over $35,000,000 has been expended), and Mr. Robert C. Douglas, hydraulic and bridge engineer of the Department of Railways and Canals, Ottawa. These gentlemen visited Niagara Falls and made as thorough an examination into the physical conditions existing at the present time as was possible, and also examined the works which have been constructed up to this date for the various power companies to whom franchises have been given. I have now received the report of Mr. Randolph, but regret to say that in respect of Mr. Douglas' report, that gentleman finds on his return to Ottawa that his official superiors will not sanction his making a report upon matters outside of his departmental work; the Commissioners therefore have to depend upon the report of Mr. Randolph.

Upon a full consideration of Mr. Randolph's report the Commissioners are of opinion that the statements made by the applicants that the flow of water and the level of the river at the intake of the Canadian Niagara Power Company will not be materially affected by the proposed works of the applicants as they are outlined in the plans attached to the applications, are substantially correct.

In view, therefore, of the report of Mr. Randolph, the Commissioners, upon a full review of the subject, see no reason why the application of Messrs. Mackenzie, Pellatt and Nicholls should not be granted, subject to the conditions recited in the memorandum submitted by the Commissioners at the hearing of the case before the Council on the 19th December last.

I beg to transmit herewith the various documents and reports in connection with the matter.

I am, yours truly,

(Signed) J. W. LANGMUIR, Chairman.

REPORTS UPON AVAILABLE SITES REMAINING FOR POWER PLANTS

AND

COST OF TRANSMITTING ELECTRIC ENERGY TO CITIES AND TOWNS IN ONTARIO

Toronto, 28th February, 1903.

My Dear Sir,—I am desirous of having a report from some hydraulic engineer of high standing upon the remaining sites at Niagara Falls where electric power could be generated on a large scale. I understand from you that in granting water-power privileges to the Canadian Niagara Company, the Ontario Company and to Messrs. Mackenzie, Pellatt and Nicholls, the Commissioners had not exhausted the field, and I should like to have this confirmed by an engineer whose opinion could be accepted as final.

I should also like to have an authoritative report upon the cost of transmitting electrical energy from Niagara Falls to cities and towns within a radius of 100 or 150 miles, showing the cost of construction of the lines for various amounts of power, and the approximate loss in transmission, say at each unit of 50 miles, and also the probable cost of maintaining such lines.

Will you be good enough to take steps to secure these reports as soon as possible?

Yours truly,

J. W. LANGMUIR, ESQ., (Sgd.) G. W. ROSS.
Chairman Queen Victoria Niagara Falls Park, Toronto.

REPORT OF ISHAM RANDOLPH, C. E., UPON THE FURTHER DEVELOPMENT OF THE NIAGARA RIVER FOR POWER PURPOSES.

Chicago, April 4th, 1903.

J. W. Langmuir, Esq., Chairman Queen Victoria Park, Niagara, Ontario:

Dear Sir,—Pursuant to your request, I have made a study of the hydraulic conditions as the same affect power development along the Niagara River, between the mouth of the Chippewa River and Queenston, and I now have the honor of reporting to you the conclusions at which I have arrived as the result of my investigations. To give me fuller familiarity with the several localities which I am about to discuss, I supplemented former visits to the Falls by spending March 27th and 28th there. The question with which I have to deal may be formulated thus: Have the available sites for water power development on the Canadian side of the river been exhausted by the acquisition and occupation of the four several sites within the domain of Queen Victoria Park for which charters have been issued

