PAGES

MISSING

The Canadian Engineer

A Weekly Paper for Civil Engineers and Contractors

Hydro-Electric Power Development at High Falls

Net Head of 80 ft. Utilized at Power Site on the Mississippi River by the Hydro-Electric Power Commission of Ontario—Details of Dam, Intake, Gate House, Pipe Line and Power House—Surface Area Method of Proportioning Materials Shows Excellent Results in Construction of Concrete Dam

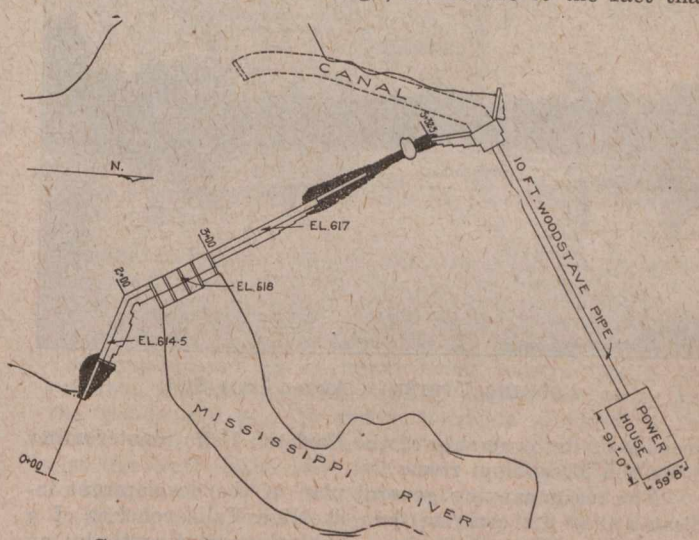
AT HIGH FALLS, on the Mississippi river, in the southern part of Lanark county, Ont., about 25 miles northeast of Perth and ½ mile above Dalhousie lake, the Hydro-Electric Power Commission of Ontario is developing a power site and installing hydro-electric machinery with total capacity of 3,600 h.p. This plant will be the fifteenth generating station to be owned by the "Hydro" Commission, and two others are also under construction, the Nipigon plant (see *The Canadian Engineer*, June 12th, 1919, issue) and the great Queenston undertaking (see the following issues of *The Canadian Engineer*: August 28th, 1919; November 21st, 1918; September 26th, 1918; and June 20th, 1918). The fourteen other plants owned by the "Hydro" are the following:—

Wasdell's Falls, Eugenia Falls, Nipissing Power Co., Erindale Power Co., Trenton, Campbellford, Frankford, Auburn, Fenelon Falls, Carleton Place, Ontario Power Co., Big Chute, Healy Falls and South Falls.

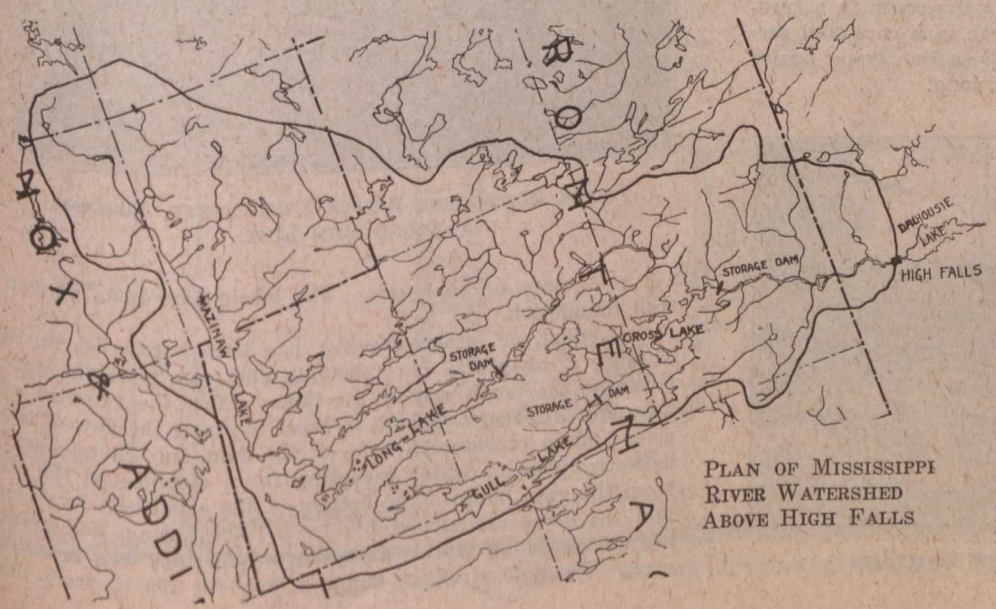
The first two mentioned—Wasdell's Falls and Eugenia Falls—were constructed by the "Hydro," but all of the others were purchased from the former private owners, although in the case of the four last-mentioned plants, the "Hydro" has built extensive additions.

The drainage area of the Mississippi river above High Falls is approximately 450 square miles. The first complete year for which run-off records were obtained by the "Hydro" was November, 1915, to November, 1916, for which twelve months the maximum run-off was 2,940 c.f.s., and the minimum 214 c.f.s., with a mean of 776 c.f.s., or a run-off depth of about 23 inches on the drainage area. For the following year, the maximum run-off was 2,060 c.f.s., the minimum 72 c.f.s., and the mean 426 c.f.s., or a run-off depth of about 12.8 inches on the drainage area. For the year November, 1917, to November, 1918, the maximum run-off was 2,530 c.f.s., the minimum 186 c.f.s., and the mean 499 c.f.s., or a run-off depth of about 15 inches on the drainage area. The watershed is still fairly well forested. The average run-off for the three years recorded was 567 c.f.s.

The plant that is being installed requires 540 c.f.s. when operated at maximum capacity. The water is used under 80 ft. net head. There are three horizontal, double-runner double-discharge hydraulic turbines; one of them is connected to a single generator, but each of the other two turbines drives a generator at each end of its shaft. This is not a matter of present design, but is due to the fact that practically all of the hydraulic and electrical machinery for this plant was purchased at a low price, as used equipment, from the Hannawa Falls Power Co., of Potsdam, N.Y.

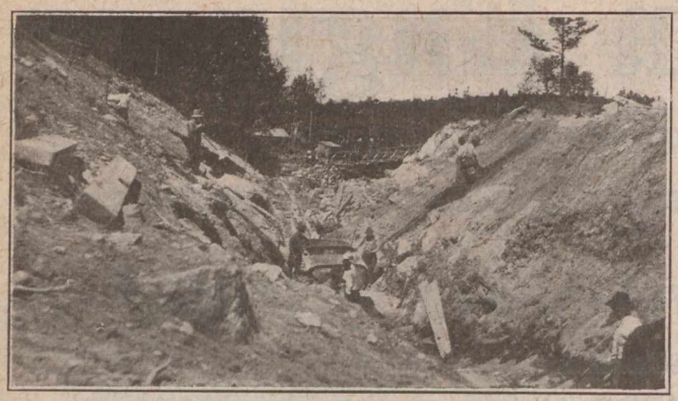


GENERAL PLAN OF HIGH FALLS DEVELOPMENT



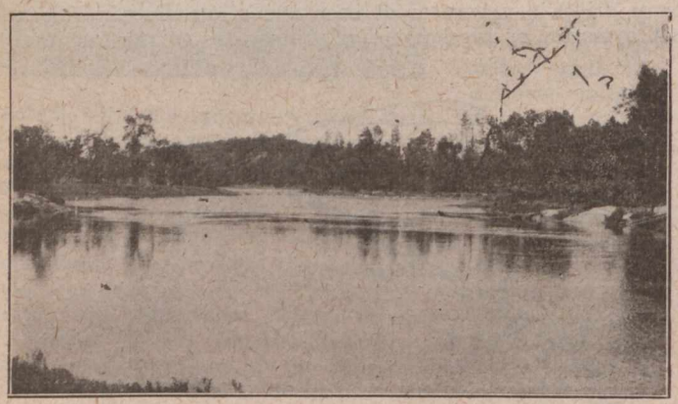
PLAN OF MISSISSIPPI RIVER WATERSHED ABOVE HIGH FALLS

There is ample storage area above High Falls, as the Mississippi river flows through a chain of many lakes of various sizes, including Cross, Gull, Long, Mazinaw, Mud, Mississagagon, Kashwakamak, Buckshot and Grindstone lakes. The required storage dams on these lakes are already built and are owned and operated by the Mississippi Improvement Co., a private company that was organized by the power users who have developed other sites further down the river. The expenses of the Improvement Co. are met by assessments on all of the power users on the river, in



EXCAVATION FOR CANAL, LOOKING DOWNSTREAM

proportion to the power developed. The Improvement Co. has acquired the necessary flowage rights on the various lakes. The chief storage dams are those at the outlets of Cross, Gull and Long lakes, and are rock-filled timber cribs. There is also a pondage area of over 500 acres behind the new concrete dam that is being built at High Falls by the "Hydro," this dam also increasing the available head by approximately 12 ft. The "Hydro" purchased the power site at High Falls two years ago from its private owner. The "Hydro" was already a member of the Improvement Co., on



LOOKING UPSTREAM ABOVE DAM SITE

account of its ownership of the Carleton Falls plant further down the Mississippi river.

The accompanying general plan of the development indicates that the concrete dam at High Falls consists of a sluiceway section 76 ft. long, flanked on the south by an overflow section 104 ft. long, and on the north by a gravity section 112 ft. long, and terminating at the south in a core-wall section 38 ft. long and at the north in a core-wall section 140½ ft. long, the north core-wall section being sealed to the gate house by a wing wall 40 ft. long.

