

64
CONVENTION and PROTOCOL

BETWEEN

CANADA AND THE UNITED STATES

REGARDING

THE NIAGARA FALLS AND THE
NIAGARA RIVER

Signed at Ottawa, January 2, 1929



OTTAWA
P. A. ACLAND
PRINTER TO THE KING'S MOST EXCELLENT MAJESTY
1929

CONVENTION AND PROTOCOL

for the preservation of Niagara Falls by the construction of
remedial works and for the experimental withdrawal
of additional water from the Niagara River.

Signed at Ottawa, January 2, 1929

CONTENTS

	PAGE
Text of Convention..	3
Text of Protocol..	5
Appendices—	
I. Covering Report by Special International Niagara Board.. . .	8
II. Joint Proposals in respect to the construction of Remedial Works at Niagara Falls..	11
III. Description and Estimate of Costs..	15

TEXT OF CONVENTION

His Majesty the King of Great Britain, Ireland and the British Dominions beyond the Seas, Emperor of India,

And the President of the United States of America;

Considering that a Special International Niagara Board was established in 1926 by the Government of the Dominion of Canada and the Government of the United States to study and submit to the two Governments a report upon certain questions relating to the Niagara Falls and the Niagara River, more particularly the questions how the scenic beauty of the Niagara Falls and Rapids could be best maintained, by what means and to what extent the impairment thereof by erosion or otherwise might be overcome and prevented, and what quantity of water might consistently be diverted from the river above the Falls;

And that on the fourteenth day of December, 1927, the said Special International Niagara Board submitted to the two Governments an interim report recommending the construction of certain works in the Niagara River for preserving and improving the scenic beauty of the Falls and Rapids;

And considering that Article 5 of the treaty with respect to the boundary waters between Canada and the United States, concluded between His Majesty and the United States of America, on January 11th, 1909, limits the quantity of water which may be withdrawn from the Niagara River above the Falls;

And that the Special International Niagara Board considers it desirable to make temporary diversions of water from the Niagara River above the Falls in excess of those permitted by Article 5 of the treaty of 1909, as a means of observing and testing the efficacy of the proposed works under widely varying conditions;

Have deemed it necessary to preserve and improve the scenic beauty of the Niagara Falls and Rapids, and to that end to adopt the recommendations of the said Special International Niagara Board, and have resolved to conclude a Convention, and for that purpose have appointed as their respective Plenipotentiaries:

His Britannic Majesty, for the Dominion of Canada: The Right Honourable William Lyon Mackenzie King, Prime Minister and Secretary of State for External Affairs; and

The President: The Honourable William Phillips, Envoy Extraordinary and Minister Plenipotentiary of the United States of America to Canada;

Who, after having communicated to one another their full powers, found in good and due form, have agreed upon the following Articles:

ARTICLE I

The High Contracting Parties agree that remedial works shall be constructed in the Niagara River above the Niagara Falls, designed to distribute the waters of the river so as to ensure at all seasons unbroken crestlines on both the Canadian and the American Falls and an enhancement of their present scenic beauty.

ARTICLE II

Concurrently with the construction and tests of the remedial works and as a temporary and experimental measure, diversions of the waters of the Niagara River above the Falls from the natural course and streams thereof additional to the amounts specified in Article 5 of the Boundary Waters Treaty of January 11th, 1909, may be permitted to the extent and subject to the conditions hereinafter provided:

(1) The additional diversions shall be permitted only within the period beginning each year on the first day of October and ending on the thirty-first day of March of the following year, both dates inclusive.

(2) The additional diversion to be permitted within the State of New York shall not exceed in the aggregate a daily diversion at the rate of ten thousand cubic feet of water per second.

(3) The additional diversion to be permitted within the Province of Ontario shall not exceed in the aggregate a daily diversion at the rate of ten thousand cubic feet of water per second.

(4) The provisions of this Article shall terminate seven years from the date of the initial additional diversion authorized under this Convention.

ARTICLE III

The present Convention shall be ratified by His Britannic Majesty in accordance with constitutional practice, and by the President of the United States of America by and with the advice and consent of the Senate thereof. The ratifications shall be exchanged at Ottawa as soon as possible and the Convention shall take effect on the date of the exchange of ratifications.

IN FAITH WHEREOF the respective Plenipotentiaries have signed this Convention in duplicate and have hereto affixed their seals.

Done at Ottawa on the second day of January in the year of Our Lord One Thousand Nine Hundred and Twenty-Nine.

(L.S.) W. L. MACKENZIE KING.

(L.S.) WILLIAM PHILLIPS.

TEXT OF PROTOCOL

At the moment of signing the Convention between His Britannic Majesty and the United States of America for maintaining the scenic beauty of the Niagara Falls and Rapids in accordance with the recommendation of the Special International Niagara Board in its interim report dated the 14th day of December, 1927, as referred to in the preamble to the Convention, the undersigned Plenipotentiaries have agreed as follows:—

1.

The construction of the remedial works contemplated in the Board's interim report and authorized in Article I of the Convention, the provision for the cost and for the control thereof, as well as the control of the diversions of water authorized in Article II of the Convention shall be carried out in accordance with the recommendations of the Special International Niagara Board as set forth in its report dated the 3rd day of May, 1928, forwarding to the two Governments a joint proposal, dated the 9th day of April, 1928, made by the Hydro-Electric Power Commission of Ontario, and the Niagara Falls Power Company of Niagara Falls, New York, which report and proposal are set out in the annex hereto.

(L.S.) W. L. MACKENZIE KING.

(L.S.) WILLIAM PHILLIPS.

APPENDICES

I

**COVERING REPORT BY SPECIAL INTERNATIONAL NIAGARA BOARD
SUBMITTING PROPOSALS OF THE HYDRO-ELECTRIC POWER
COMMISSION OF ONTARIO AND THE NIAGARA FALLS POWER
COMPANY IN RESPECT TO PROPOSED REMEDIAL WORKS AT
NIAGARA FALLS**

May 3, 1928

To the Honourable the Minister of the Interior,
Ottawa, Canada.

and

To the Honourable the Secretary of State,
Washington, D.C.

