

**CIHM  
Microfiche  
Series  
(Monographs)**

**ICMH  
Collection de  
microfiches  
(monographies)**



**Canadian Institute for Historical Microreproductions / Institut canadien de microreproductions historiques**

**© 1995**

Technical and Bibliographic Notes / Notes techniques et bibliographiques

The Institute has attempted to obtain the best original copy available for filming. Features of this copy which may be bibliographically unique, which may alter any of the images in the reproduction, or which may significantly change the usual method of filming, are checked below.

L'Institut a microfilmé le meilleur exemplaire qu'il lui a été possible de se procurer. Les détails de cet exemplaire qui sont peut-être uniques du point de vue bibliographique, qui peuvent modifier une image reproduite, ou qui peuvent exiger une modification dans la méthode normale de filmage sont indiqués ci-dessous.

Coloured covers/  
Couverture de couleur

Covers damaged/  
Couverture endommagée

Covers restored and/or laminated/  
Couverture restaurée et/ou pelliculée

Cover title missing/  
Le titre de couverture manque

Coloured maps/  
Cartes géographiques en couleur

Coloured ink (i.e. other than blue or black)/  
Encre de couleur (i.e. autre que bleue ou noire)

Coloured plates and/or illustrations/  
Planches et/ou illustrations en couleur

Bound with other material/  
Relié avec d'autres documents

Tight binding may cause shadows or distortion along interior margin/  
La reliure serrée peut causer de l'ombre ou de la distorsion le long de la marge intérieure

Blank leaves added during restoration may appear within the text. Whenever possible, these have been omitted from filming/  
Il se peut que certaines pages blanches ajoutées lors d'une restauration apparaissent dans le texte, mais, lorsque cela était possible, ces pages n'ont pas été filmées.

Additional comments:/  
Commentaires supplémentaires:

Coloured pages/  
Pages de couleur

Pages damaged/  
Pages endommagées

Pages restored and/or laminated/  
Pages restaurées et/ou pelliculées

Pages discoloured, stained or foxed/  
Pages décolorées, tachetées ou piquées

Pages detached/  
Pages détachées

Showthrough/  
Transparence

Quality of print varies/  
Qualité inégale de l'impression

Continuous pagination/  
Pagination continue

Includes index(es)/  
Comprend un (des) index

Title on header taken from:/  
Le titre de l'en-tête provient:

Title page of issue/  
Page de titre de la livraison

Caption of issue/  
Titre de départ de la livraison

Masthead/  
Générique (périodiques) de la livraison

This item is filmed at the reduction ratio checked below/  
Ce document est filmé au taux de réduction indiqué ci-dessous.

10X	14X	18X	22X	26X	30X
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
12X	16X	20X	24X	28X	32X

The copy filmed here has been reproduced thanks to the generosity of:

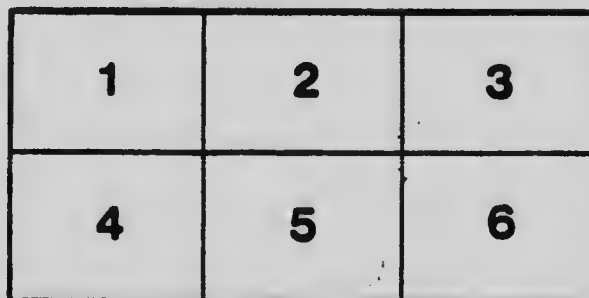
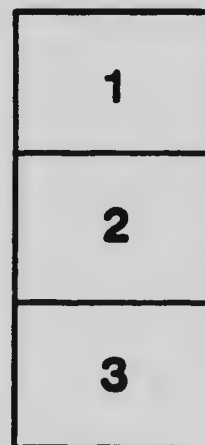
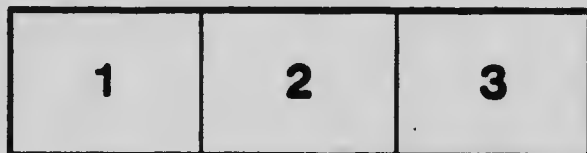
Metropolitan Toronto Reference Library  
Science and Technology Department

The images appearing here are the best quality possible considering the condition and legibility of the original copy and in keeping with the filming contract specifications.