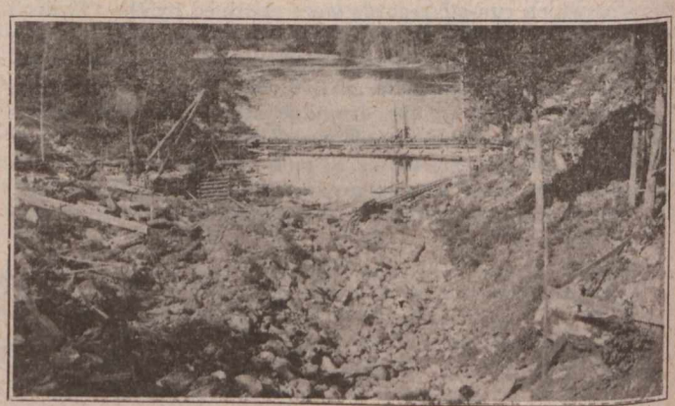
LOOKING DOWNSTREAM BELOW DAM SITE

The total length of the dam and wing wall is about 510 ft. This is about the correct length of the whole dam as constructed, but since the lay-out was made from which the accompanying general plan was copied, the dam was located slightly further upstream, with a consequent lengthening of the overflow section and a shortening of the northern core-wall section. The overflow section as constructed is also more nearly on a straight line with the remainder of the dam than is indicated by the accompanying general plan.

The four sluiceways each have a 14-ft. clear opening. Each of the four rollways is 8 ft. 7¼ ins. wide at top, with a batter of 9 in 12. The reinforced concrete deck is 17 ft. 4 ins. wide. The height of the top

PORTION OF SLUICEWAY SECTION OF DAM, SHOWING THREE OF THE FOUR ROLLWAYS

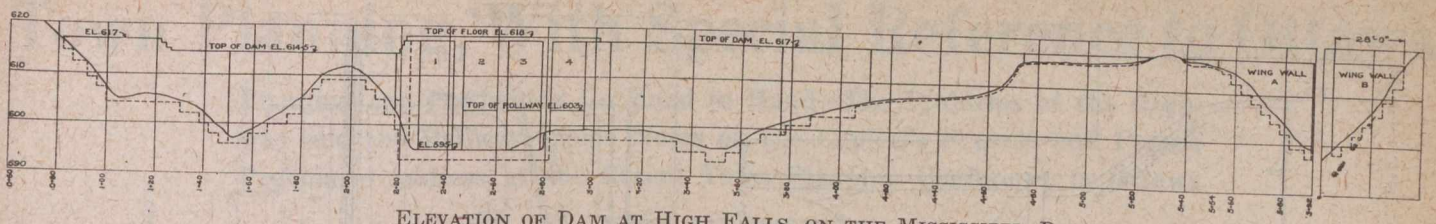
of the deck above the base of the dam is about 26 ft. for sluiceways Nos. 1, 2 and 3, and about 22 ft. for sluiceway No. 4. The clearance from the top of the rollways to the deck is 14 ft. 2 ins. The deck is 10 ins. thick. The piers have a batter of 7½ in 12. The overflow section has a top width of 4 ft. 5½ ins., and a batter of 7 in 12. The gravity section has a top width of 3 ft. and a batter of 7 in 12. The core walls have a maximum thickness of 2 ft., and a minimum thickness of 1 ft. The rock fill is 6 ft. wide at top and has



POWER HOUSE SITE BEFORE UNWATERING, LOOKING ALONG PIPE LINE

a 1 to 1 slope on each side. The whole dam rests upon a rock foundation.

A canal, or intake channel, has been excavated for a distance of about 247 ft., extending upstream from the gate house at the north end of the dam. After the removal of the cofferdam that was built in order to divert the flow of the river and so unwater the site of the dam, this channel will be entirely under water excepting for a distance of 150 ft. from the gate house. The bottom of the canal is 8 ft. wide, and the sides are sloped 1½ to 1. The bottom and sides are protected by riprap excepting where they are in solid rock. The bottom of the canal is level for 100 ft. from the

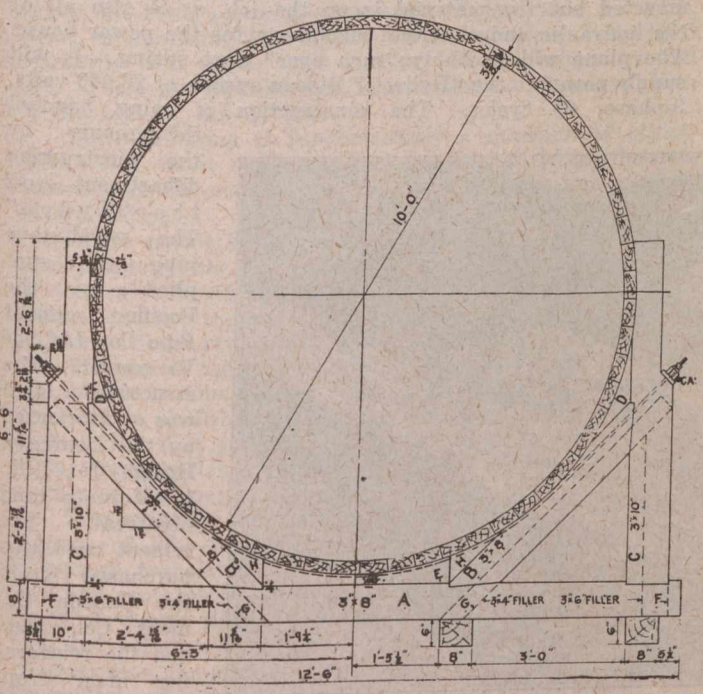


ELEVATION OF DAM AT HIGH FALLS, ON THE MISSISSIPPI RIVER

gate house, then the grade is 2% for 100 ft., then 4% for 36 ft., and 40% for about 11 ft. at the intake.

The gate house substructure is 27 ft. wide by 30 ft. long and 22 ft. high to the floor of the superstructure. Behind the racks the width tapers to 17 ft. The water section varies from 20 ft. in width by 13 ft. in height to a circular section 10 ft. in diameter, ending in a reinforced concrete elbow which connects with the continuous-wood-stave pipe line leading to the distributor in the power house.

The wood-stave pipe line is 10 ft. inside diameter, approximately 320 ft. long, and is built of British Columbia

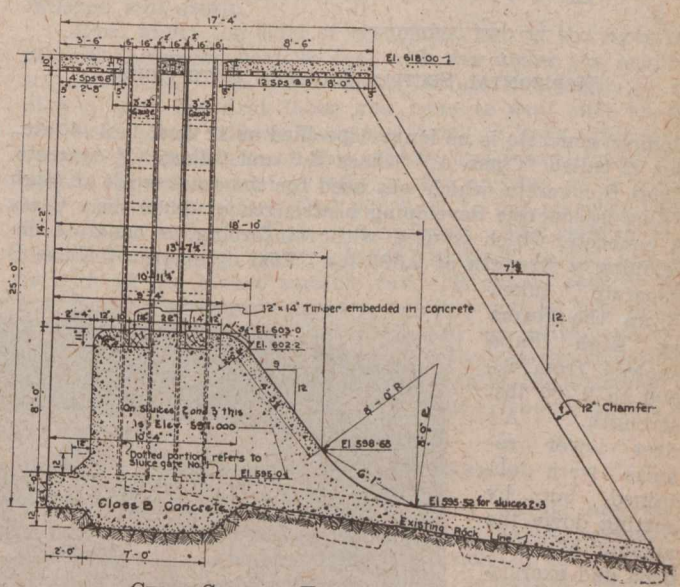


WOOD-STAVE PIPE, SHOWING SADDLE DETAILS

fir staves 3⅝ ins. thick. It is supported by timber saddles spaced at 6-ft. centres.

The pipe is laid to a 22.4% grade, the difference in elevation between the two ends being about 70 ft. It is banded with 1,025 bands (⅞-in. diameter) of two sections each, these bands being spaced as follows, starting from the gate house: 99 at 7 ins. c. to c.; 79 at 5½ ins.; 91 at 4¾ ins.; 108 at 4 ins.; 123 at 3½ ins.; 144 at 3 ins.; 157 at 2¾ ins.; and 224 at 2½ ins.

The bill of quantities for the pipe line included 2,050 shoes, 62 saddles, 124 saddle rods, 1,030 F.B.M. sills, 124