1. Upon April 16, 1928, the Special International Niagara Board of Control received a joint letter from the Hydro-Electric Power Commission of Ontario and The Niagara Falls Power Company of New York which contains a proposal by the Commission and the power Company to construct at their own expense the remedial works at Niagara Falls recommended by the Board in its interim report submitted upon December 14, 1927. The proposal includes certain conditions, the controlling one being that the Commission and the Company shall be permitted to divert and use for power purposes certain additional quantities of water during the non-tourist season from October 1 to March 31. The joint letter is transmitted herewith, with the following comments and recommendations:

2. The works proposed to be built are those recommended by the Board in its interim report. They are urgently needed to restore and enhance the scenic effects at the Falls. If constructed according to the general plans which accompany the joint letter, modified in detail during construction to secure the exact effects desired, the works will materially improve present scenic conditions and will demonstrate beyond doubt whether the normally injurious effects of additional power diversions can be neutralized by the use of such works.

3. The diversion of additional quantities of water during construction of the works is necessary as a means of securing the exact scenic effects desired. The continuation of such diversions for a short period of years after the completion of the works is desirable to enable the effects of the works to be observed under a wide range of conditions and to enable the Commission and the Company to recover the considerable sums which they will expend in the construction of the work. Continuation of the temporary additional diversions longer than necessary to accomplish these two purposes is undesirable, as the water so used would be productive of only a part of its potential power whereas any permanent additional diversion which may be found practicable should be permitted only under conditions of complete utilization. That is, use of water in the old plants proposed to be used for the temporary diversion should be

permitted only so long as necessary to enable a determination to be reached as to whether permanent additional diversions are permissible and to accomplish the international steps necessarily preliminary to the construction of modern plants. The Board considers the period of seven years sufficient to accomplish all of these purposes, and has incorporated this change, with a few others of a minor nature, into the draft of conditions proposed by the Commission and the Company.

4. It is recommended that the joint proposal of the Commission and the Company to construct the remedial works be accepted, subject to the following conditions and understandings:—

- (1) Detailed plans, designs, methods of construction and sequence of operations shall be prepared by the Commission and the Company and submitted to the Board for its approval within three months after notice of acceptance of this proposal. Modification of details, as the work progresses, shall be made as directed by the Board.
- (2) The Commission and the Company shall secure from all Federal, Dominion, State and Provincial authorities, whose consent is required by law, the necessary permits for the construction of the proposed works. The Board will use its best efforts to assist the Commission and the Company in obtaining the said permits.
- (3) Construction of the proposed works on the flanks of the Horseshoe Falls shall be commenced not later than 90 days after receipt by the Commission and the Company of the approval of the Board and all other governmental authorities, and, subject to any interruption occasioned by governmental authority, shall be completed within two years after commencement, except for such reasonable extensions of time as may be granted by the Board.
- (4) Construction of the proposed weir in the Grass Island Pool shall be commenced at such time as may be directed by the board after completion of the works on the flanks of the Horseshoe Falls and after receipt by the Commission and Company of the approval of the designs of the weir by the Board and all governmental authorities, and, subject to any interruption occasioned by governmental authority, shall be completed within two years after commencement, except for such reasonable extensions of time as may be granted by the Board.
- (5) To permit observation of the effects of remedial works, after a substantial beginning shall have been made upon the works on the flanks of the Horseshoe Falls the amount of water which under the International Treaty may be diverted for power from the Niagara River above the Falls on each side of the river shall be increased by an amount not exceeding in the aggregate a daily diversion at the rate of 10,000 cubic feet of water per second during the non-tourist season from October 1 to March 31, inclusive, yearly.
- (6) The Board shall have complete supervision and control over the additional waters permitted to be diverted, with power to diminish or suspend such additional diversions.
- (7) If, upon completion of said remedial works, the withdrawal of the additional 20,000 cubic feet per second or some part thereof shall not, in the opinion of the Board, appreciably affect the scenic value of the Falls and the integrity of the river, it is understood that diversions for observation purposes, referred to under section (5) hereof, may be

continued only so long, not exceeding seven years from date of beginning field construction, as may be necessary to enable negotiations to be undertaken and concluded for the modification of the present International Treaty so as to permit permanent additional diversions of such amounts as may then be agreed upon.

- (8) After construction of the works herein specified, they shall be considered as parts of the bed of the Niagara River and subject to the same ownership and control as those parts of the river in which they have been constructed.

5. It is understood that where the present "International Treaty" is referred to in the foregoing, the Boundary Waters Treaty of 1909 is intended, and that where the "Board" is referred to, the Permanent International Niagara Board of Control, appointed by the two governments in 1923 to insure the proper observance of the provisions of Article V of the said Treaty, is intended. This Board would act in such matters as approval of detailed plans and direct supervision of the work.

6. It is recommended, however, that the Special International Niagara Board, appointed by the two Governments in 1926 to investigate and determine how the scenic beauty of Niagara Falls and Rapids can best be maintained, shall, throughout the period of the construction of the works herein provided for, pass upon all scenic effects resultant from the construction of such works.

(Sgd.) DEWITT C. JONES

DEWITT C. JONES,
Major, Corps of Engineers, U.S. Army,
United States Member
Special International Niagara Board.

(Sgd.) J. T. JOHNSTON

J. T. JOHNSTON, C.E.,
Canadian Member
Special International Niagara Board.

(Sgd.) J. HORACE McFARLAND

J. HORACE McFARLAND, L.H.D.,
United States Member
Special International Niagara Board.

(Sgd.) CHARLES CAMSELL

CHARLES CAMSELL, LL.D., F.R.S.,
Canadian Member
Special International Niagara Board.

Dated the 3rd of May, 1928.