by the Government of Ontario? I answer most emphatically, no; and in support of my position I submit the following array of sustaining facts. First, I will take up that reach of the river which begins at the mouth of the Chippewa River and ends at the steel arched highway bridge below the Falls. To illustrate the situations which come first in order of discussion, I submit a map drawn on a scale of four hundred feet to one inch, marked Exhibit "A." On this map the respective locations of the Ontario Power Company, the Toronto & Niagara Power Co., the Canadian Niagara Power Co., and the Niagara Falls Park & River Railway Co.—the first mentioned three being now in process of construction—are shown and named, and the available but unappropriated sites are numbered 1, 2, 3 and 4. G. K. Gilbert, Geologist U. S. G. S., states in a report dated May, 1901, "It (the Niagara River) affords enormous water power, of which five million horse power is readily available." Between the mouth of Chippewa River, where the mean elevation is taken as 561 above sea level, and the pool at the foot of the Falls, elevation taken as 342.4, with the volume of flow given by the United States engineers as 222,400 feet per second, we arrive by computation at a total gross horse-power of 5,542,814. The river front between the mouth of Chippewa River and the south boundary of the Park domain affords sites for locating power plants which have marked advantages over those located within the bounds of the Park property, the only disadvantage being in the longer tail water tunnels. The advantages are cheaper preliminary construction, due to the comparatively still water in which the work must be done; less extensive, and hence less costly, wing-dams, and lastly, greater available head. I show upon Exhibit "A" (map) three suggested power plants occupying a river frontage of 2,700 feet in length; the northerly plant (No. 3) being 600 feet south of the Park limits. These locations are numbered from the south 1, 2 and 3 respectively, the tunnels, leading from them, to discharge in rear of the cataract, as is planned for the Toronto & Niagara development. The elevation of the bottom of the tunnel at the discharge end is in each case assumed as 338.3, and the ascending grade in the tunnel is taken as 7 feet per 1,000 feet (which is the grade used in the Canadian Niagara Power Company's tunnel, the dimensions of which, 18x25 feet, are also adopted). The length of this tunnel will be approximately 6,220 feet. The elevation of the intrados will therefore be 406.84. The available head will be 151 feet nearly, and the water required to develop 100,000 net horse-power, assuming an efficiency of 75 per cent., will be 7,776 cu. ft. per sec. The tunnel leading from location No. 2 will be 5,450 feet long, the available head 156 feet, nearly, and the water required to produce 100,000 net horse-power (75 per cent. efficiency) 7,507 cu. ft. per sec. The tunnel leading from location No. 3 will be 4,300 feet long, the available head 164 feet, nearly, and the water required to produce 100,000 net horse-power (75 per cent. efficiency) 7,140 cu. ft. per sec. Any one of these three sites when developed would have a decided advantage over the American Niagara Falls power development on account of its freedom from ice gorges. The experiences of the past spring have served to emphasize the advantage which the Canadian side of the river possesses over the American side when ice is running. I will not go into estimates of cost in this discussion, further than to show by analogy that either one of the three sites discussed above can be developed at a much less cost than was involved in the development of the American Niagara Falls Power Plant. In the first place, no head race need be constructed, as the buildings may be located as I have shown them, and the water can pass from the river proper into the intakes. The tunnels will be shorter. The

tunnel for the American plant is 7,000 feet long, whereas the lengths of the three tunnels suggested for the locations covered by this discussion are, respectively, 6,220, 5,450 and 4,300 feet in length. The three suggested sites do not exhaust the possibilities of power development on this upper level of the river.

I have to suggest a further development, near the cataract, which is numbered 4 on the map. This development calls for a subterranean power house; such a power house, though unusual, is not an original suggestion, for there is such a one at Snoqualmie Falls, Washington Territory, 34 miles from Tacoma. There the shaft is 250 feet deep; the subterranean rock chamber is 200 feet x 40x30 feet. The length of the subterranean chamber in the proposed No. 4 development would be governed by the size of the units adopted for the service. Its width need not exceed forty (40) feet, nor its height, from floor to ceiling, thirty (30) feet, if the rock admits of using a flat ceiling, nor forty feet if it should be found best to use an arched ceiling. I will state here that I have been in cement quarries in Indiana where I have seen perfectly flat ceilings of limestone, unsupported for spaces of ninety (90) feet. Allowing for a margin of one foot outside of neat lines of such a subterranean chamber with arched roof, the cubiture per lineal foot of length would be 59 9-10 yards; allowing $5.00 per cubic yard to cover the cost of excavation and lining (I am advised that the going price for tunnel excavation at Niagara is $3.50 per cubic yard), the cost per lineal foot would be $299.50, which would bring the cost of a chamber, 600 feet long, up to $179,700.00. A chamber such as this, close to the cataract, would have an advantage over a power house built in the open, correspondingly near to the cataract, because it would be free from the spray effects. To secure the water necessary for operating this plant, it would be necessary to run an impounding wing-dam on (as shown in Exhibit "A") from the north side of the intake of the Niagara Falls Park & River Railway Co.'s intake of such length and dimensions as would provide ample volume both for the existing plant and for the proposed development. The intakes for the proposed development would be located southerly of and adjacent to the intake of the existing plant. The available head for this development would be about 155 feet, and the water required to develop 100,000 net horse-power (75 per cent. efficiency) 7,574 cu. ft. per sec. The tail-water tunnel for this development would be only 450 feet long. The only structures connected with this plant which would be visible in the Park would be a shaft head house, which could be made an ornamental, even a monumental structure, and the intake works along the shore line.