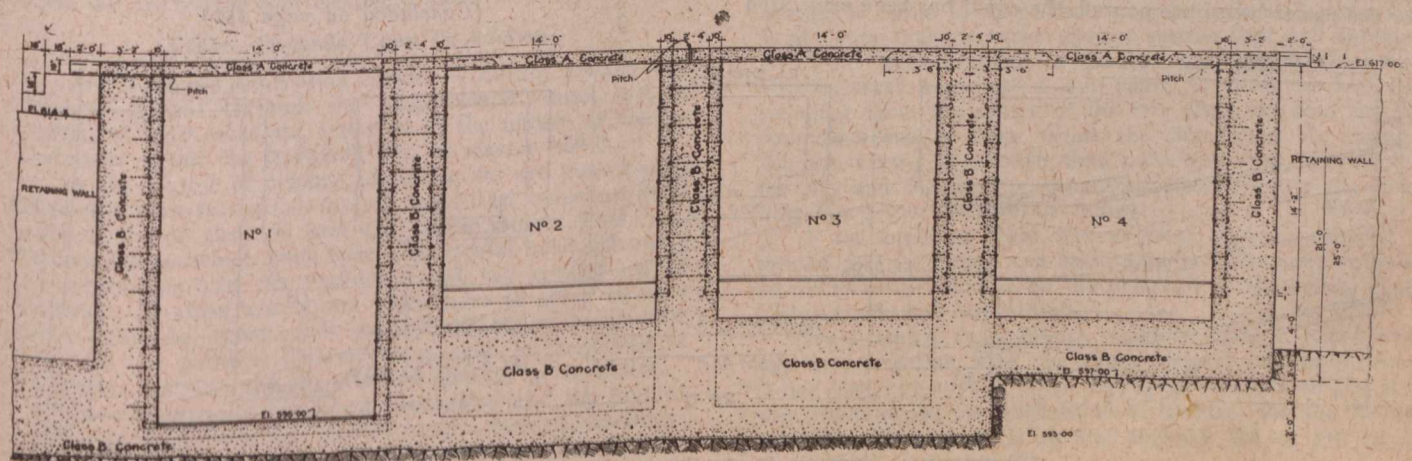


CROSS-SECTION THROUGH SLUICEWAY

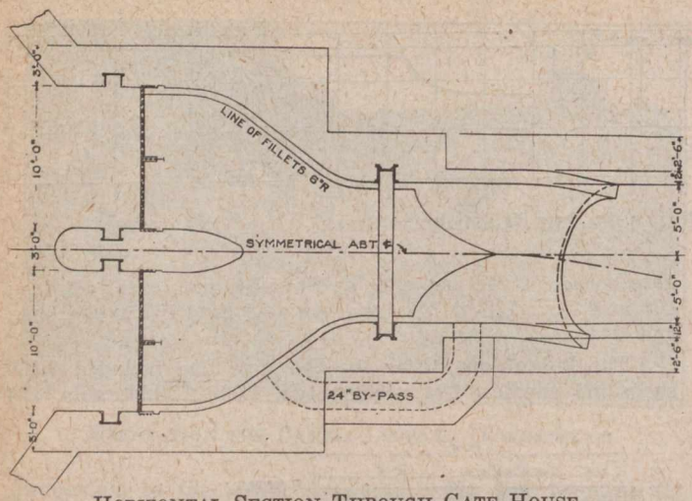
washers and 75 cu. yds. of 2-in. stone for use in bringing rock fill to grade.

The power house is situated on the river bank, and its substructure is approximately 94 ft. long by 62 ft. wide. The greater part of the power house substructure is mass concrete, but the distributor which carries the water from the wood-stave pipe to the turbines, is moulded in reinforced concrete. The turbine casings are steel plate, as are also the draft tubes. The tail water level is 532.5 when the forebay is at 614.0, so the gross head on the plant is 81.5 ft. at high level. The velocity in the pipe line at full load is about 6½ ft. per second.

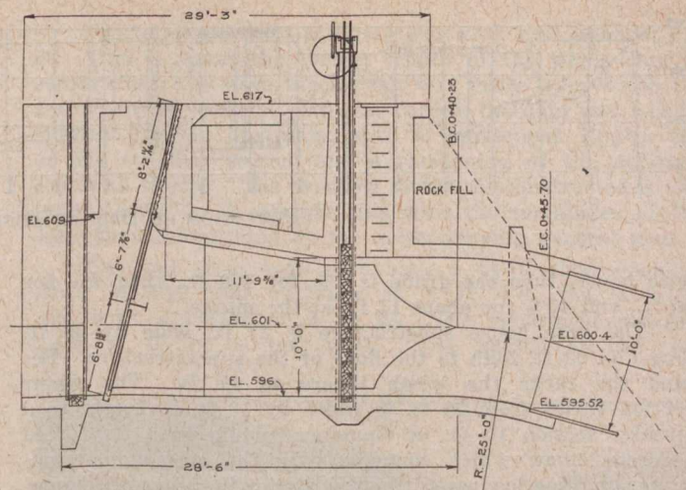
It is of interest to note that the Heath-Edwards surface area method of proportioning materials for concrete was used for the dam, this being the first time that it was used by the "Hydro." According to this system of propor-



LONGITUDINAL SECTION THROUGH SLUICEWAYS OF HIGH FALLS DAM

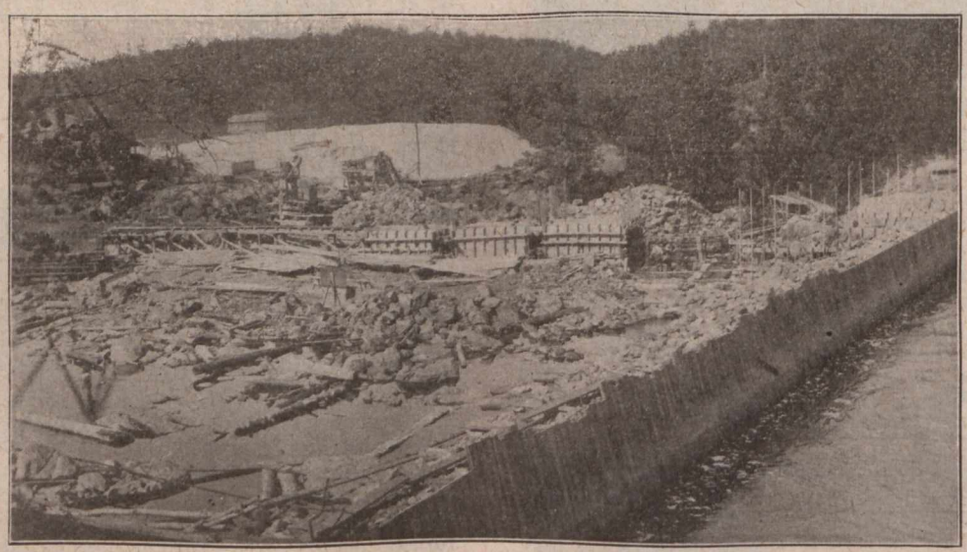


HORIZONTAL SECTION THROUGH GATE HOUSE



VERTICAL SECTION THROUGH GATE HOUSE

tioning, concrete is no longer specified as 1: 2: 4, 1: 3: 6, etc., but is called "Class A," "Class B," and "Class C" concrete. Class B concrete, which was used for the mass work at High Falls, is concrete developing a strength of 2,000 lbs. Class A concrete, which is used with reinforcing, is concrete developing a strength of 2,500 lbs. Test cylinders of Class B concrete taken from the forms at High Falls showed from 2,500 to 2,700 lbs. strength. At first lower results were obtained, but by cutting down the amount of water used and exercising greater care in the proportioning of the materials, the higher strengths were soon secured. Some samples of Class A concrete did not fail at 4,000 lbs., which is the limit of the "Hydro's" machine, so they were held there for three minutes and then tested no further. Crushed stone and gravel were used as aggregate. The stone is a trap of high quality.

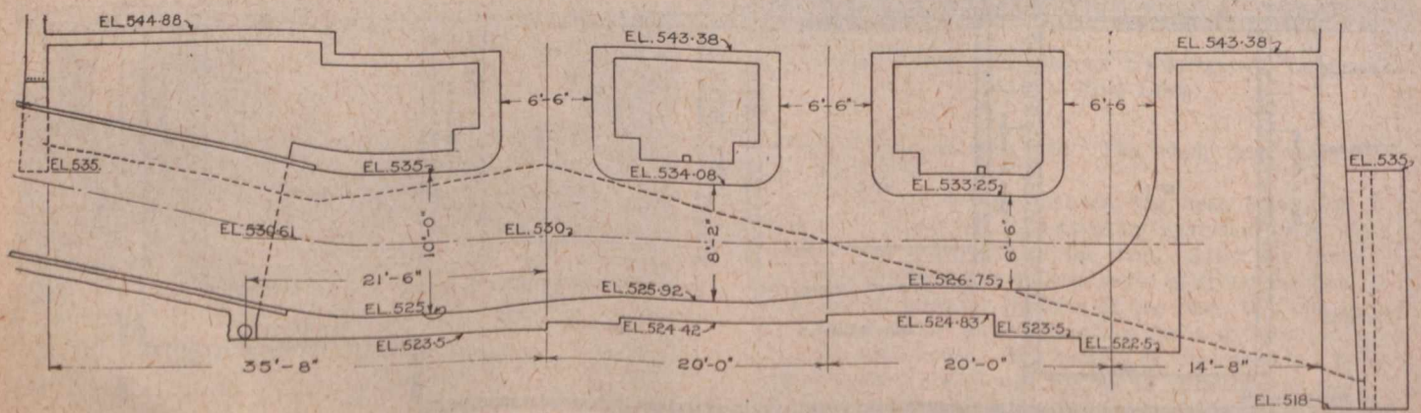


DAM SITE, SHOWING COFFERDAM FOR DIVERSION OF STREAM DURING CONSTRUCTION

Work on the High Falls plant started in October, 1918, and is now about 75% completed. The dam is finished, the gate house partially constructed, the foundations and walls for the power house are poured, the canal has been excavated and the pipe line graded. The pipe has not yet been constructed but the material is on the job, as is also all of the hydraulic and electrical machinery for the power house. The plant will probably "turn over" next spring. It will supply power to the "Hydro's" Rideau system at 23,000 volts, 3-phase, 60 cycles. The construction is being handled throughout by the construction department of the "Hydro." The wood-stave pipe was supplied by the Pacific Coast Pipe Co., Ltd., of Vancouver. The structural steel was fabricated by the Dominion Bridge Co., Ltd., of Toronto and Montreal. The cement used was purchased from the Canada Cement Co., Ltd., and the reinforcing steel from the Steel Co. of Canada, Ltd., of Hamilton

Hon. Sir Adam Beck is chairman of the Hydro-Electric Power Commission of Ontario; W. W. Pope, secretary; and Frederick A. Gaby, chief engineer. The design and construction of the High Falls plant, with the exception of the electrical work and the power-house superstructure, are under the direction of the Commission's hydraulic depart-

(Concluded on page 467)



LONGITUDINAL SECTION ALONG CENTRE LINE OF POWER HOUSE

Town Planning, With Special Reference to Ottawa

Planning and Production Go Hand in Hand—The Problems of the Highway and the Railway—Some Notes on the Capital's Present and Future Problems—Address at the Recent Town Planning Conference in Ottawa

By NOULAN CAUCHON
Consulting Engineer and Town Planner, Ottawa

THE principal thing about town planning—at any rate, one of the things that we must bear in mind—is that a city cannot live unto itself any more than can an individual. That is why we have been advocating the benefits of regional planning. The surroundings of a city are what the city depends upon; the city is merely a market of exchange; and transportation is the flux of exchange. By adopting the principle of regional planning we are endeavoring to bring about the intensive cultivation and development of land around the cities, from which the cities derive their supplies.