II

PRESERVATION OF NIAGARA FALLS

JOINT PROPOSALS OF THE HYDRO-ELECTRIC POWER COMMISSION OF ONTARIO AND THE NIAGARA FALLS POWER COMPANY OF NEW YORK IN RESPECT TO THE CONSTRUCTION OF REMEDIAL WORKS AT NIAGARA FALLS

April 10, 1928

April 9, 1928.

To the Special International Niagara Board:

SIRS:—In view of the conclusions contained in your Interim Report of December 14, 1927, the undersigned, the Hydro-Electric Power Commission of Ontario, of Toronto, Ontario (hereinafter called the Commission), and The Niagara Falls Power Company, of Niagara Falls, New York (hereinafter called the Company), jointly, submit the following for your consideration and for the consideration of the Governments of the United States and Canada.

In this report you have recommended certain initial remedial measures which might with advantage be undertaken at Niagara Falls in the immediate future. Submerged weirs, with incidental excavation to improve the flow over the flanks of the Horseshoe Falls, and a submerged weir in the Grass Island Pool to raise the level of the pool and increase the flow over the American Falls are specified. Because such accomplishment will mean an early and most material enhancement of the scenic beauty of the Falls in the interests of more than two million visitors annually, early construction of these works is recommended in your report as highly desirable.

You point out, in paragraphs 41 and 42 of your report, that this initial construction will afford an opportunity to the Governments of the United States and Canada to test out in practice the effect of temporary additional withdrawals of water and the sufficiency of remedial works to offset such withdrawals. It is stated that adequate facilities for additional water passage can be provided in the existing power stations on both sides of the river to permit substantial additional withdrawals of water at such times and for such periods as will most effectively demonstrate the sufficiency of such remedial works.

The Commission and the Company have consistently followed the recommendations of their respective Governments in respect of scenic improvement along the Upper Niagara River and in the Gorge below the Falls. They are always willing to do their part in preserving the scenic effects of Niagara Falls and vicinity. They believe, moreover, that it is possible to divert more water for power purposes without impairing the scenic value of the Falls and the integrity of the River, and, within a relatively short time, to retard the recession of the Horseshoe. They concur in your view that its crest can be completely covered with water in such a manner that its appearance will be appreciably enhanced and that no more effective demonstration of the efficacy of remedial works is possible than that provided by direct observation of the Falls themselves.

The facilities for additional temporary withdrawals of water through existing power stations of the Commission and the Company are sufficient to utilize a daily diversion from above the Falls of Niagara at the rate of 20,000 cubic feet per second in addition to the daily diversion at the rate of 56,000

cubic feet per second now permitted and diverted under the Boundary Waters Treaty of 1909. The additional water so diverted may be put to beneficial use in the generation of power to be supplied to customers in the territories within the Province of Ontario and the State of New York, now served by Niagara power.

Under these circumstances, the Commission and the Company jointly have prepared the drawings attached hereto, marked A, B and C, showing works in the Niagara River which it is believed conform to the recommendations of your Board in its Interim Report dated December 14, 1927. A description of such works and estimates of cost are also attached hereto. The Commission and the Company have available construction forces and plant which they believe will enable them to construct such works efficiently, quickly, and at minimum expense.

In view of the foregoing, the Commission and the Company hereby jointly offer to construct, at their own expense, the initial remedial works shown on the said drawings, subject to the following conditions:—

- (1) Detailed plans, designs, methods of construction and sequence of operations will be prepared by the Commission and the Company and submitted to the Board for its approval within three months after notice of acceptance of this proposal. Modification of details, as the work progresses, will be made as directed by the Board.
- (2) The Board will use its best efforts to assist the Commission and the Company to obtain from all Governmental authorities, whose consent is required by law, the necessary permits for the construction of the proposed works.
- (3) Construction of the proposed works on the flanks of the Horseshoe Falls will be commenced not later than ninety days after receipt by the Commission and the Company of the approval of the Board and all other Governmental authorities, and, subject to any interruption occasioned by Governmental authority, will be completed within two years after commencement except for such reasonable extensions of time as may be granted by the Board.
- (4) Construction of the proposed weir in the Grass Island Pool will be commenced at such time as may be directed by the Board after completion of the works on the flanks of the Horseshoe Falls and after receipt by the Commission and the Company of the approval of the designs of the weir by the Board and all Governmental authorities, and, subject to any interruption occasioned by Governmental authority, will be completed within two years after commencement, except for such reasonable extensions of time as may be granted by the Board.
- (5) To permit observation of the effects of remedial works, after a substantial beginning shall have been made upon the works on the flanks of the Horseshoe Falls, the amount of water which, under the International Treaty, may be diverted for power purposes from the Niagara River above the Falls on each side of the river shall be increased by an amount not exceeding in the aggregate a daily diversion at the rate of 10,000 cubic feet of water per second during the non-tourist season from October 1st to March 31, inclusive, yearly.
- (6) The Board shall have complete supervision and control over the additional waters permitted to be diverted, with power to diminish or suspend such additional diversions.
- (7) It is understood that diversions for observation purposes referred to under Section (5) hereof, shall be discontinued upon six months' notice given by the Governments to the Commission and the Company after a period not less than ten years from the date of authorization.

- (8) The construction of the works herein specified shall not be considered as effecting any change in the existing ownership of or title to those parts of the bed of the Niagara River upon which they have been constructed.

This offer has been duly authorized by the Board of Directors of the Company and by the Commission, as appears by certified copies of their respective resolutions enclosed herewith.

If it meets with your approval, the Commission and the Company respectfully request your Board to transmit the above offer to the Government of the United States and the Government of Canada, for which purpose this letter is done in two original signed copies.

Respectfully submitted,

HYDRO-ELECTRIC POWER COMMISSION
OF ONTARIO

By (Sgd.) C. A. MAGRATH,
Chairman.

Attest:

(Sgd.) W. W. POPE,
Secretary.

THE NIAGARA FALLS POWER COMPANY

By (Sgd.) PAUL A. SCHOELLKOPF,
President.

Attest:

(Sgd.) F. L. LOVELACE,
Secretary.