Original copies in printed paper covers are filmed beginning with the front cover and ending on the last page with a printed or illustrated impression, or the back cover when appropriate. All other original copies are filmed beginning on the first page with a printed or illustrated impression, and ending on the last page with a printed or illustrated impression.

The last recorded frame on each microfiche shall contain the symbol  $\rightarrow$  (meaning "CONTINUED"), or the symbol  $\nabla$  (meaning "END"), whichever applies.

Maps, plates, charts, etc., may be filmed at different reduction ratios. Those too large to be entirely included in one exposure are filmed beginning in the upper left hand corner, left to right and top to bottom, as many frames as required. The following diagrams illustrate the method:



L'exemplaire filmé fut reproduit grâce à la générosité de:

Metropolitan Toronto Reference Library  
Science and Technology Department

Les images suivantes ont été reproduites avec le plus grand soin, compte tenu de la condition et de la netteté de l'exemplaire filmé, et en conformité avec les conditions du contrat de filmage.

Les exemplaires originaux dont la couverture en papier est imprimée sont filmés en commençant par le premier plat et en terminant soit par la dernière page qui comporte une empreinte d'impression ou d'illustration, soit par le second plat, selon le cas. Tous les autres exemplaires originaux sont filmés en commençant par la première page qui comporte une empreinte d'impression ou d'illustration et en terminant par la dernière page qui comporte une telle empreinte.

Un des symboles suivants apparaîtra sur la dernière image de chaque microfiche, selon le cas: le symbole  $\rightarrow$  signifie "A SUIVRE", le symbole  $\nabla$  signifie "FIN".

Les cartes, planches, tableaux, etc., peuvent être filmés à des taux de réduction différents. Lorsque le document est trop grand pour être reproduit en un seul cliché, il est filmé à partir de l'angle supérieur gauche, de gauche à droite, et de haut en bas, en prenant le nombre d'images nécessaire. Les diagrammes suivants illustrent la méthode.

17

# Progress on Queenston-Chippawa Power Canal

---

Reprint from *The Canadian Engineer*  
September 16th, 1920, issue

---

# Pro

**R**EVIEW  
 Pow  
 the Queer  
 are as fo  
 completed  
 sary for  
 house si  
 power-ho  
 been stat  
 tion railw  
 to the po  
 been buil  
 tion; and  
 crete arc  
 the cana  
 structured.

Since  
 August 2  
 last artic  
*Engineer*  
 was bein  
 developmen  
 lion doll  
 dditional  
 ment ha  
 all of w  
 on the j  
 that exc  
 coming  
 proceed a  
 Labor tr  
 appear t  
 fered gre  
 this year  
 being ca  
 last spri  
 which th  
 pletely s  
 two mo  
 much  
 being pa  
 housed in  
 tain am  
 lost in  
 ganizatio  
 tivities  
 it is on  
 few wee  
 force ha  
 mal effi  
 it is c  
 that pow  
 from the  
 take car

At  
 whom a  
 carried  
 labor ex  
 days a  
 for pum  
 of a con

At  
 the cana  
 piling is  
 deepenin

## Progress on Queenston-Chippawa Power Canal

**Nearly Seven Million Cubic Yards of Excavation Completed—Forebay Ready to be Lined—Power House Excavation Nearing Tailwater Level—Plant and Methods to be Used for Concreting Walls and Floor of Canal—New Construction Equipment Purchased—Complete Development to Total Half Million Horse-Power**

**R**EVIEWING the progress made by the Hydro-Electric Power Commission of Ontario in the construction of the Queenston-Chippawa power canal, the outstanding items are as follows: The excavation for the forebay has been completed; approximately half of the total excavation necessary for the entire work has been completed; the power-house site has been cleared and excavation for the power-house foundations has been started; the construction railway from Queenston to the power-house site has been built and is in operation; and three of the concrete arch bridges spanning the canal have been constructed.