I want to give some of the principles upon which we carry out town planning—the angle from which we work. Now, in analyzing the town planning problem I divide it primarily into threee main issues: Ethics, economics and art. These are but different manifestations of natural law, of the organic law of life.

Town planning is fundamentally a question of ethics. Ethics are those customs of righteousness which become necessity in the evolution of the race in prevailing against extermination.

Ethics means the conservation of energy—above all, of human energy, the most precious of all. That is the point of view we are taking in Canada; it is the conservation of human energy, the unit of production. All wealth, after all, comes from production; it is based fundamentally upon the efficiency of the unit of production. So we are directing our efforts mainly to that organic law of life, production. We have to abolish the slum and we have to eliminate congestion for that purpose. Town planning is a gospel of social regeneration; we are looking at it altogether as a matter of sociology.

Economics are but the conversion of energy in the maintenance of life—production. Economics are but the laws of nature translated into current terms, usually into dollars and cents as the most convenient common denominator to which things different by nature can be brought to equation and solution. In other words, to engineers I may say in particular, the economics by which we compare everything by dollars and cents is, quite outside of the matter of money, the finest decimal scale that the world has ever had for a common denominator to which you can reduce things, as I have said, to an equation and solution for the conservation of energy. The values of horses differ, the values of farms differ, but when you get down to the decimal scale of dollars and cents you get a relative value for the time being; you get your scale and you get your perspective. That is why you must not think we are always thinking of money when we are giving you economic ideas.

Future Depends Upon Production

Art is simply expression sought—I do not always say, obtained—sought through the properties of mind and of matter, of truth absolute, inherent in the nature of things. Technique is but the tempered tool in master hands.

In the matter of organic planning, we are immediately concerned with two great factors, land and transportation, productivity of the soil and the trade routes. These are the two factors which from time immemorial have influenced the migrations and the evolution and the revolutions of mankind. In other words, our whole hope of going on as a nation must be based upon production; where production fails you get political disintegration such as happened in the Roman Empire, and the city and country go to pieces.

Therefore, to get the finest production and the highest results we must have the highest human unit of efficiency; that is the ethics of the thing, and it is upon that that we found our endeavors in the matter of housing. That is why housing is such a very important thing in the life of the nation. It is not philanthropy; it is not religion; it is just pure ethics. It is a matter of what is due to man as his right; and as a result, the efficiency which that man and his children will attain.

Now, under the head of economics, two of the most important things we have to deal with are under the head of transportation. In other words, before you begin to replan a city, the first thing you have to deal with is the matter of your railway transportation. I have attended a number of conferences on this subject, and I have found that people almost invariably refer to the railway as a necessary evil; as something that you have to put up with. But there is no evil at all about a railway. The railway is a splendid means of transportation, both of people and of freight, at the lowest possible rate. It should seek to follow the line of least resistance, but it is not by any means an evil. I do not say that there are not evils connected with railways; sometimes they are evilly located; sometimes they are mismanaged; but fundamentally the railroad is the sinew of life and is essential to the transportation of the country.

Railways as Decorative Feature

I see no reason why your railway station and your railway facilities should not be as fine a decorative feature of your city as is any other of the functions of life—for it is a function of community life; it is inherently fine and beautiful if you treat it so, if you give it proper expression.

The trouble with the railways in most of our cities in this country is that the railway got there first. In the old days property was not so valuable and the railways went where it was most convenient to go and where it was cheapest to build the road; then the cities grew up around them and eventually there came a condition of congestion.

When you are taking hold of a city and developing it and planning it for the future, you have to ascertain what is the path of least resistance in which you can put that railway, because if it is not in the right place, just to the exact measure that your city is prosperous will there be an inducement, an economic justification, for that railway leaving its bed and going, like a great stream in a deep valley, to the lowest point where the flow will be uninterrupted. The point is, that the more successful and the greater your city becomes, the greater will be the danger of the whole thing being upset because the railway is not in the right place. Town planners can see that a railroad roving around is liable to upset their best laid plans; so you have to get your transportation system settled first and foremost.

Your next problem is that of the arterial highways. By "arterial highway" I am going to refer to highways reaching from the centre of the city clear out into the surrounding country from which the city draws its supplies. We are trying to abolish that hard and fast line between the city and the country, because one merges into the other; it is the proper relation of things.

I am claiming that the arterial highway should be located and developed and maintained on the same principle as the railways, that is, on the principle of the ruling grade. Motor traffic has come to stay.

As I stated in a report which I made a short while ago in connection with the separation of grades in cities, it has been the custom when you come to apply to the Railway Commission for separation of grades, for the railway to state: "Our grade is so and so," 0.5, 0.6 or 1% as the

case may be. "Of course, in the separation of grades with the street you cannot depreciate the railway grade because if you do you affect the haulage capacity of the railway"; and invariably the highway has had to be sacrificed. Now, I maintain that neither the railway grade nor the highway grade should be sacrificed. In the separation of these grades the cost should be proportioned in accordance with the importance of the two; but the fundamental point is that the arterial highway ruling grade is just as important as the railway grade.

More Power on Highways

We have to-day, or we had at the close of the war, about 5,000 locomotives in Canada, which, taken at an average of about 300 h.p. each, means 1,500,000 h.p. We have also 250,000 motor cars on our roads, which, at the low average of 20 h.p., means 5,000,000 h.p. That motor traffic is going to double, treble, quadruple, within our easy knowledge; therefore you will have a horsepower of not 5,000,000, but possibly 50,000,000 in the future.

The highway traffic of Canada and of the United States is going to be a greater factor in connection with our transportation than the railway traffic, because you must recognize that everything that is carried on the railways is first carried over the highways, and an enormous amount of the stuff that is carried over the highways never reaches a railway. So your highway traffic, if you have proper roads, will eventually be greater than your railway traffic and this is a matter which will have to be taken into consideration; you will have to preserve your ruling grades for these highways the same as you do your railway grades.

We have 24,000 level crossings, in Canada, or thereabouts, so we have some work cut out for us to separate these grades. They are not all equally dangerous, but the economic factor is there of separating them and at the same time protecting the grades.

Local vs. Through Highways

There are two classes of roads, the local development and the through highway such as the Toronto and Hamilton highway. We are expecting that the Toronto and Hamilton highway will be carried through for connection between Niagara and Hamilton and then on to Brantford, London, Chatham, Windsor, Detroit and through. But if these roads are to become "through" highways, they must be dealt with on the same principle as the great railways of this country; that is to say, they must go on independent rights of way without any frontage.

I may say, by the way, that some remarks I made with regard to the Toronto and Hamilton highway were taken up wrongly; and in that connection I had to address a letter to one of the highway's commissioners in Toronto. The Toronto and Hamilton highway is the best example of the local development road that can be found anywhere in the country; it is fast becoming a village from one end to the other. Now that very feature of the local development is going to choke the usefulness of that road as a "through" highway. Therefore we shall have to have both; we shall have to have good local highways as well as "through."

Triplication of Service

One of the first things that was proposed in the planning of Ottawa, back in 1909-10, was in connection with these railways that enter the city. As is the case in many cities in the United States and Canada, we had a triplication of services; we had three railways coming into the city, each with an independent entrance. That is absolutely unnecessary. Our national waste is perhaps more in the duplication of terminals than it is in the duplication of main lines, bad as that has been. About 80% of the cost of the land for a railway running, say, from Ottawa to the heart of Montreal, would be in the entrances to the two cities.

If you enter three railroads by three different entrances, you are triplicating not only the service; 160% out of 300% is absolute waste upon which the public have to pay interest. We are just waking up in Canada to the economic fact that the public pays the piper. When the railways come near to the margin where they cannot meet their obligations, the Railway Commission has to come to their assistance by permitting them to raise their rates, and a great part of that increase in rates has been necessitated by the policy of unwarranted duplication in the past. You cannot blame one person more than another. The whole of Canada has been developing during the last 25 or 30 years on a speculative policy, not on an economic policy; and when everybody in the country is speculating, you cannot expect that the government policy will not reflect the policy of the everyday man in the street.

We were building railway lines as fast as we could, stretching out over the country a skeleton system and trusting to the inflow of immigration to fill the vacant spaces. Then came the time when immigration stopped, the war broke out, and we suddenly realized that we were simply discounting the future. So we have to get down to economic methods, and one of the most economic things we can do with a view to reducing railway expenditure is to eliminate the duplication of terminals.

Union Terminals Required Everywhere

In other words, the order of the future is union terminals in all cities, whether those terminals be owned by the railways or by the respective municipalities. That is what we are attempting to do at the present time in Hamilton and in London.