RESOLVED that the Chairman of this Commission be, and hereby he is, authorized to execute and deliver and the Secretary of this Commission to attest the joint offer by this Commission and The Niagara Falls Power Company, of Niagara Falls, New York, to the Special International Niagara Board, in the form presented to this meeting.

DOMINION OF CANADA }
PROVINCE OF ONTARIO } ss.
COUNTY OF YORK }

I, W. W. Pope, Secretary of the Hydro-Electric Power Commission of Ontario, do hereby certify that the foregoing is a true copy of a resolution duly adopted by the Commission at a meeting of the said Commission held at the city of Toronto, Ontario, on the 11th day of April, 1928, at which meeting a quorum was present and acted. I do further certify that the document hereto attached is the joint offer referred to in said resolution and is in the form presented to the said Commission.

IN WITNESS WHEREOF, I have hereunto subscribed my name and set the Seal of the said Hydro-Electric Power Commission of Ontario.

(Sgd.) W. W. POPE,
Secretary.

RESOLVED that the President of this Company be, and hereby he is, authorized to execute and deliver and the Secretary of this Company to attest the joint offer by the Hydro-Electric Power Commission of Ontario and this Company to the Special International Niagara Board, in the form presented to this meeting.

UNITED STATES OF AMERICA }
 STATE OF NEW YORK } ss.
 COUNTY OF NIAGARA }

I, Frederick L. Lovelace, Secretary of The Niagara Falls Power Company, do hereby certify the foregoing is a true copy of a resolution duly adopted by the Board of Directors of the said Company at a regular stated meeting of the said Board, duly noticed for and held at the city of Buffalo, New York, on the 30th day of March, 1928, at which meeting a quorum was present and acted. I do further certify that the document hereto attached is the joint offer referred to in said resolution and is in the form presented to the said meeting of the Board of Directors.

IN WITNESS WHEREOF, I have hereunto subscribed my name and set the Corporate Seal of the said The Niagara Falls Power Company.

(Sgd.) FREDERICK L. LOVELACE,
Secretary.

STATE OF NEW YORK }
 COUNTY OF NIAGARA } ss.

Benjamin Klopp, a duly appointed and acting Notary Public for and in the county of Niagara and State of New York, hereby certifies that he has compared the within copy of letter dated the 9th day of April, 1928, addressed to the Special International Niagara Board signed by Paul A. Schoellkopf, President, for The Niagara Falls Power Company, and by Charles A. Magrath, Chairman, for the Hydro-Electric Power Commission of Ontario, with the original thereof and that the within copy of letter is in all respects a true copy of said original and of the whole thereof.

(Signed) BENJAMIN KLOPP,
Notary Public, Niagara County, N.Y.

III

PRESERVATION OF NIAGARA FALLS—PROPOSED REMEDIAL WORKS

DESCRIPTION AND ESTIMATES OF COST

GENERAL DESCRIPTION

It is proposed to restore the scenic effect of the American and Horseshoe Falls by the construction of the remedial works shown on the attached drawings, marked A, B and C. The works are designed to cover the crest of the Horseshoe Falls with water at the American and Canadian ends and to increase the flow of water over the American Falls and in the channel between Goat Island and the American shore.

Drawing A is a detail map showing the Horseshoe Falls and vicinity, on which has been drawn a plan of the works proposed to be constructed at the two extremities of the Horseshoe.

On the American side, a cofferdam will be built commencing at a point on Goat Island about 1,100 feet upstream from Terrapin Point and will be extended out into the river, in a direction at an angle of about 45 degrees to the shore line, for a distance of about 400 feet. At that point the cofferdam will be extended downstream for a distance of about 150 feet. This cofferdam will unwater the bed of the river below it and a section of the crest of the Horseshoe Falls for a distance of about 600 or 700 feet from Terrapin Point. Within the area thus unwatered, the bed of the river will be excavated to the extent and depths to be determined by the Niagara Control Board and one or more submerged masonry weirs will be built approximately in the positions shown on the drawing. The areas crosshatched indicate approximately the extent of the excavation, and the dotted lines the length and position of the weirs. The depth of the excavation will not exceed 3 or 4 feet.

The cofferdam will be constructed of timber cribs, or of timber cribs and stop logs, as shown on drawing C, in such a manner that the stop logs or portions of the cribwork may be removed and the water allowed to flow over the unwatered area so that the effect of the works may be observed before the cofferdams shall be removed. It is intended that the submerged masonry weirs will deflect some of the water from its natural channel and the excavated areas will cause a sufficient quantity of water to flow close to the shore of Goat Island and over the crest of the Falls in the vicinity of Terrapin Point. If the observed effect is not all that may be desired, the stop logs or cribwork can be replaced and such additional work done as may be necessary.

On the Canadian side, a cofferdam will be built commencing at a point just below the intake to the forebay of the Canadian Niagara Power Company's plant and will be extended out into the river in a direction about 45° to the shore line for a distance of about 300 feet. At that point the cofferdam will be turned downstream for a distance of about 400 feet. This cofferdam will unwater the bed of the river below it and a section of the crest of the Horseshoe Falls for a distance of about 400 feet from its extremity at the Canadian shore. Within this area excavations will be made and submerged weirs built, as directed by the Board, in the same manner as that described above to be done on the American side. The crosshatched areas and dotted lines indicate approximately the areas to be excavated and the length and position of the weirs to be built. It is intended that the effect of these works will be to cover the Canadian end of the Horseshoe with a sufficient quantity of water.

Drawing B is a general location map showing the position of the works above described and also the position of a submerged weir which it is proposed to build in the Chippewa-Grass Island Pool for the purpose of raising the level of the pool so as to increase the flow of water down the American channel and over the American Falls. This weir is to be located about 1,700 feet upstream from the intake to the plant of the Ontario Power Company and will extend out into the river for a distance of about 2,200 feet. It is designed to be built of loose rock fill, as shown on drawing C. Two methods for its construction are indicated; the one to be used where the bed of the river is hardpan, and the other where the bed is solid rock. It is intended that the weir will raise the standard low water level of the Chippewa-Grass Island Pool approximately one foot, which will be sufficient to increase the flow over the American Falls by about 2,500 to 3,000 cubic feet per second.