Since the publication (on August 28th, 1919), of the last article in *The Canadian Engineer* on the progress that was being made on this development, nearly two million dollars' worth of additional construction equipment has been purchased, all of which will soon be on the job, with the result that excavation during the coming twelve months will proceed at accelerated speed. Labor troubles, which now appear to be settled, interfered greatly with the work this year, strike after strike being called by the unions last spring, as a result of which the work was completely shut down for nearly two months this summer, much of the machinery being partly dismantled and housed in. Necessarily a certain amount of time was lost in perfecting the organization again when activities were resumed, and it is only within the last few weeks that the working force has recovered its normal efficiency. Nevertheless, it is confidently expected that power will be delivered from the Queenston plant before the end of 1921, in time to take care of the Toronto Street Railway load.

At present there are over 3,000 men on the payroll, of whom approximately 2,400 report for work daily. Work is carried on in two 10-hr. shifts, 6 days a week, for outside labor excepting pump-runners, and in three 8-hr. shifts, 6 days a week, for machine-shop and other inside labor, and for pump-running and other outside labor that is necessarily of a continuous nature.

At the intake, near Chippawa (see page 354 for plan of the canal), dredging is in progress at 1,200 lin. ft. of sheet piling is being driven at the rate of 50 ft. per day. The deepening and widening of the Welland River is still being

carried on by means of the cableway excavator. About 750,000 cu. yds. of earth have been moved from the Welland River section of the canal, but another 1,250,000 cu. yd. must be excavated before the river channel will be satisfactory for a flow of 6,500 c.f.s., which will drive the first four 750-h.p. units in the Queenston power-house. Additional work in further enlarging the Welland River channel can be accomplished without difficulty after the first four units are in operation; but the canal from the control works at Montrose to the power house at Queenston must be excavated, lined and built complete to its full and final capacity before any water can be turned into the canal prism. The work of widening the Welland River has been done wholly on the north side of the river for its entire length of 4½ mi. from the intake to Montrose. The river is now being dredged to a depth of 30 ft. below low-water level.

Two new bridges must be built across the Welland River on account of the increase in width of that stream. One will be a highway bridge and the other a railway bridge (Michigan Central R'y.) The substructure for the highway bridge is complete and awaiting the steel for the superstructure, which is being fabricated by the Hamilton Bridge Co. As the Welland is a navigable river, this bridge will be a bascule, of Strauss type, with 90-ft. clear span.

The M.C.R. bridge will be a swing span. Used steel was purchased for this superstructure, and the necessary alterations are now being made in the shops of the Hamilton Bridge Co.

The substructure for this bridge is nearly finished, and as soon as the steel is received it will be erected so that the railway can abandon its present temporary diversion.

It can be noted from the profile of the canal (see page 534) that the original ground line along the canal route is below El. 565 for several hundred feet north of the Welland River. The mean level of the river is approximately 560. The canal will be excavated from the north up to the 565 contour line, and the control works will be built before the berm between the river and the 565 contour line is removed, which will be done by dredging from the river side of the berm. Construction of the control works has not yet been started, but they will probably consist of Stoney sluice gates,