The city of Hamilton, as an outcome of the scheme that has been evolved there, has applied to the Ontario legislature for, and has obtained, a special Act to enable them to build the terminals of the city as a municipal enterprise. I believe that Hamilton is the first city in Canada, possibly the first in America, which has undertaken and is preparing and authorized to assume the responsibility of building terminals as a municipal enterprise. Of course, they will be leased to the railways for operation. They are awaiting the outcome of the Bill which is now before parliament providing for the taking over of the Grand Trunk Railway System; when that is settled, the city will be enabled to deal with the companies whose rails come within the city's bounds.

So far as Ottawa is concerned, the three railroads which now come into the city by three separate routes, the Canadian Northern, the Canadian Pacific and the Grand Trunk, could be joined up 3½ or 4 miles out of the city, on the east, and brought in on a common entrance. They could come down the canal to the central station; a tunnel under the city would clear everything in the way of level crossings; then they could proceed out through the Chaudiere and the industrial section and so out of the city on a common route to the dispersal point 6 or 7 miles west at Britannia. The carrying out of that scheme would mean the elimination of the Grand Trunk line across the heart of the city and out to Britannia.

Eliminating the Railway Barriers

In the plan that was originally proposed, I suggested the elimination of some 21 miles of trackage, and some years afterwards 18 miles of that was adopted by the Ottawa and Hull Federal Plan Commission.

If the Grand Trunk passes to the government, one of the first things we hope they will do in connection with the beautification of Ottawa—not as a city in Ontario, but as the capital of Canada—is to eliminate this cross-town line and thus remove a very serious barrier to the development of the city. In the middle of that line, where it runs for ¾ mile through the heart of the city, there is a hole called the Bank street subway, and if you do not go via Bank street, you have to go round one of the ends of that stretch of line in order to get past. Any further opening of that barrier would cost the city $150,000. Several miles of that line are beyond the present city limits and will constitute a like barrier in the future; so the removal of that line and its conversion into a boulevard, parkway or a great highway, will not only remove a barrier but will also enable the city to avoid spending from $8,000,000 to $15,000,000 in the years to come in the construction of subways or under crossings.

But you cannot under cross in the case of every street; and where you do not, you are discounting your development. As a general principle, of course, we prefer to

elevate the roads in the case of these crossings, but it is purely a matter of circumstances.

Ottawa was not planned at all; like Topsy, it "just grew." The mesh of Ottawa streets is as bad as any you can find; it is a girdiron gone crazy, as may be said of almost every city in America where they have not taken hold of town planning. If we do not get this Grand Trunk right of way we will in time have to build other arterial highways through there; that means that instead of buying from one owner, we shall be buying from 1,500 or 2,000 owners. My advice to my brother town planners is this: Wherever possible see that the city purchases the right of way of any railroad that can be removed like this and takes it for a great highway.

Must Plan to Purpose

In regard to zoning, I maintain that you cannot plan except to purpose; you cannot plan unless you know what you are doing it for. If you are going to plan an industrial section, you want great broad streets, narrow sidewalks and blocks probably 500 ft. square. You have to provide for uninterrupted traffic; when one or two thousand men suddenly come out of a factory, they simply swarm down the road, which is at peak load at certain hours. If you are going to develop a high-class residential district, you want deep lots, broad frontages and boulevards; they can stand the carrying charges of the public improvements. Then, if you want a workman's industrial district, you must follow a certain plan—and here I absolutely agree with Mr. Veiller: I am in favor of small lots and small streets, because workmen's homes cannot stand the carrying charges of a great boulevard.

This is the mistake the Germans made in their town planning. In Berlin they had magnificent boulevards and six-story tenement houses for their workmen. Within limits these were architecturally beautiful; they were fine, costly buildings, and the effort to attain the beautiful was there and also in the broad boulevard. But the result was that these working men had to live in six-story tenement houses to pay the carrying charges, with as many as five courts in these great lots 500 ft. deep. Just before the war, the death rate from tuberculosis in these beautiful tenements was 2½ times as great as the death rate among the children brought up in the gutters of English towns. The explanation is very simple. Families live in two rooms. When the head of the house goes to work in the morning, he is not going to bring the children down and allow them to play where they will be run over by motor cars. The mother has to do the house work, and when the father comes home at night he is too tired and it is too late to take the children down to play. Besides, it is not satisfactory nor sanitary for a family to live in one or two rooms where they sleep, cook, eat, do the washing and everything else.

German statistics with regard to the health of the people are based on information respecting the efficiency of a man for military service at the proper age. Their statistics show that just before the war only 20% of the young men whose parents had been born in Berlin were fit for military service at the military age; and that was due to the condition of living which I have suggested. Moreover, it cannot be said that the German was not an orderly man; he was subjected to military training; he was amenable to rules and regulations with regard to cleanliness. There was never any suggestion that these people were not cleanly; the high death rate among these children was a result of a purely economic condition.

The Technique of Sociology

As I say, city planning is simply the technique of sociology. Regulations as to how high a house should be, as to how wide a house should be, as to how wide a street should be, and as to the distance between buildings—these are simply means of ensuring health; it is simply the technique of sociology, the ensuring to a man of living conditions which will give to him and to his children a degree of efficiency and a state of health that will enable him to go forward instead of backward.

In this planning of Ottawa, then, one of the main features is the grouping of railways and the elimination of certain rights of way and their translation into boulevards. I am going to discuss this matter as impersonally as I can; I do not agree with a good deal that is in the commission's plan.

As can be seen from the plan, a subdivision made up of lots of standard size is set apart, enough for a couple of million people. It is subdivided to the limit of site, in a manner which presupposes 50 by 100 ft. lots, to infinity. That is just the error of the gridiron plan magnified to infinity. You cannot select from it one section and say that that is to be a high-class residential section or a cheap workingmen's section—and when I say "cheap" I do not mean to say cheap in the nasty sense; I mean the securing of the best possible conditions for the very least amount of money. It is simply a question of taking into account a man's wages and allowing 15% for his rent—that factor varies between 10% and 25%—and a certain amount for the land. If the land is expensive, the purchaser may not be able to build his house with due regard to comfort and sanitation. Of course, the man who owns the land will get what he wants, and what is left will build the house—or, as is generally the case, will not build the house—and you get a condition lacking in sanitation and efficiency.

Location of Arterial Highways

I claim, therefore, that you cannot plan unless you know the purpose for which you are planning; that is why I say that the location of the great arterial highways is the next move after you deal with the railway situation. You may say: "We are going to make an industrial section of this part." Well, you may make it on the plan, but if your industrial section is planned on the top of a hill, the people simply will not haul their produce there. It is a fundamental law of nature; it is Newton's law of gravitation. Every ounce lifted and set down costs so much money. Man is also an animal; he likes to do things with the least effort. It is one of the fundamental principles of political economy that a man seeks to accomplish his ends with the least possible effort.

Special Conditions at Ottawa

This Federal District plan embraces Ottawa in the province of Ontario, and Hull in the province of Quebec. It would be very difficult to bring about here such a Federal district as there is at Washington. There are certain things applicable to the conditions in the District of Columbia that are not applicable at Ottawa. There is the fact that this proposed Federal District would embrace two different provinces, each with different laws. The suggestion has been made by some that we might have something like the London County Council—simply community control of physical features and public utilities, the legal twists and kinks being left with the various lawyers to disport with.

It is fundamental that water supply be protected. Many years ago the Ottawa Board of Trade took this matter up, and they asked me to delimit what should be the Federal District. I simply ran my pencil around the watershed and said: "You have to have control of your watershed; otherwise anything you may do for the purification and protection of your water supply may be nullified."

Must Control Water Supply

You have to control your water supply within the area that you are going to govern; otherwise you cannot guarantee sanitary conditions. One of the reasons, therefore, why we want to include both sides of the river in the Federal District is in order that we may secure control of the water supply and prevent the pollution of the river. At present there is noting to prevent the villages above the city—and they do it—from putting sewage into the river. Of course if the villages are far enough above the city, the aeration, etc., may obviate the danger; but this consideration has an important bearing upon the whole matter. It is true that we have legal means to stop it, but if we take steps in that direction, the people below will put us to the expense of building a purification plant. That is the position we are in. It is a case of you scratch my back and I will kick you,—not scratch yours!

(Concluded in next week's issue)

COMMITTEE FOR MONTREAL CONVENTION

JOHN A. KIENLE, secretary of the Water Works Manufacturers' Association, announces that the following have been appointed to serve on the entertainment committee for the next annual convention of the American Water Works Association, which is to be held next June in Montreal, Que:—

H. G. Hunter (chairman), of the New York Continental Jewell Filtration Co., Montreal; G. B. Greene, of the General Supply Co. of Canada, Ltd., Ottawa; T. W. Lesage, of the Montreal Water Works; T. A. Hutchinson, of Drummond, McCall & Co., Montreal; F. C. Laberge, consulting engineer, Montreal; John A. Kienle, of the Electro-Bleaching Gas Co., New York; and James J. Salmond, representing *The Canadian Engineer*.

The objects of the Water Works Manufacturers' Association are: "(a) The advancement of the interests of its members and of the water works associations; (b) the providing for and having custody of such exhibits of materials as may be made at the conventions; (c) the furnishing and distributing of all badges used at conventions; and (d) the establishment of friendly co-operation and relations with its members and with the delegates of the water works associations."

C. B. & C. I. NOW HAS DOMINION CHARTER

IN preparation for the second general conference of the Association of Canadian Building and Construction Industries, to be held January 27th to 30th, inclusive, at Ottawa, the executive of the association has issued a pamphlet briefly reviewing the association's work to date, as follows:—

"1. One meeting of the national council has been held in Toronto, defining the policy of the association, and drafting by-laws.

"2. Several smaller meetings of members of the council have taken place in Montreal, Toronto and Ottawa.