Changes in designs and methods of construction to suit field conditions may be made as the work proceeds.

Estimates of cost of the proposed works are attached hereto.

ESTIMATED COST OF PROPOSED REMEDIAL WORKS AT THE FLANKS OF THE HORSESHOE FALLS

COMBINED SUMMARY		
	American Side	Canadian Side
Rental of construction equipment.. . . .	\$ 34,500	\$ 34,500
Construction houses and road.. . . .	5,000	5,000
Repairing and maintaining roads.. . . .	10,000	5,000
Excavation.. . . .	48,000	22,500
Submerged weir.. . . .	15,000	5,300
Cofferdam.. . . .	49,000	56,000
Total.. . . .	\$161,500	\$128,300
Contingencies.. . . .	24,300	19,200
Engineering, superintendence and overhead.. . . .	16,200	12,800
Insurance.. . . .	8,100	6,400
Contractor's profits.. . . .	20,000	16,000
	\$230,100	\$182,700
Construction interest.. . . .	4,600	3,700
Total cost.. . . .	234,700	\$186,400

PROPOSED REMEDIAL WORKS—ESTIMATED COST OF SUBMERGED WEIR IN CHIPPAWA-GRASS ISLAND POOL

COMPARATIVE SUMMARY		
	Rock Bottom	Hard pan Bottom
Plant rental.. . . .	\$ 84,600	\$ 83,000
Stone delivered at site.. . . .	150,000	150,000
Construction roadway.. . . .	10,000	10,000
Construction houses and plant erection.. . . .	10,000	10,000
Steel trestle.. . . .	112,000
Labour installing trestle.. . . .	37,000
Pile bents..	28,000
Stringers, decking and trackwork..	24,000
Decking and trackwork.. . . .	16,000
Precast concrete block anchors.. . . .	25,000	25,000
Removing trestle.. . . .	25,000	15,000
Placing stone in weir.. . . .	45,000	45,000
Total.. . . .	\$514,600	\$390,000
Contingencies.. . . .	77,300	58,500
Engineering, superintendence and overhead.. . . .	51,500	39,000
Insurance.. . . .	25,800	19,500
Contractor's profits.. . . .	50,000	40,000
	\$719,200	\$547,000
Construction interest.. . . .	21,500	16,400
Total cost.. . . .	\$740,700	\$563,400

ESTIMATED COST OF PROPOSED REMEDIAL WORKS ON AMERICAN
FLANK OF HORSESHOE FALLS

SUMMARY

1. Rental of construction equipment.. . . .	\$ 34,500
2. Construction houses and road.. . . .	5,000
3. Repairing and maintaining roads.. . . .	10,000
4. Excavation 9,600 yards at \$5.. . . .	48,000
5. Submerged weir (340 feet long), 660 yards at \$22.. . . .	15,000
6. Cofferdam, 650 feet at \$75.. . . .	49,000
Total.. . . .	\$161,500
Contingencies at 15 per cent.. . . .	24,300
Engineering, superintendence and overhead at 10 per cent.. . . .	16,200
Insurance, 5 per cent.. . . .	8,100
Contractor's profit.. . . .	20,000
	\$230,100
Construction interest, 2 per cent.. . . .	4,600
Total cost.. . . .	\$234,700

DETAILS

<i>1. Construction Equipment Rental</i>		
1 20-ton locomotive crane.. . . .	\$ 30	
6 drills at \$10.. . . .	60	
1 compressor at \$25.. . . .	25	
1 $\frac{3}{4}$ -yard shovel.. . . .	35	
6 trucks at \$15.. . . .	90	
Fuel and supplies.. . . .	25	
130 days at \$265.. . . .		\$ 34,500
<i>2. Construction Houses and Road.. . . .</i>		
	\$ 5,000	5,000
<i>3. Repairing and Maintaining Roads.. . . .</i>		
	10,000	10,000
<i>4. Excavation—</i>		
Area to be covered, 130,000 sq. ft. Approx.		
average depth to be excavated, 2 feet.		
Total excavation, $\frac{130,000 \times 2}{27} = 9,600$ yds.		
9,600 yds. at \$5.. . . .	48,000	48,000
<i>5. Submerged Weir—</i>		
Length, 340 ft.; width, 12 ft.; height, 5 ft.		
Volume, 2 yds. per lin. ft.		
Total volume, $340 \times 2 = 680$ yds.		
680 yds. at \$22.. . . .	15,000	15,000
<i>6. Cofferdam—</i>		
Length.. . . .	650 feet	
Average depth of water.. . . .	$3\frac{1}{2}$ feet	
Average height of cofferdam.. . . .	$8\frac{1}{2}$ feet	
Average cost per lin. ft., \$75.		
$650 \times \$75 = \$48,750$		
say, \$49,000.		

ESTIMATED COST OF PROPOSED REMEDIAL WORKS ON CANADIAN
FLANK OF HORSESHOE FALLS

SUMMARY

1. Rental of construction equipment.. . . .	\$ 34,500
2. Construction houses, etc..	5,000
3. Repairing and maintaining roads.. . . .	5,000
4. Excavation, 4,500 yds. at \$5.. . . .	22,500
5. Cofferdam construction, 700 ft. at \$80.. . . .	56,000
6. Submerged weir (120 ft. long), 240 yds. at \$22.. . . .	5,300
Total.. . . .	\$128,300
Contingencies, at 15 per cent.. . . .	19,200
Engineering, superintendence and overhead at 10 per cent.. . . .	12,800
Insurance, 5 per cent.. . . .	6,400
Contractor's profits.. . . .	16,000
	\$182,700
Construction interest, 2 per cent.. . . .	3,700
Total cost.. . . .	\$186,400