The water required for the four suggested developments would be:

For No	Cubic feet per sec.
1	7,776
2	7,507
3	7,139
4	7,574
Total for proposed plants	29,996

The volume of water used in the N. F. P. & Ry. plant is not considered.

	Cubic feet per sec.
Ontario Plant	12,000
Toronto Plant	11,200
Canadian Plant	8,900
	32,100

Total chartered and suggested development on Canadian side from the river above the Falls calls for 62,096 cubic feet per sec.

The American developments now in operation and arranged for from the high level of the river calls for the following volumes of water:

	Cubic feet per sec.
American Niagara Falls Power Co.	8,600
Niagara Falls Hydraulic and Manufacturing Co.	7,700
Total on American side	16,300
Total on Canadian side	62,096
	78,396

81,396 cubic feet per second out of a total of 222,400 cubic feet per second, or an appropriation of 35 1-4 per cent. of the available water to develop power; leaving 144,006 cubic feet per second to continue the scenic effects of the cataract.

Water power in the Niagara Gorge.

The second division of this discussion has to do with the River below the Steel Arched Highway Bridge.

I find in the report of your able Superintendent, Mr. James Wilson, for the year 1897, a discussion of five possible developments on the lower River. The first of these to have its intake just above the Cantelever R. R. Bridge, and its discharge 3,500 feet down stream, developing under a head of 30 feet. This development as discussed by him is entirely feasible along the lines which he recommends, and a power of great value awaits preemption there. Mr. Wilson's suggestions are tentative and a very careful study of all the conditions which affect this situation must be made before the plans for development are entered upon. From data furnished me by Mr. Wilson it is evident that there will be violent changes of head for any water-power development in the Niagara Gorge, as the guage readings show an extreme oscillation of 15 feet nearly. This oscillation makes me doubt the propriety of attempting the development of Mr. Wilson's suggestions No. 2 and No. 3 on seven foot heads, as a low head, subject to variations twice as great as the head itself, is of doubtful utility. Developments No. 4 and 5 having head respectively of 20 and 14 feet, are each meritorious suggestions, which like No. 1 must be worked out carefully in detail to reach the best results. I have not had time at my disposal to follow this work to a conclusion, but I have examined the conditions sufficiently, both upon the ground and by a careful consideration of Mr. Wilson's report, to satisfy me of the great value of the water-power possibilities which exist in the Niagara Gorge.

Respectfully submitted.

ISHAM RANDOLPH,
Advisory Engineer.

REPORT ON LONG-DISTANCE HIGH-TENSION TRANSMISSION.

By L. L. and P. N. Nunn, Electrical Engineers.

The purpose of these recommendations is to provide for the transmission of power by means of three phase, twenty-five cycle, alternating electric current.

The requirements will be given in detail for the delivery of twenty thousand horse-power at the terminus of transmission, and, by comparison, the requirements for both ten thousand horse-power and thirty thousand horse-power.

Duplicate Lines.

We recommend for twenty thousand horse-power a transmission of the general type and construction shown by accompanying exhibit A, consisting of two distinct pole lines, entirely separate, except at junction points, each carrying the three conductors necessary for a complete three wire, three phase transmission.

By means of the junction points, each of the above pole lines is divided into sections of approximately twenty miles each. At each of such junction points the conductors of the two otherwise separate pole lines are brought together and paralleled, or cross connected, and each of the four terminal of the four sections thus connected is equipped with a triple pole automatic switch. Such equipment occurs at each end of each of the divisions comprising the two pole lines.

The purpose of the automatic switches, in short, of the whole junction point design, is to provide means whereby any one of the sections may be cut out of the service without interrupting the operation of the remaining sections, and the purpose of using automatic switches, or circuit breakers, is to provide means by which the sections may be automatically cut out, in case of accident, so promptly as to prevent appreciable disturbances throughout the system.