"3. The Montreal Builders' Exchange has been reorganized in accordance with the aims and objects of the Canadian Association, and is now known as 'The Association of Montreal Building and Construction Industries.' It is now organized in three main sections, viz.: general contractors, trade contractors and supply men.

"4. A branch has been organized at Sherbrooke, Que., and affiliation was later secured with the local board of trade.

"5. The contractors of Ottawa held a banquet and organized the Ottawa Branch of the association. A very successful industrial council has been formed.

"6. At a banquet of Toronto builders early this year the question of reorganizing as a Toronto branch was discussed, and the idea approved. No definite action has since been taken, as it was felt that a number of questions should be settled at the next annual conference before final action.

"7. Ever since the last conference in Ottawa the officers of the association have been consulted by the government as representing the building and construction industries of Canada. The government requested the association to send six representatives to the recent industrial conference, and we had a delegate on each of the two most important committees.

"8. We have been building up a connection with the National Federation of Construction Industries of the United States, and have been visited by the president, Ernest A. Trigg, and the secretary, John C. Frazee, who furnished us with valuable information.

"9. A Dominion charter has been obtained, thus giving the association a corporate existence."

The pamphlet also states that it is planned: (a) To invite the affiliation of existing local and provincial bodies; (b) to organize new branches throughout the Dominion; and (c) to promote a closer acquaintance and knowledge of conditions throughout the Canadian building and construction industries by various membership publications.

The association needs about $2,000 to finance requirements until the next conference, when a permanent membership basis will be arranged. Contributions of from $10 to $50 each are being requested by J. Clark Reilly, the acting general secretary.

NOVA SCOTIA POWER COMMISSION

AT the request of the Pictou County Light and Power Committee, a public meeting of the Nova Scotia Power Commission was held November 4th, in New Glasgow, in order that the citizens of Pictou County might have an opportunity of demonstrating to the commission the necessity of some immediate action in connection with the power situation in Pictou County. It was claimed that Pictou County, already a large and industrial community with great possibilities of expansion, is absolutely handicapped in competition with other parts of the country, due to the present high cost of power in that vicinity, even though it is a large coal-mining district.

It was shown that there is at present available a guaranteed market of at least 10,500 h.p., and that the municipality of Pictou County, being free from bonded indebtedness, is ready and willing to undertake the distribution of any power which might be supplied to it in bulk by the Nova Scotia Power Commission, either from hydro-electric or central steam plants.

Hon. Mr. Armstrong, chairman of the commission, assured the meeting that steps would be taken immediately to deal effectively with the situation as presented, and pointed out that although the commission had been in existence only six weeks, it is already prepared to make a definite recommendation to the provincial government and to take immediate action upon receiving the necessary authority in regard to the power situation in the vicinity of Halifax.

The Ontario Section of the American Society of Mechanical Engineers will hold a meeting at 6 p.m. to-morrow evening at the Engineers' Club, Toronto. Supper will be served. This meeting is to enable the members of the section to become better acquainted, and to decide questions of policy regarding the future of the section and the work for the coming winter. Brig.-Gen. C. H. Mitchell will deliver an address. The chairman of the section is Prof. R. W. Angus, and the secretary is C. B. Hamilton, Jr., of the Hamilton Gear and Machine Co., Ltd., Toronto.

Following is the schedule of the short courses in highway engineering at the University of Michigan as announced by Prof. Blanchard: Highway Transport, Prof. Blanchard. Feb. 2 to Feb. 6; Bituminous Surfaces and Bituminous Pavements, Prof. Blanchard, Dec. 1 to 19; Highway Laboratory Research, Prof. Bateman, Jan. 5 to 23; Highway Bridges, Prof. Gram, Feb. 9 to 20; Specifications and Contracts, Prof. Riggs, Feb. 9 to 20; Earth, Gravel and Broken Stone Roads, Prof. Bateman, March 1 to 12; Cement-Concrete Pavements, Prof. Blanchard, March 1 to 9; Brick Pavements, Prof. Blanchard, March 11 to 19; Highway Engineering Seminar, Prof. Blanchard, Dec. 1 to March 19. The fees for courses are from $5 to $15 each.

Morran & Beatty, Ltd., contractors, of Peterborough, Ont., have been awarded the contract for the hydro-electric power development at Grand Falls, on the Nepisiguit river, for supplying power to the Bathurst Lumber Co., of Bathurst, N.B., in connection with their lumber mills and new pulp plant. Two units will be installed, provision being made for a third unit. Each unit will be 4,500 h.p. The turbines will be of the vertical type, direct connected to generators. The turbines will operate under a head of 100 ft. The dam and power house—the former 450 ft. long—will be constructed of concrete. The power will be transmitted for 19 miles; the line will be constructed on steel poles. William Kennedy, Jr., of Montreal, is the hydraulic engineer, and Dr. L. A. Herdt, Montreal, the electrical engineer for the project.

WATER METERS A PROFITABLE INVESTMENT*

By W. H. Randall
Managing Director, Neptune Meter Co., Ltd., Toronto

THE general meter question has been before the public in the United States for some years, but in Canada it is only starting to become a live subject. Those who are closely connected with water distribution, have found that something in the way of a check must be done to offset the waste, due largely to the carelessness of the public, who in many cases allow their plumbing to become defective, and in others, who allow the water to run to waste down the sewer instead of closing the valve or tap after each operation.

This is a common practice in garages and other places where they have cement floors drained to the sewer. The washer drops the hose on to the floor and lets the water run until he is ready to use it again. Thousands of gallons of water are allowed to go to waste daily in this manner.

An important feature has arisen which practically makes it compulsory for every city to consider the selling of water by meter to-day. Filtration plants have become a necessity in practically all parts of Canada, and the pumping and filtering of water, with the cost of labor and the price of coal, is a very expensive proposition for any city. To allow people to use water indiscriminately, without any restriction, in the very near future will be a thing of the past.

Large Cost of Waste

One would at once ask why a man should pay for electricity and gas by meter and be allowed to take water just as he saw fit on a rate based upon the number of rooms in his house. I think that nobody would start a private water company upon any such basis as that.

The per capita daily consumption during the year 1918 in Toronto was 128 Imperial gals. Buffalo, N.Y., used 310 U.S. gals. per capita, while New Orleans, La., used only 64 gals. While we admit that there may be circumstances why cities would differ more or less in their per capita consumption, this should hardly be so great as the difference between Buffalo and New Orleans. Buffalo used about five times as much as New Orleans. Much of this, surely, must have been due to waste.

Scarcely anyone doubts the strong tendency of water meters, as of gas and electric meters, to prevent waste and leakage and to secure careful use. How far meters will accomplish this requires a very careful and exhaustive study.

In the United States, according to census figures, every million gallons of supply of water allowed to run to waste through leaking underground piping and bad plumbing costs a city (for operation and interest charges) $65 a day, or over $23,000 a year.

Flat Rate More Expensive

With our high tax rate and rapid increase in the cost of living, the financial advantages of checking leakage and other waste of water can hardly be exaggerated.

The metering of business properties is agreed to by all. It will surprise most people, however, to know that the average house-owner, as well as the city, gains by the installation of a water meter, and every tenement house owner in Toronto, for example, would gain by having a meter installed. Take an eight-roomed house under the present system of rating in Toronto:—

Eight rooms at 65c.	$ 5.20
Basin or tap in sink	1.25
One bath	1.25
Closet	2.00
Hose	1.00
Pair of laundry tubs	1.25
Total	$11.95

With four persons in the house, and taking a maximum use of 40 gallons a head through the meter, it would figure for the 12 months, 58,400 gallons. This at 13 cents net would only amount to $7.59 per annum by meter, while the flat rate shows $11.95. The minimum rate, however, in Toronto, for meter rent is $2 a quarter-year, which would mean $8 per annum, so a person with a meter in an eight-roomed house would at least save the difference between $11.95 and $8, or $3.95, providing that his plumbing, etc., was kept in proper condition.

From this it can be seen that anyone with a house of eight rooms or more would be better off by having a meter, and would pay for the same in a few years, even if he had to buy the meter himself.

My opinion on this question would be best expressed as follows:—

1. The water supply should be metered.
2. The meters should be purchased and installed by the city at its expense, and not by the property owners, as is often done at present.
3. The city should make all repairs to meters at its own expense.
4. The installation should be spread over five or six years.
5. A minimum rate should be established.

*Excerpt from an address delivered November 6th, 1919, at a meeting of the master plumbers of Toronto.

SWIMMING POOL MANAGEMENT*

By William P. Mason
Professor of Chemistry, Rensselaer Polytechnic Institute, Troy, N.Y.

OF course a swimming pool should be constructed in a satisfactory manner from an engineering standpoint. And it is especially desirable that the means of getting the water out of the pool should be carefully looked into. Several pools that I have had more or less to do with, have their outlets in the side. That is a very serious error. If there be any deposited matter in the pool that is to be gotten rid of, it is practically impossible to draw such sediment through any side orifice without nearly emptying the pool. If the orifice be in the floor, then the material can be pushed on top of the outlet grating and a very few turns of the valve handle in the pipe leading to the sewer will dispose of the sediment without difficulty and with small loss of water. With a pool, the size of ours at Troy, containing 100,000 gallons, unnecessary loss of water quickly runs into money and calls the attention of people who have to pay for it.

I have noticed that the side gutters are sometimes poorly designed. If they extend too far from the wall it is a very serious inconvenience; on the other hand, if they are covered by the overhang the swimmer cannot easily spit into them unless he is a dead shot, and in his efforts to do so he often misses entirely and the sputum gets into the pool, where it proves a most disgusting thing for a bather to swim against.