DETAILS

1. Rental of Construction Equipment—		
1—20 ton locomotive crane at \$30.. . . .	\$ 30	
1— $\frac{1}{2}$ yd. shovel.. . . .	35	
6—trucks at \$15.. . . .	90	
6—drills at \$10.. . . .	60	
1—compressor.. . . .	25	
Fuel and supplies.. . . .	25	
130 days at.. . . .	\$265	\$34,500
2. Construction Houses.. . . .	5,000	5,000
3. Repairing and Maintaining Roads.. . . .	5,000	5,000
4. Excavation—		
Area to be covered—		
Around crest.. . . . 30,000 sq. ft. x 2=60,000 cu. ft.		
Shoal at crest.. . . . 6,000 sq. ft. x 2=12,000 cu. ft.		
First cascade.. . . . 10,000 sq. ft. x 3=30,000 cu. ft.		
Miscellaneous.. . . . 20,000 cu. ft.		
	122,000 cu. ft.	
122,000		
—=4,500 yds.		
27	4,500 yds. at \$5.. . . .	22,500
5. Cofferdam—		
Length.. . . .	700 feet	
Average depth of water.. . . .	4 $\frac{1}{2}$ feet	
Average height of cofferdam.. . . .	9 $\frac{1}{2}$ feet	
Average cost per lin. ft.. . . .	\$80	
	700 x 80=\$56,000	
6. Submerged Weir—		
Length.. . . .	120 ft.	
Width.. . . .	12 ft. 0 in.	
Height.. . . .	5 ft. 0 in.	
Volume.. . . .	2 yds. per lin. ft.	
	120 x 2=240 cu. yds.	
	240 cu yds. at \$22=\$5,300	

**PROPOSED REMEDIAL WORKS—ESTIMATED COST OF SUBMERGED
WEIR IN CHIPPEWA-GRASS ISLAND POOL ROCK BOTTOM**

SUMMARY

Plant rental.. . . .	\$ 8,600
Stone delivered at site 30,000 yards at \$5.. . . .	150,000
Construction roadway at site.. . . .	10,000
Construction houses and plant erection.. . . .	10,000
Steel trestle 2,800,000 pounds at 4 cents.. . . .	112,000
Labour installing trestle.. . . .	37,000
Decking and track work 2,000 feet at \$8.. . . .	16,000
Precast concrete block anchors for rock fill.. . . .	25,000
Removing trestle.. . . .	25,000
Placing stone in weir 30,000 yards at \$1.50.. . . .	45,000
Total.. . . .	\$514,600
Contingencies at 15 per cent.. . . .	77,300
Engineering, Superintendence and Overhead at 10 per cent.. . . .	51,500
Insurance at 5 per cent.. . . .	25,800
Contractor's Profits.. . . .	50,000
	719,200
Construction Interest at 3 per cent.. . . .	21,500
Total Cost.. . . .	\$740,700

DETAILS

Construction Equipment Rental

Six trucks at \$15.. . . .	\$ 90
One 20-ton locomotive crane.. . . .	30
One 40-ton locomotive crane.. . . .	60
Eight dump cars at \$10.. . . .	80
Electric light plant.. . . .	25
Two derricks.. . . .	20
One 1-yd. shovel.. . . .	50
Ten skips.. . . .	30
One compressor.. . . .	35
Fuel and supplies.. . . .	50
One hundred and eighty days at.. . . .	\$470
	\$84,600