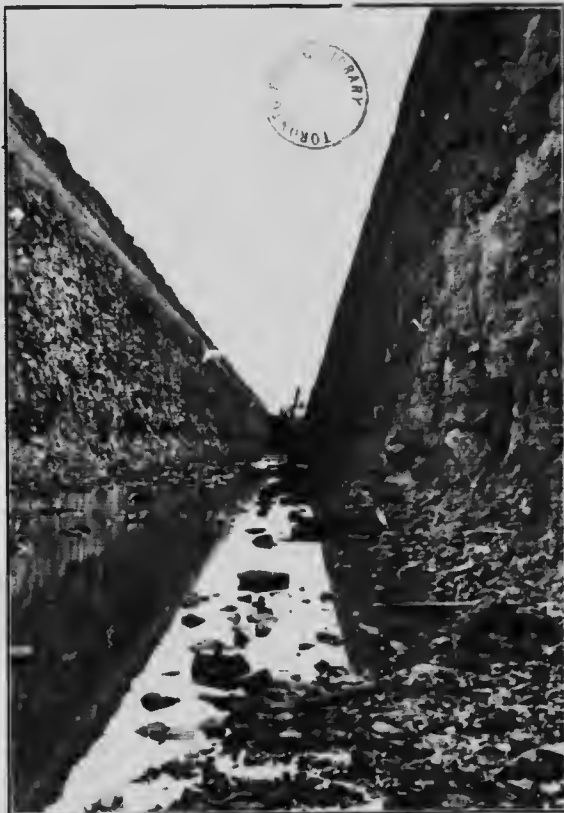


FIG. 1—TYPICAL ROCK CUT, QUEENSTON-CHIPPAWA CANAL

The control works will be at Sta. 66, where the trapezoidal earth section will end and the rectangular rock section will begin.

As previously stated, the excavation for the forebay has been completed. The situation as regards the excavation of the canal from the Welland River to the forebay is as follows:—

From Sta. 273 to the forebay the excavation is complete, excepting about 350,000 cu. yd. of rock. Some of this is between Sta. 273 and Sta. 286, and a smaller amount between Sta. 324 and Sta. 332, but a large part of it is between Sta. 350 and Sta. 390. The top lift (10 ft.) is off, however, on those three sections, and shovel No. 1 is at Sta. 395, going south on the second lift.

The earth excavation for the trapezoidal section at the Whirlpool Gully is nearly finished, and the fill at the Whirlpool is complete, excepting for trimming and the concrete-slab lining, which will be one of the last pieces of construction to be started, so as to allow as long a time as possible

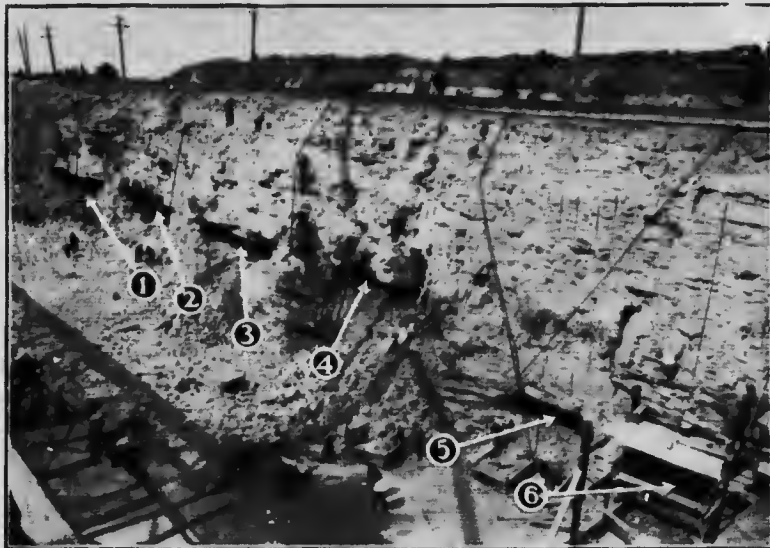


FIG. 2.—VIEW SHOWING TUNNEL PORTALS AT FOREBAY

1, 2, 3 and 4—Portals for penstocks. 5—Portal for service penstocks. 6—Portal for ice chute.

for the fill to settle. The slabs that will protect the slopes through the fill will be 4 ft. thick and well reinforced.