"Fill and draw" pools are usually filled and emptied about once a week. This type is getting somewhat scarce and water must be pretty cheap in order to allow of such a form of operation. More commonly, the water is continually circulated, as at the Rensselaer Polytechnic, is subjected to some system of improvement, and is replaced after long stated intervals. At Rensselaer we retain the same water for a year, making the change in August. That time is selected because the students are then away, and we can run out the old water, look things over and refill with less inconvenience. Throughout the year the same water is continually circulated by the pumps through the filters, of which we have four, each 4 ft. in diameter. Our rule is to chlorinate once a week with chloride of lime. Where the same water passes constantly through filters using alum, it is necessary to keep watch of the alkalinity and restore it at times with soda ash.

What is to be done in the way of protecting the pool by rules? It is easier to make than to enforce them, and at

*Paper read at the last annual convention of the New England Water Works Association.

times some failures will occur, but on the whole they are not troublesome. So far as disease transmission is concerned, people who are suffering from anything very serious are not likely to ask admission to the pool, and if they do ask admission, it is the watcher's business to keep them out. I believe that there is less trouble in the matter of damaging the pool from specific diseases than people imagine, due very largely to the fact that people who are suffering therefrom do not care about entering the bath, and certainly they do not care to be caught doing so. We do not ask that a man with a slight cold shall refrain from bathing. In some places they do ask that, but it is carrying the protection of the water pretty far. I have no doubt a man with a mild cold can easily get by without being detected and get to the pool if he wants to go.

Temperature, Color and Turbidity

At what temperature is it best to keep the water? At Rensselaer we keep the pool at 76°, except on the occasion of a swimming match of some kind and then we run it down to 72° merely to put a little "pep" into the men who are performing. Under ordinary conditions if one is going in simply for the pleasure of having a dip, or for learning how to swim, anything short of 74° or 76°, makes it a rather strenuous undertaking. In the summertime, a swim in the open is quite different, and one can stand cold water then very well, but with a pool under cover in the winter time, unless the water is up in the seventies, a bath feels uncomfortably chilly. Of course, a Turkish bath is a different proposition; a cool pool is needed under those circumstances in order to start a reaction from the very high temperature to which the bather has been exposed.

High color or turbidity is unsightly and masks such undesirable floating material as sputum, but beyond that either may be absolutely dangerous. I have in mind what happened at one of our large institutions not many years ago. The pool was very turbid and on draining it, a man who had been missing for some days was found at the bottom. Unless the bottom of a pool can be seen, it is better not to use it. A prominent girls' school has recently closed its pool on account of the turbid character of the water. While it was still in use, whenever a group of girls went in, the teacher had to keep watch all the time to see if somebody was missing. A turbid pool is very dangerous and should not be tolerated. A color or turbidity small enough to be possibly unobjectionable in a drinking glass might be sufficient to prevent the bottom of a pool being seen through a depth of eight or nine feet. Partly in this connection, it may be permitted to add that at one of our universitieis a fatality was occasioned by a student diving into an empty pool at night. Such an accident can, of course, be guarded against by suitable rules controlling admission.

Suction Sweeper Removes Fibre

To remove the sediment which collects at the bottom of the pool we use a sweep at Rensselaer and push everything that settles, onto the top of the outlet grating, whence it is flushed to the sewer by suddenly opening the valve. As I have already said, the grating must be on the bottom rather than on the side to allow of this being done.

In pools used by women, bathing suits are worn, usually colored ones, and the amount of fibre that comes off is vastly more than one would think, and it is most unsightly. I saw a device not very long since in Boston, designed to remove such material. It is best described as a modified carpet sweeper of the suction type, entirely similar to what is ordinarily used for cleaning floor rugs. The handle is about one-and one-quarter inches in diameter, and of course it is hollow, and it is attached to a suction motor by a hose. There is a brush at the bottom and about 18 ins. long and 6 or 8 ins. wide, filled with stiff bristles set along a slot. Upon applying suction the material goes out through the handle and is discharged into the side gutter.

Although chlorination and filtration are the usual means employed for keeping the pool water in proper condition, there are two other ways of securing water improvement—ultra-violet light and ozone—which have been somewhat recently introduced. The University of Illinois formerly used chlorination, but they are now using ultra-violet light, and they speak well of it. As a device it is certainly very attractive in appearance. It may be remembered that the Athletic Club at 59th St. and Sixth Ave., New York, uses it successfully, although with what charge for upkeep I cannot say. The Board of Health of New York City has pretty thoroughly threshed out the question of ozone and has reported favorably on it. The amount of money which is quoted in the Board of Health report is small enough, but the upkeep of an ozone plant is usually considerable. It is a fragile thing. And so is the ultra-violet light outfit a fragile thing. We have one in Troy, used for other purposes, and we have found it to be pretty fragile in our experience.

At Rensselaer we attempt to keep our alum dose about one grain per gallon, but, of course, we do not hope to strike that amount accurately, as we employ self-feeders. It is not as though we had a large plant where we could run in a well-controlled alum solution.

So far as chlorination is concerned, we use a very homely, but we think an efficient, method of application; ordinary bleaching powder is mixed up with water into a cream and distributed directly by hand at the shallow of the pool. In dose we use "bleach" enough to correspond to .6 of a part per million of chlorine, which is the amount legally adopted in California. At Yale they use .3; Northwestern .6, the same as we do; and in some other instances the dose is as high as 1 part per million.

Objections to Dosing

We all realize that there is an immense amount of objection on the part of some bathers to the dosing of a pool. We have had complaint time after time, and it is usually based upon imagination. A bather cannot detect the presence of .6 of a part of chlorine per million. In practical tests we found that there was a suggestion of smell at 1½ parts chlorine per million, but no taste and no action on the eyes whatever. At 2½ parts per million of chlorine there was a faint smell, but there was no taste and there was no action on the eyes. When we ran up to 50 parts per million, of course we got a strong taste and we also got a strong smell, but did not notice any action on the eyes. The bathers have complained of dosing when no dose had been used. I remember that years ago when we were about to turn on the alum at the new filter plant at Elmira, the people tasted the alum four days before we put it in.

With reference to establishing a legal standard for the water of swimming pools, I know of only two states that have made the attempt, California and Florida. California has a pretty liberal standard. They attempt to keep the total count of bacteria below 1,000. At Rensselaer we do better than that. It may be rather more good luck than good management, but we have been running on an average of about 250.

So far as the presence of coli is concerned, we rarely get coli, as our .6 of a part per million of chlorine every week seems to control their growth. California allows one bacillus coli communis per cubic centimeter.

The preliminary showers should not be too cold and the soap used should be liquid. Many people dread a cold shower although they do not object to a cool plunge, consequently, unless arrangements are made to take the chill off the shower water, the actual washing accomplished by it will be rather sketchy.

Treatment With Copper Sulphate

Pools that are built in the open without protection from direct sunlight, will probably be troubled with growths of algæ, especially if they be filled with ground water. Copper sulphate is the natural remedy in such a case and the amount required, which is very minute, is best determined by trial. Considerable stress is sometimes laid upon the advantages of direct sunlight in those unusual cases of such indoor pools as possess it, but the gain is offset, at least in part, by liability to algal growths. In such instances copper sulphate is again useful, but the need for complicated apparatus to administer the dose is unnecessary. Plants supplied with such dosing outfits seldom or never employ them.

(Concluded on page 467)

Report on Water Powers of British Columbia

Volume of More Than 650 Pages, by Arthur V. White, Published by the Commission of Conservation—Thoroughly Covers Water Legislation, Meteorological and Topographical Data, Surveys and Maps, Stream Flow Data, Bench Marks, Power Sites, Present and Proposed Developments, Electrical Inspection and Bibliography

COMPRISING 610 pages (6¾ by 9¾ ins.) of text, 36 pages of half-tone illustrations, 10 pages of line diagrams, 3 maps and 24 pages of index, the volume, "Water Powers of British Columbia," just issued by the Commission of Conservation, forms a substantial and noteworthy contribution to Canadian civil engineering literature. The volume was written by Arthur V. White, consulting engineer to the Commission, assisted by Charles J. Vick.

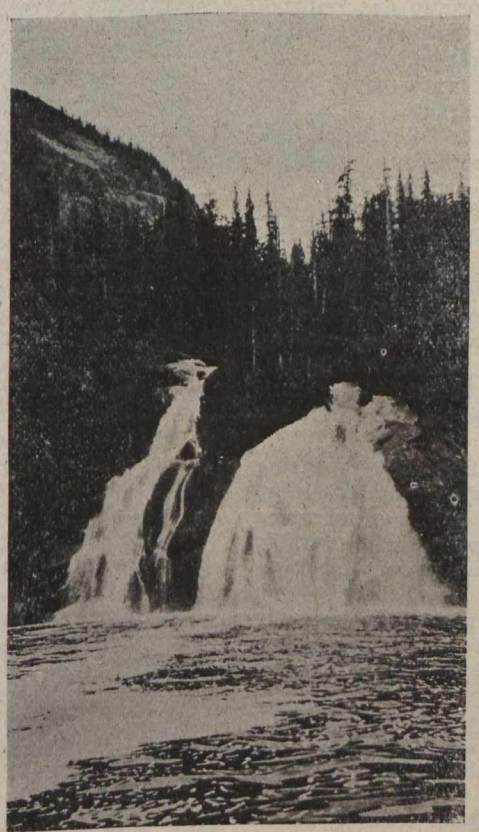
The field work necessary to secure the data for the volume was started in 1911, with the assistance of the British Columbia government, but circumstances connected with the war delayed the publication of the report. It is now ready for gratuitous distribution, however; engineers and others interested in the subject should apply at once for copies, as the edition is limited. A small number of copies have been bound in cloth, but the greater portion of the edition is paper-bound.