PROPOSED REMEDIAL WORKS—ESTIMATED COST OF SUBMERGED
WEIR IN CHIPPEWA-GRASS ISLAND POOL HARD PAN BOTTOM

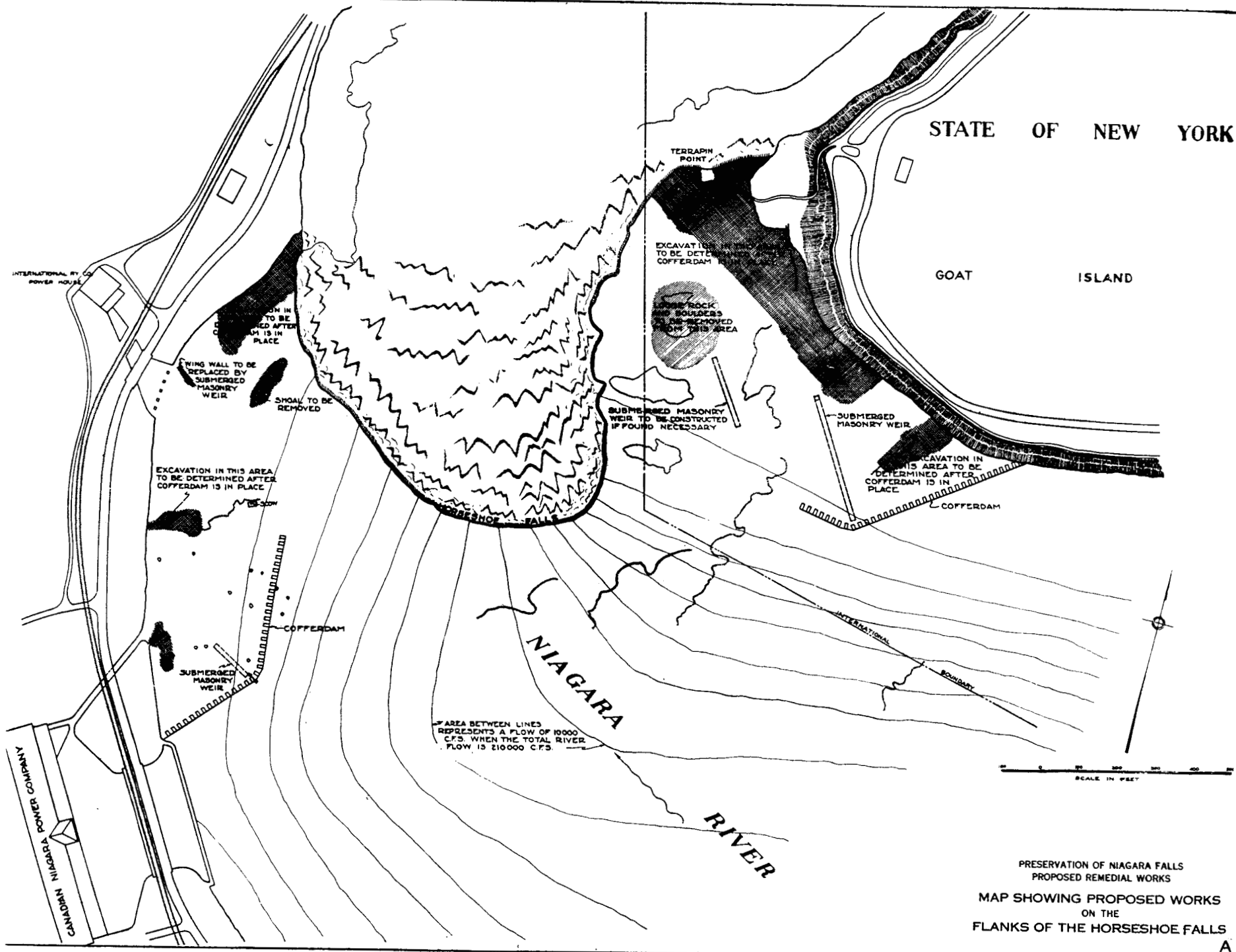
SUMMARY

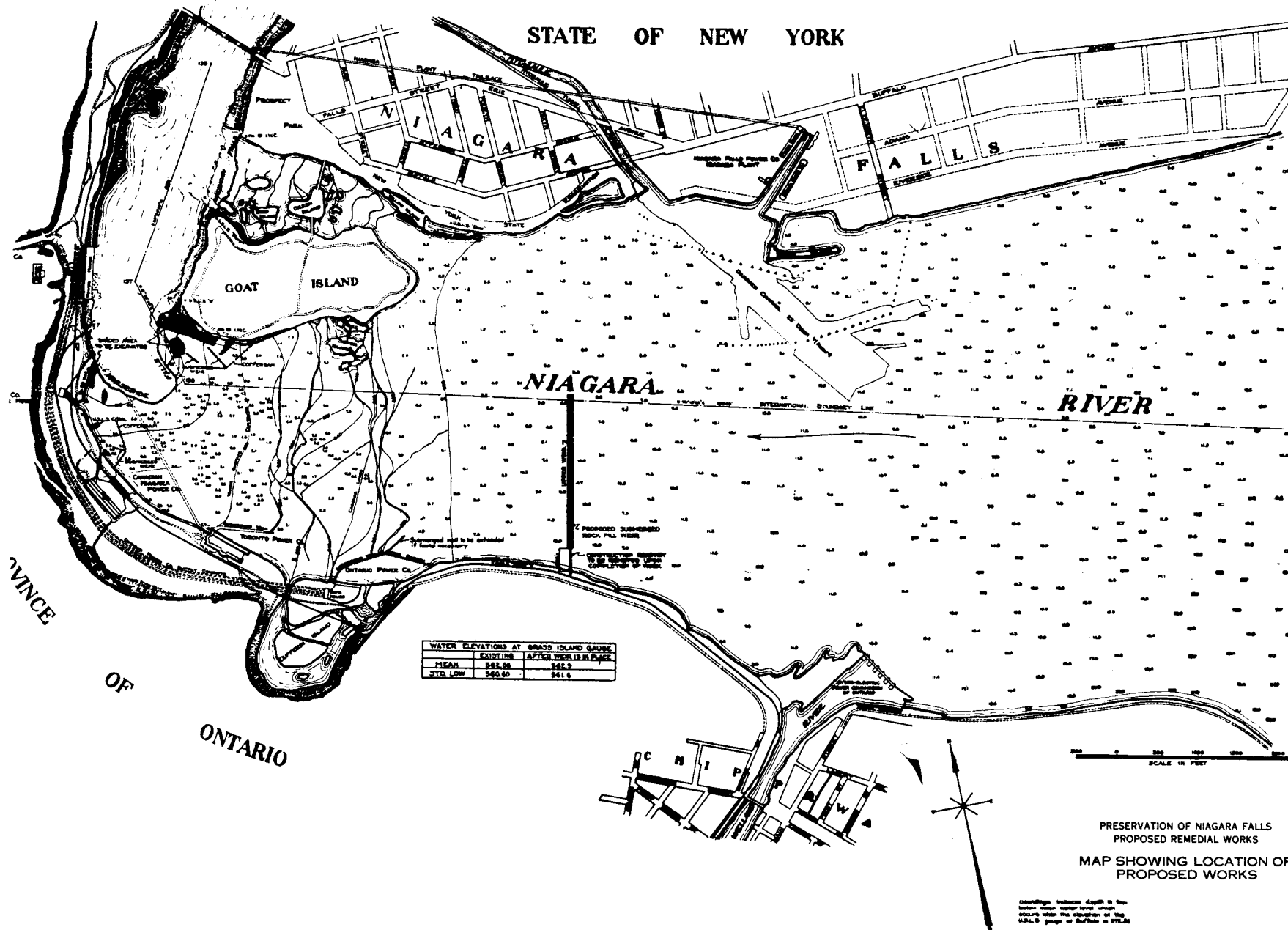
1. Plant rental..	\$ 83,000
2. Stone delivered at site 30,000 yards at \$5..	150,000
3. Construction roadway at site..	10,000
4. Construction houses and plant erection..	10,000
5. Pile bents in place 140 at \$200..	28,000
6. Stringers, decking and trackwork 2,000 feet at \$12..	24,000
7. Precast concrete block anchors for rock fill..	25,000
8. Removal of trestle..	15,000
9. Placing stone in weir 30,000 yards at \$1.50..	45,000
Total..	\$390,000
Contingencies at 15 per cent..	58,500
Engineering, Superintendence and Overhead at 10 per cent..	39,000
Insurance at 5 per cent..	19,500
Contractor's Profits..	40,000
	547,000
Construction Interest 3 per cent..	16,400
Total Cost..	\$563,400