From Sta. 273 to Sta. 215 the overburden has been entirely removed, with the exception of approximately 100,000 cu. yd., but the rock work there is just starting. Shovel No. 9 is working south from Sta. 273, and the first lift is being drilled and blasted ahead of it. The high ridge at Sta. 240 was cut through when it was reached by the shovels that were removing the overburden.

At Sta. 215 shovel No. 8 is working south, while shovel No. 2 is cleaning up between Sta. 273 and Sta. 215, and will follow No. 8 to clean up.

From Sta. 210 to Sta. 170 two pilot cuts have already been made, and shovel No. 3 is now taking out the third and will continue until No. 8 catches up to it.

From Sta. 170 to Sta. 108 the overburden has been removed to an elevation varying from 8 to 40 ft. above rock surface. Another 80,000 cu. yd. must be removed from between Sta. 170 and Sta. 108 before the grade throughout will be economical for the operation of a big shovel. Shovel No. 3 will remove this 80,000 cu. yd., when it moves south of Sta. 170, after No. 8 takes up the work between Sta. 210 and Sta. 170. This 80,000 cu. yd. is near Sta. 160.

From Sta. 108 to Sta. 80 only one pilot cut has been taken out.

From Sta. 80 to Sta. 28 three pilot cuts have been completed, but there are still 1,400,000 cu. yd. of earth to be removed.

From Sta. 28 to Sta. 11, a pilot cut was finished this summer, and shovel No. 7 is now working south from Sta. 28, digging its way down to an elevation from which it can excavate for the abutments for the Michigan Central Railway bridge at Sta. 11.

From Sta. 11 to Sta. 5 a pilot cut has been completed and shovel No. 10 is now working on the second cut. Approximately 28,000 cu. yd. have been removed from this part of the canal, with 190,000 cu. yd. yet to handle.

It will be noted that at least a pilot cut has been excavated for the entire length of the canal from Sta. 5 to the forebay.

There are now ten power shovels at work on the canal, and the above gives the location of seven of them. The other three are engaged as follows:—

Shovel No. 4 is excavating at the power-house site below the cliff; No. 5 is cleaning up behind the scaling mat which is working in the canal near the forebay; No. 6 is working on the construction railway between Queenston and the junction with the Michigan Central Railway.

All ten shovels were manufactured by the Bucyrus Co. Nos. 1, 2 and 8 are electrically driven, 400-ton shovels, with buckets of 8 cu. yd. capacity in earth and 6 cu. yd. in rock. Nos. 4, 7 and 9 are electrically driven, equipped with 4½-cu. yd. buckets (in earth). No. 5 is electrically driven, equipped with 7½-cu. yd. bucket and caterpillar traction. Nos. 3, 6 and 10 are steam driven, having buckets of 2 cu. yd., 1 cu. yd. and ¾ cu. yd. capacity, respectively; two of these have caterpillar traction. Two new shovels have been ordered (one Marion and one Bucyrus), each of the same type and capacity as shovel No. 1, but they will be steam driven, because the manufacturers were able to promise better delivery on steam-driven equipment. The Marion shovel has been delivered and is being set up.

It was estimated that the total earth excavation between the Welland River and the forebay amounted to approximately 9,000,000 cu. yd. Of this, 175,000 cu. yd. are in the berm between the Welland River and Sta. 5; and between Sta. 5 and the forebay, approximately 8,825,000 cu. yd., of which nearly 4,705,000 cu. yd. have been removed, leaving approximately 4,120,000 cu. yd. yet to handle, distributed approximately as follows:—

Between Sta.	5 and Sta.	11	190,000 cu. yd.
"	"	11	"
"	"	28	400,000 "
"	"	28	1,400,000 "
"	"	30	108 390,000 "
"	"	108	170 740,000 "
"	"	170	215 900,000 "
"	"	215	Forebay 100,000 "

It was estimated that 4,000,000 cu. yd. of rock had to be removed from the canal between the Welland River and the gate-house. Of this, approximately 1,500,000 cu. yd. have been removed from between Sta. 273 and the gate-house, leaving 2,500,000 cu. yd. of rock yet to be handled, of which 350,000 cu. yd. are between Sta. 273 and the forebay, the remainder being south of Sta. 273. Very little rock has been removed to date south of Sta. 273.