Continuity of Service,

for important industries, is a prime requisite of any source of power, and while any power line properly equipped and thoroughly constructed upon a favorable right of way should cause but little interruption, nevertheless it has always been recognized, and is still correctly regarded, as the weakest link in the chain of transmission. With duplicate water wheels, or engines, generators, transformers, in short, with everything also in duplicate, it is regarded as essential for the best results that pole line be also in duplicate.

In addition to the mere advantage of duplicate conductors in case of accident, there is also another and important advantage in the provision by means of which any section properly patrolled may usually be cut out of service, repaired and returned to service, before actual accident occurs.

Whereas, when one of duplicate generators, water wheels or transformers is removed from service, but one-half of the load can be carried, the above design of duplicate lines provides for the removal of the above sections, one at a time, without affecting the amount of power transmitted, and with a temporary increase in the loss of transmission of only a few per cent.

Another, and in this case very important, advantage derived from a duplicate line lies in the more favorable "Regulation," or fluctuation, in voltage at delivery, due to the varying loss of electric potential in the transmission. These variations or fluctuations of voltage with duplicate transmission are but approximately one-half as great as with a single circuit, while the corrective effect of charging current, due to electro-static capacity, in relieving producer from the losses due to idle current, is substantially twice.

Greater cost may be urged as an objection to duplicate lines. When the amount of power to be transmitted is large, as in this case, requiring large conductors, the cost of copper is an almost controlling factor in the cost of transmission. This cost for copper, for such a given amount of power, transmitted at a given loss, is no greater for duplicate than for single transmission: the conductors in the former case being required of just one-half the weight of those in the latter.

Right of way is likely to be the next most important element of expense. The cost of a wider strip is usually but slightly greater than that of a narrower strip, because the principal element of damage to property lies in the cutting of premises, rather than in the acreage purchased. Moreover, of the total expense for right of way, legal and other contingent expenses are likely to be greater than the amount actually paid for property, and these contingent expenses are no greater for the duplicate line.

Thus poles, cross arms, pins and insulators become the only elements of transmission expenses which are proportionally greater for the duplicate line.

Voltage.

We recommend the use of sixty thousand volts for this transmission.

High voltage is desirable because of the small amount of copper required, and consequently lessened cost of line. There is a certain loss of energy in all electrical transmission, due to the heating of the conductors.

In determining the voltage and size of conductors for any line, this energy loss is generally assumed at a certain allowable amount.

The relation of voltage and size of wire is such that for any given amount of power transmitted the size of wire decreases as the square of the voltage increases. For instance: At forty thousand volts a certain amount of power transmitted requires No. 000 wire, the loss by heating being 6.6 per cent.; at eighty thousand volts the same power can be carried with the same per cent. of loss by a number four wire, which is only one-fourth as large as number 000 wire.

There is a limit, however to the voltage for which we can obtain suitable insulators at the present day. There are in successful operation several transmissions using forty thousand and fifty thousand volts, and perhaps if the line were to be put into operation at once we would find it necessary to limit the voltage to the above figures, which are undoubtedly the commercially advisable pressures for the present day. On the other hand, there are in the process of being perfected insulators which promise well to stand up under eighty thousand volts, and there is little question that within the next two or three years eighty thousand volts will be as practical as is forty thousand at the present time. Hence our recommendation for sixty thousand volts in this case.

Conductors.

Accepting a pressure of sixty thousand volts, we recommend the use of No. 00 B. & S. gauge copper wire. The energy loss would be approximately 7 1-2 per cent. when the line is carrying its full load of 15,000 kilo-volt-amperes, which is, at unity power factor, twenty thousand horse-power for the duplicate line, or ten thousand horse-power per single line.

We recommend bare wire. All ordinary insulators are worse than useless as a protection against sixty thousand volts. It is possible that a fallen wire may be prevented by it from grounding sufficiently to open the circuit breakers, and cut it out of the line, and still be deadly to any person who might touch it.

Adequate insulation for protection against such voltage would be too costly to be considered.

TABLE OF VOLTAGES AND COPPER SIZES SUITABLE FOR MEANS OF FOLLOWING DISTANCES:

PER MILE OF DUPLICATE TRANSMISSION.

40,000 volts per 50 to 70 miles.