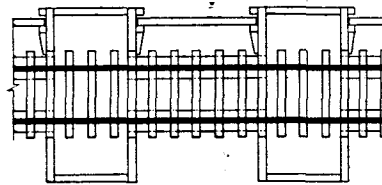
DETAILS

Construction Equipment Rental

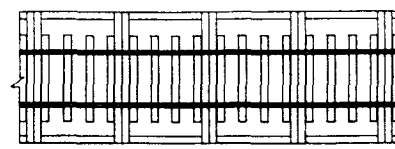
Six trucks at \$15..	\$ 90
Two 20-ton locomotive cranes at \$30..	60
Eight dump cars at \$10..	80
Electric light plant..	25
Two derricks at \$10..	20
One yard shovel..	50
Ten skips at \$3..	30
One compressor..	35
One air hammer pile driver..	20
Fuel and supplies..	50
One hundred and eighty days at..	\$460
	\$83,000







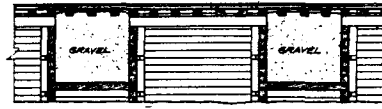
PLAN OF COFFERDAM
STOP LOG TYPE



PLAN OF COFFERDAM
CRIB TYPE



TYPICAL SECTION OF COFFERDAM



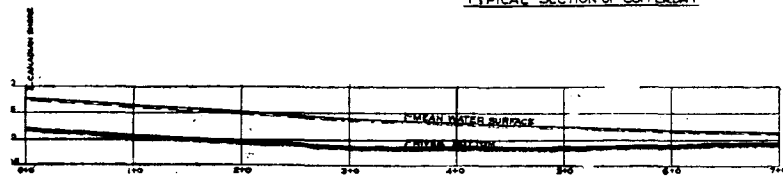
ELEVATION OF COFFERDAM



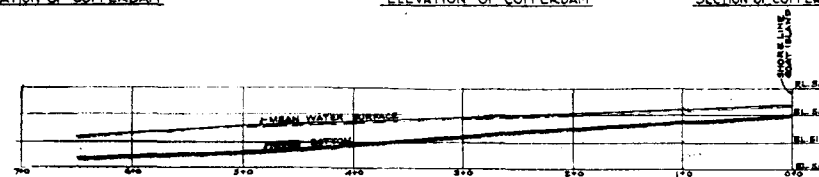
ELEVATION OF COFFERDAM



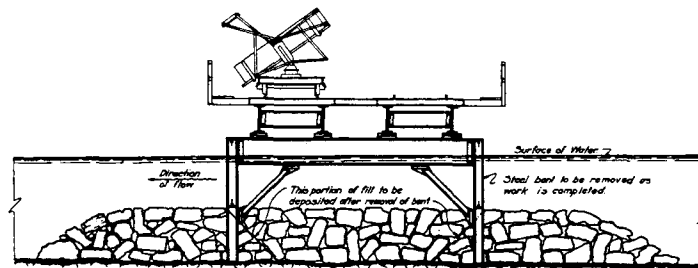
SECTION OF COFFERDAM



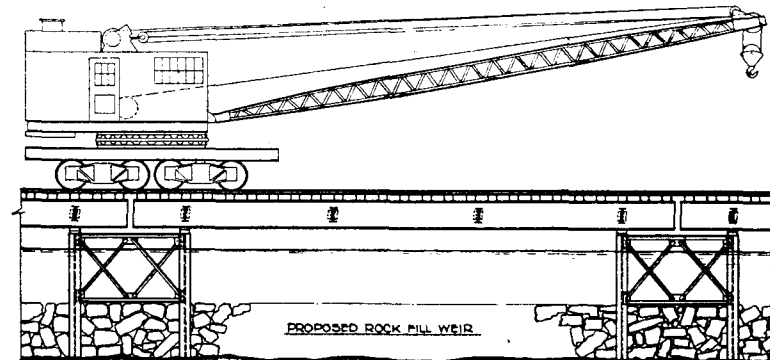
APPROXIMATE PROFILE ON SITE OF COFFERDAM
CANADIAN PLANK OF HORSESHOE FALLS
SCALE (HOR. 1"=50'
VER. 1"=10')



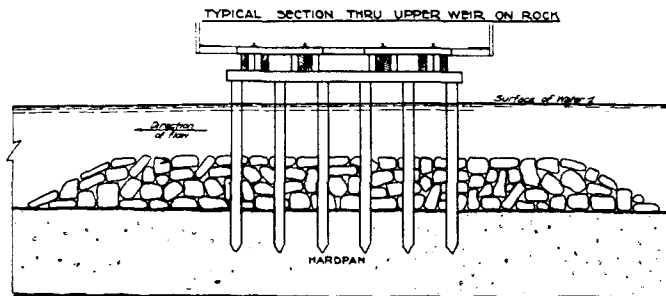
APPROXIMATE PROFILE ON SITE OF COFFERDAM
AMERICAN PLANK OF HORSESHOE FALLS
SCALE (HOR. 1"=50'
VER. 1"=10')



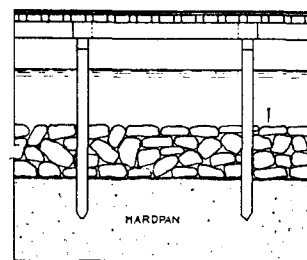
TYPICAL SECTION THRU UPPER WEIR ON ROCK



LONGITUDINAL SECTION OF UPPER WEIR ON ROCK



TYPICAL SECTION THRU UPPER WEIR ON HARDPAN



LONGITUDINAL SECTION OF UPPER WEIR ON HARDPAN

SCALE IN FEET
0 5 10 15 20

PRESERVATION OF NIAGARA FALLS
PROPOSED REMEDIAL WORKS
TYPICAL SECTIONS OF
PROPOSED COFFERDAMS AND
SUBMERGED ROCKFILL WEIR