It has been decided to line the rock sections of the canal with concrete, of 6-in. minimum thickness, to a height of from 30 to 32 ft. Plain round ¾-in. bolts, 2 ft. 9 in. long

This  
and space  
concrete v  
into the r  
and will  
upper end

There  
side wall  
floor of t  
along the  
paved bef  
will be of  
mum thl  
pressions  
stone will

The  
done with  
which wil  
will be p  
account o  
and which  
ek sect  
e laid a  
ft. from





FIG. 3—VIEW OF FOREBAY FROM CLIFF ABOVE POWER-HOUSE SITE

This view is not panoramic, as it is three separate photographs taken from the same point, looking south, west and north. Note crushing plant at right.

and spaced at 4 ft. intervals in both directions, will hold the concrete wall to the rock. Each bolt will extend downward into the rock at an angle of about 30 deg. from horizontal, and will be grouted in; it will be bent up vertically at the upper end, which will be embedded in the concrete.

There will be three concreting plants at work on the side walls, while three or four other plants will pave the floor of the canal. With the exception of an 18-ft. strip along the centre line of the canal, the floor will be entirely paved before the adjoining side walls are poured. The floor will be of 2-in. minimum thickness, with 6-in. as the maximum thickness. Where the rock is so uneven that depressions of a greater depth than 6 in. must be filled, loose stone will be used up to within 6 in. of the top.

The floor will be screeded and floated. This will be done without any difficulty on account of the 18-ft. strip which will be left along the centre of the canal, and which will be paved after the side walls are constructed, and on account of the 2-ft. strip which will be left along each wall and which will be poured as a part of the wall. In the 48-ft. rock section, for example, two slabs, each 13 ft. wide, will be laid along the canal 18 ft. apart and approximately 2½ ft. from the rock wall on the side.



FIG. 4—SCALING TOWER IN ROCK CUT NEAR FOREBAY

Each of the plants for paving the floor of the canal will consist of a 1-yd paving mixer (with chute) mounted on a flat car. On this car there will also be an overhead bin to hold sand and crushed stone, and a cement platform. The cement will be chuted in bags to the platform from the con-



FIG. 5—SHOVEL No. 1 IN ROCK CUT

struction railway, and the sand and stone will also be chuted from specially arranged dump cars to the overhead bin. Supported upon the bin will be a frame-work that will carry the chute as a part of the concreting plant, so that the chute will move right along with the plant.

After the two parallel floor slabs are poured, a track will be laid along each of them, and upon this pair of tracks will run the concreting equipment for the construction of the side walls. Each of the three sets of equipment for the construction of the side walls will consist of two "batteries" of forms and one concreting plant. Each "battery" will be made up as follows:—

Two flat cars on each track will be bolted together and cross girders will bolt the cars on one track to the cars on the other track. Upon this portable structure will be erected a light steel tower, the top beams of which will overhang the lower portion of the structure and will span the canal prism from one wall to the other. From the end of these top beams will hang a steel frame-work to which will



be bolted steel plates which, together with the frame, will comprise the form. Jacks will be inserted at intervals between the tower and the frame, so that the frame can be adjusted in proper alignment, and so that it can be swung back toward the tower after the side walls have been poured and have set sufficiently to allow the forms to be moved to the next position further along the canal.

As each of these towers carries two sets of forms, one



Photo by McCarthy Aero Service, Ltd.