Horse Power.	Size. B. & S.	Energy Loss.	Max. Reg.	Copper in pounds.
10,000	00	0.10 %	0.12 %	12,774
20,000	250 000 C. M.	0.10 "	0.17 "	24,156
30 000	350,000 C. M.	0 11 "	0.22 "	33,816

60,000 volts, 70 to 100 miles.

10,000	2	0 09 %	0 095 %	6,384
20,000	00	0.09 "	0 11 "	12,774
30,000	0000	0.08 "	0. 12 "	20,292

80,000 volts, 100 to 150 miles.

10,000	2	0 05 %	0 05 %	6,384
20,000	00	0 05 "	0 06 "	12,774
30,000	0000	0.05 "	0.07 "	20,292

Span.

We recommend a span of 160 feet, or 66 poles per mile, for duplicate line. Shorter spans are obviously less liable to break than long ones. Weight of sleet freezing on the wire and the wind pressures are smaller for shorter spans. Through agricultural tracts and thickly settled districts, where the falling of a wire would be of the greatest danger to life and property, especially ripe crops, it is advisable to use shorter spans, down to 120 feet, while in thinly settled areas, waste land or public domain, 200 feet will answer.

The surveyor who lays out the line may vary the span slightly at times, so that the poles shall come on the higher points, not in hollows.

At railroad and other line crossings the span must be the shortest possible, down to twenty feet.

Arrangement.

The general design of the pole and its trimmings is illustrated by exhibit B. The wires are arranged in the form of an equilateral triangle, which is at once a symmetrical and simple arrangement, advantageous both from an electrical and a mechanical standpoint. The mutual reactance and capacity effects are thus kept equal, so that there is an even balance in the electrical conditions as well as balance in mechanical strains. It is obvious that there is no symmetrical arrangement of three wires horizontally on cross arm, nor could suitable distance be provided without going to excess in length of cross arm.

Construction.

Poles—The poles should be winter cut Canadian red cedar. The standard size for forty thousand and sixty thousand volts should be forty feet long, and not less than eight inches in diameter at the top. For eighty thousand volts they should be forty-two feet long. All defects, such as large, loose or protruding knots, rotten hearts, excessive season checks, etc., should be excluded.

Winter cut timber is much preferable, even at a materially higher price. The sap is mostly in the ground when such poles are cut; consequently, they are not checked as badly as summer cut poles. Timber grown on a north slope is preferable, on account of its slower growth, and because it has a better taper. If possible, select poles the greatest per cent. of whose cross section is red or heart stock. Knotty poles last longer, though they are somewhat harder to handle, because there is more resin in the wood.

No pole should be accepted which is in wind more than four inches, or which is in wind more than one direction.

The pole is to be framed and roofed as shown on exhibit C. The mortise must be at right angles to the principal axis of the pole, and shall be neatly and cleanly cut, so that the cross arm shall be square with the pole when seated and wedged.

The sides of the mortise must fit the cross arm snugly, as wedges cannot be used on the side. The hole for the top pin is to be bored approximately in line with the axis of the pole.

The roof, pin hole and mortise are to have two coats of elastic bitumen paint. The butt of the pole to two feet above ground line shall have two coats of carbolineum, which should be applied hot.

Holes.

The holes for forty foot poles should be six feet deep in average ground. For each additional five feet of length in the pole the hole should be one foot deeper. On hillsides the depth must be measured from the lower side. One foot extra of depth should be allowed at angles. The holes should

be from four to six inches larger than the butt of the pole, to allow room for tamping.

Cross Arms.

We recommend for sixty thousand volts a cross arm four inches by six inches, by eight and one-half feet long. It is to be exact size when dry and surfaced. For forty thousand and eighty thousand volts, the cross arms should be 3 1-4 in. x 5 1-4 in. x 7 feet and 4 in. x 6 in. x 10 feet, respectively. They must be surfaced on all sides, roofed, and have two holes for insulator pins, as shown on exhibit C.

The material for these cross arms is to be selected clear, long leaf yellow pine, free from excessive gum, large or rotten knots, and imperfections generally. It is especially insisted upon that the cross arms shall be close and straight grained, so as to avoid danger of splitting out at the ends.

The cross arms should be treated with a mixture of elastic bitumen paint and creosote, in such a manner as to saturate the outer fibres with the preservative, and leave a heavy coating all over the arm.