FIG. 6—AERIAL VIEW OF CANAL NEAR STA. 240

for each wall of the canal, the opposite sections of both walls can be poured at the same time. While one section is being poured, the walls that have been poured behind the forms of the other tower will be allowed to set, so the mixing plant will work first with one tower and then with the other, and will always be between the two towers.

The mixing plant and tower from which the concrete will be poured will be mounted on a flat-car substructure similar to that used for the form towers. The forms which will lead the way along the canal will have side plates to retain the concrete, but the second (or following) set of forms will not need side plates, as the walls will be poured in alternate 40-ft. lengths, and the second set of forms will be used only for pouring the intermediate 40-ft. sections.

At a height of 2 ft. above the floor of the canal each of the forms will be inclined at an angle of 45 deg. to meet the floor slab, thus forming the fillet that will join each

side wall to the floor. The panels comprising the forms will be 1½ by 3 ft., and will be fastened to the frame in such manner that any panel or panels can readily be removed to permit the insertion of the end of the chute, and for spading, etc.

The equipment for the concreting plants is being supplied by F. H. Hopkins & Co., Ltd., the forms being manufactured by the Hydraulic Pressed Steel Co. The towers will be equipped with chain blocks, supplied by the Herbert Morris Crane & Holst Co., Ltd., for swinging back the frames carrying the forms when it is desired to move ahead.

Drain-tile will be laid back of the concrete walls wherever there is any indication that it is likely to be required.

There will probably be approximately 150,000 cu. yd. of concrete in the side walls. While the minimum thickness of the walls is to be 6 in., the average thickness will be considerably more owing to the uneven rock surface. In order to make the rock surface as smooth as possible before concreting, a scaling tower is being used. This tower nearly fills the whole prism of the canal in the rock section, and is built upon trucks. It carries at each side a platform that can be raised and lowered, and upon which the scalers work. The scaling is done with hand air-tools, the air being supplied from the pipe lines which parallel the canal.

The forebay will also be lined, but it has not yet been decided whether to concrete it in the same manner as the canal prism or to "gunite" it.

During the past year the construction railway has been extended for the whole length of the canal on the west side as far as Sta. 11. There are 29 miles of main and yard lines; altogether, counting service lines, there are 65 miles of track.

A new disposal area is being used which is one mile south of Lundy's Lane, approximately opposite Sta. 110, and only one-half mile west of the canal. This new disposal area will accommodate approximately 2,000,000 cu. yd. of material. The original disposal area at St. David's, which is two miles west of the canal (approximately west of Sta. 320) is still being used to a certain extent. The St. David's disposal area is large enough to hold all of the material that has to be excavated from the whole canal, as it is estimated that if entirely filled it would hold 21,000,000 cu. yd.

At present, approximately 6,000 cu. yd. of rock are being taken out every day. At times as much as 2,000 cu. yd. per day, or 65,000 cu. yd. per month (measurement in place) are taken out by one shovel. The crusher plant has a capacity of 3,500 cu. yd. (loose measurement) per day. Last month 560,000 cu. yd. of material were moved from the canal prism, of which 90,000 cu. yd. were rock; and an additional 45,000 cu. yd. of material were dredged in the Welland River section. When all the new equipment that has been ordered is received, it is expected that the work will go ahead even faster than the splendid records that have been made in the past.

Among the new equipment that has been ordered are 60 "Western" dump cars of 20-cu. yd. capacity, 3 electric locomotives, 7 steam locomotives, 10 Ingersoll-Rand compressors of 1,000-cu. ft. capacity against 125 lb. pressure (for a new sub-station at Montrose), 2 Bucyrus spreaders of the latest and heaviest type, 2 London concrete mixers, 2 Ransome concrete mixers and a large number of pumps.

At the powerhouse site rapid progress is being made. The site has been entirely cleared and excavation for the



draft  
Niagar  
pleted  
junction  
ston w  
the ju  
arrive  
enough  
tioned  
that t  
casing  
have i  
ably b

At  
cliff f  
two se  
be nin  
portal

The  
constr  
Ontari  
Pope,

The  
projec  
the di

desig  
E  
missio





FIG. 7—N. S. & T. RAILWAY B.



FIG. 9—WABASH RAILWAY BRIDGE OVER CANAL

drift tubes and tailrace is down to the water level of the Niagara River. The construction of the railway has been completed as far as Queenston, and within another month a junction with the Michigan Central Railway east of Queenston will be effected. A small yard will be established near the junction for storing any heavy machinery that may arrive before power-house construction has proceeded far enough for its erection. In this connection it may be mentioned that orders have been placed for five turbines, and that two turbine runners have already been cast and one casing has been tested and is ready for shipment. Tenders have been received for the penstocks and contract will probably be let within the next two weeks.

At the forebay, portals have been excavated through the cliff for the penstocks for the first four units and for the two service penstocks and for the ice chute. As there will be nine units in the plant (totalling 495,000 maximum h.p.), portals must be excavated for five more penstocks.

The Queenston-Chippawa power development is being constructed by the Hydro-Electric Power Commission of Ontario, of which Hon. Sir Adam Beck is chairman; W. W. Pope, secretary; and Frederick J. Gaby, chief engineer.

The design and construction of the Queenston-Chippawa project, with the exception of the electrical work, are under the direction of the Commission's hydraulic department, of which Henry G. Acres is the hydraulic engineer; Thos. H. Gaby, assistant hydraulic engineer; and Maxwell V. Sauer, designing engineer.

E. T. Brandon is the electrical engineer of the Commission; and Arthur H. Hull, assistant electrical engineer.

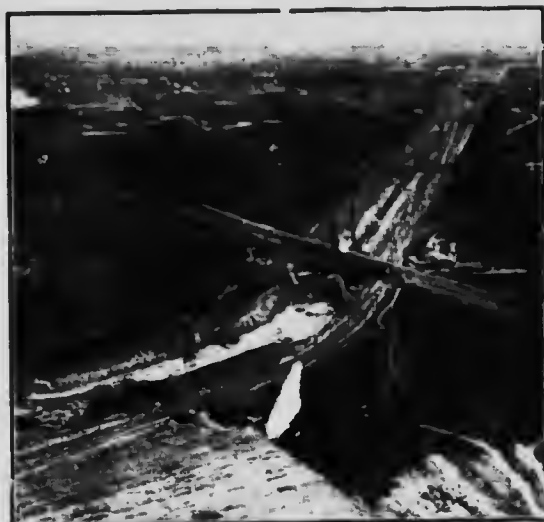


Photo by McCarthy Aero Service, Ltd.

Copyrighted.

FIG. 10—AERIAL VIEW OF CANAL NEAR STA. 320



FIG. 8—VIEW UP CANAL FROM FLOOR OF FOREBAY



FIG. 11—POWER-HOUSE SITE—VIEW FROM CLIFF

At Niagara Falls there is a large staff under the direction of J. B. Goodwin, works engineer, and of George Angell, general superintendent of construction. A. C. D. Blanchard is chief field engineer; Francis W. Clark, division engineer in charge of the intake, river section and canal; Walter Jackson, division engineer in charge of the forebay and powerhouse; and Rex. Johnson, office engineer.

The resident engineers are W. S. Orr, Division No. 1 (river section); C. H. McDougall, Division No. 2 (Welland

River to Sta. 235); and George S. Lowry, Division No. 3 (Sta. 235 to Sta. 438). Channel Anderson is superintendent of Division No. 1; F. W. Scriven, of Divisions Nos. 2 and 3; and W. L. LeRoy, of Division No. 4 (forebay, power-house and Queenston construction railway). Harold L. Bucke is superintendent of railway construction; R. T. Gent, plant engineer; P. Reid, mechanical superintendent; and F. I. Cooper, chief clerk.



FIG. 12—SHOVEL NO. 1 AT STA. 440