Pins—The pin recommended for sixty thousand volts is 2 1-2 inches in diameter by 17 1-2 inches long, for cross arm pins, and 2 1-2 x 20 inches for pole pins. The general shape is shown on exhibit E. The design of the pin is, however, a matter largely depending on the kind of insulator used. The pins are held in place in the top of the pole and in the cross arm by small dowel pins, as shown on exhibit C.

The material for these pins should be selected black locust, straight grained, and free from knots. No split, splintered or rough pins should be used. The threads should be carefully cut.

The pins should be treated with paraffin. The operation consists of immersing the pins in paraffin oil at a temperature of 130 deg. F. The temperature is gradually raised in three hours to 240 deg. F., where it is held for six hours; then it is allowed to cool down again to 130 deg. F., when the pins are removed. The process requires considerable care in execution, but if properly done it is possible to drive the paraffin entirely through the fibre of the pin, and leave a smooth coating on the outside.

Dowel pins and wedges should be of oak, and should be dipped in elastic bitumen paint before being driven. The pin holes should be draw bored, 1-16 inch.

Insulators—The insulator recommended for sixty thousand volts is of the type having a large, nearly flat petticoat near the top, with a sleeve extending down the pin. The petticoat should not be less than 10 inches in diameter, and the sleeve should extend about the same distance down the pin. For forty thousand volts an insulator 6 inches in diameter, and with no sleeve, may be used. The weight and cost of insulators increases very rapidly with increase of voltage. Good forty thousand volt insulators can be had at 25 cents each; forty sixty thousand volts they would probably cost about 75 cents; for eighty thousand it is estimated they would cost from $1.25 to $1.50.

In General.

The construction should be such as to leave no places for moisture to collect, which is both dangerous to the insulators, and shortens the life of

the structure. All is to be made strong and solid, without the use of bolts or any metal to draw the metal together, but by good workmanship and the use of the above proposed framing.

Preservative and insulating paint is to be used on all exposed places, worked by tools.

An angles are to be turned in curves made up of short 10 foot spans, the angle between each span and the one preceding being not over 5 deg. For instance, if a 14 deg. angle is to be turned, it should be made with five poles and four short 10 foot spans, the deflection at each of the three intermediate poles being 4 deg. 40 min.

In places where there are likely to be excessive strains on pins and cross arms, as at entrances to switch and sub-stations, two or three poles should be set close together, having double cross arms, like the scheme shown by exhibit D, or the device illustrated by exhibit H may be used instead. This device has five pins and insulators on each of the three bars, two of which are supported at the ends of regular cross arms, and the other at the tops of the two poles. The structure is braced so as to be very rigid.

There should be no abrupt angles in a vertical direction. Where the profile of the ground has sharp rises and descents, a judicious use of different lengths of poles and proper selection of places to set them will avoid bad strains.

Switch Stations.

The junction points of the line must have buildings suitable for containing the automatic switches. These should be of fireproof construction, preferably of brick, or brick and steel, with iron roof.

A diagram of the connections showing the location of the switches is given on exhibit F.

Inlets and Outlets.

The means of conducting the high-tension wires into and out of the switch and sub-stations is a point requiring great care. An approved design is shown by exhibit G. The opening in the wall is 30 inches square, and is closed by panels of ceiling. Through the centre passes a 6x6 inch paraffined oak bushing, 4 feet long, carrying two concentric glass tubes, which in turn carry the conductor. This bushing must be entirely covered by a hood which will protect it from snow and rain, the wires entering from below. No metal should be used except in fastening the ends of the ceiling at the edge of the panel.

Switches.

The switches recommended for the junction points are of the oil immersion type, singe pole, and are best erected in separate masonry compartments built along the ends of the junction house upon the floor level.

The cost of these switches would probably be about $1,500 for the number required in each switch station.

Recommendations by

L. L. AND P. N. NUNN.

April 27, 1903.
S N F.

We estimate the cost of constructing a transmission for twenty thousand horse-power, at sixty thousand volts, of No. 00 B. & S. guage copper, at 15 1-2 cents per pound (the present market price), as above outlined, not including cost of right of way and surveying, presuming nothing dutiable.

PER MILE OF DUPLICATE TRANSMISSION, $3,600.00.

The maintenance of such a transmission, including replacing poles every fifteen years, not including fixed charges or interest on investment, should not exceed.

PER YEAR PER MILE OF DUPLICATE TRANSMISSION, $125.00.