The book is divided into 18 chapters, as follows:—

1. General introductory survey (30 pages).
2. Water power data (16 pages).
3. Historical survey of water legislation in British Columbia, with chronological key (66 pages).
4. Certificates of approval; orders in council; rules, regulations and fees (18 pages).
5. Electrical inspection by province of British Columbia; table of power plants (10 pages).
6. Electrical inspection by Dominion of Canada; exportation of electricity (9 pages).
7. Power developments in British Columbia; brief description of the chief developed water powers from the physical standpoint; some proposed power developments; brief reference to a few undeveloped water powers which have been specially investigated (27 pages).
8. Surveys and maps of British Columbia, including a reference to range of tidal levels (15 pages).
9. General topography of British Columbia (5 pages).
10. Columbia river and tributaries; topography; power site tables (32 pages).
11. Fraser river and tributaries; topography; power site tables (29 pages).
12. Vancouver Island; topography; power site tables (9 pages).
13. Mainland Pacific coast; topography; power site tables (31 pages).
14. Mackenzie river and tributaries; topography; power site tables (8 pages).
15. Stream flow data; gauging stations in British Columbia; historical reference to inauguration of stream flow study in province; description of stream flow data included in this volume; index to published stream flow data; tables of stream flow data; miscellaneous discharge measurements (158 pages).
16. Stream flow data; certain gauging stations in United States; reference to gathering of stream flow data in United States; index to published stream flow data on international streams; tables of stream flow data (22 pages).
17. Diagrams showing the distribution of precipitation, temperature and run-off in British Columbia; explanatory statement (17 pages).
18. Meteorological data; introductory statement; list of precipitation stations in British Columbia and selected stations in Alberta and Yukon; precipitation records for stations in British Columbia and selected stations in Alberta and Yukon; list of selected precipitation stations in United States on international watersheds or adjacent to British Columbia; monthly and annual mean precipitation at selected stations in United States; temperature records for selected stations in British Columbia; monthly and annual mean temperature at selected stations in United States (85 pages).

Appendices: (a) Hydraulic conversion tables and convenient equivalents, with statement respecting the "miner's inch" (10 pages); (b) list of certain bench marks on Vancouver Island and Pacific mainland coasts (4 pages); (c) bibliography (19 pages); and (d) index (24 pages).

A two-page, two-color physiographic map of British Columbia is bound in with Chapter 9, "General Topography of British Columbia," while two large three-color maps, "Water Powers in British Columbia," and "Precipitation Stations in British Columbia and Portions of Yukon, Alberta and United States," are folded and inserted in a pocket in the cover. The various power sites and precipitation stations indicated on the maps are so numbered as to afford rapid and easy reference from the maps to the corresponding description in the text, or vice versa.



STREAM ON PRINCESS ROYAL ISLAND

A typical steep descent from lake in "hanging valley," as frequently found along the fjords of the British Columbia coast.

1. Introductory Survey

Chapter 1 reviews the general objects of the report and discusses various phases of the subject under such headings as the influence of forests upon run-off; the relation of water to agriculture; the relation of water power to irrigation; the interdependence between water power and navigation; the serious interrelationship between inland fisheries and the dams and other structures required for water-power development; the relation of the inland waters to mining and to the tourist traffic; the possible effect upon international relationships, etc. Concluding this discussion, the author summarizes it as follows:—

"First, we have observed that precipitation is the prime source of inland water supply, and that not only water power, but such other interests as domestic and municipal water supply, agriculture, irrigation, navigation, fisheries, mining and riparian rights, are all dependent upon the same source. Consequently, water should not be allotted for power development without due recognition to the just demands of other interests having claims upon our inland waters viewed broadly as a natural resource.

"Second, run-off, manifested in the form of stream flow, is intimately associated with the character of the ground

upon which precipitation falls, and, consequently, care should be taken to conserve vegetal cover; more especially is this necessary for rocky areas which have but scanty soil covering.

"Third, subsoil waters are by no means inexhaustible. Plant growth is dependent upon having available an adequate amount of soil moisture. Nothing should be done to deplete, unduly, the ground-water storage. Effective legislation and administration should be provided governing the tapping of underground water supplies.

"Fourth, the use of water for irrigation tends materially to increase the permanent settlement of the country. Consequently, in most instances, when irrigation requirements and power requirements conflict, the former are entitled to precedence. Hydro-electric power developed on somewhat distant streams may, by means of high tension transmission, be used for pumping water supplies where such are not available by gravity, and may thus facilitate irrigation development.

"Fifth, not infrequently navigation interests are regarded as of much greater importance than power development. Any works contemplated for the improvement of navigation should be considered in their relationship to river systems as a whole. Expenditures should be carefully watched and precautions taken to ensure that improvements, so called, are not undertaken ostensibly for navigation, when in reality they are sought for the sake of such water-power benefits as may incidentally be developed thereby.

"Sixth, the fishing industry in British Columbia is one which demands that the best possible methods be used for its conservation. Provision requires to be made for the upward migration of adult salmon for spawning purposes, and the downward passage of the young fish to the sea. Obstructions, such as dams, rock slides, log jams, etc., may have a disastrous effect upon this industry. Fishways should be provided. The whole question of fishways requires thorough investigation. Other fish besides salmon require conservation. It is not established that satisfactory means have been devised by which fish may successfully ascend over high dams—even over dams which do not exceed twenty to thirty feet in height.

"Seventh, the development of the mining industry during recent years has resulted largely through electrical energy being available through the development of provincial water powers, and the future offers bright prospects for the further application of hydro-electric power to the various branches of this industry.

"Eighth, the pollution of inland waters must be jealously guarded against. Mining, factory and industrial wastes and sewage must not be permitted to foul inland waters. Debris and other waste resulting from logging operations are apt to cause serious log jams, which are a menace to public highways, bridges and also to power development.

"Ninth, the tourist traffic is a valuable provincial asset, not only because of the money actually spent by travellers, but because of the opportunity afforded of drawing attention to the various natural resources of the province. Consequently, every reasonable care should be taken to guard against the spoiling of shorelands through submergence; and further, care should be exercised in the design and construction of power works, making them, where possible monize with the general natural features of their surroundings.

"Tenth, in connection with the use of boundary waters, problems, from time to time, may arise necessitating consideration by the International Joint Commission. In this connection, therefore, it is especially desirable that physical data appertaining to such waters should be so collected as to be available for use in connection with such problems as may arise respecting waters which are classed in the Boundary Waters Treaty as boundary waters."

2. Water-Power Data

Chapter 2 states that "one of the chief objects in securing and publishing data respecting water powers, is to enable the owners of rights to determine the possibilities and limitations of their powers and thus arrive at sound judgment respecting their possible uses and value. Another object is to enable prospective promoters to learn the general possibilities of various powers without the necessity of making costly independent, preliminary surveys. Certainly, if the Crown be the owner of water powers, it is of the utmost importance that it be informed beforehand upon essential facts connected with its water resources."

This chapter cautions investors against proceeding with developments without sufficient knowledge of physical and economic governing factors. The author cites a number of cases in the United States where financial losses have resulted from power developments. The summary of this chapter is as follows:—

"First—Governments have been bestowing increasing attention upon the investigation of inland water resources and, during recent years, Canada has made great advancement in this work. Such work is essential in order to acquaint interested parties with the possibilities of the powers with which they may be dealing.

"Second—A number of factors, such as character of use, uniformity of flow, the making of but partial development in a manner prejudicial to future complete utilization, failure rightly to differentiate between primary power and secondary power, etc., have been noted and attention drawn to the necessity for reckoning with such factors.

"Third—Hydrometric data extending over a sufficient period of time should be available, and conclusions involving important procedure should not be predicated upon scattered and insufficient records. Topographic maps should also be available.

"Fourth—Those interested from the standpoint of the investor may, by the expenditure of ordinary effort, place themselves in a position, independently, to check and form a judgment respecting some of the basic engineering factors involved in any power project under consideration.

"Fifth—Failure rightly to assemble or interpret essential physical data, has been responsible for many serious failures, and has resulted in great financial loss.

"Sixth—No reliance should be placed upon general statements setting forth the existence of vast undeveloped water powers. The total amount of water power capable of economic development is much less than popularly assumed and most of the valuable sites are already under development or control by various interests. Attention has been directed to the concentration of control of water powers as proceeding rapidly in the United States, and the need has been pointed out that those interested in the conservation of our water powers should be alert to see that the same menace to public welfare does not operate in Canada. Much of this concentration of control has taken place during a time when general statements representing the existence of large reserves of potential water power were being presented to the attention of the public and were receiving general acceptance.

"Seventh—The importance of storage has been pointed out, and the possibilities of storage causing damage to riparian owners has been emphasized. Government provision for a flowage easement along the shores of lakes and rivers, would to some extent protect settlers against loss, and would protect the government itself against claims for damage by overflow."

3. Water Legislation

British Columbia possesses one of the most comprehensive water codes in the world. This code has been a gradual evolution from the mining regulations, growing out of the first mining activities in the province. The whole water law of the province is reviewed in Chapter 3, where more than 80 separate enactments have been carefully analysed in order to show their contribution to the water code as it today exists.

The present law deals with the utilization of water for mining, municipal and industrial purposes; irrigation; lumbering operations; water power; and many other purposes. British Columbia is the owner of the water in its inland streams and lakes. This water is leased, under certain conditions of rental, etc., for a term of years. The present provincial Water Act is a voluminous document of some 300 sections. It is a noteworthy measure and vests in the gov-

ernment, by statutory laws, the absolute control of the inland waters of the province. It is not possible to obtain an adequate understanding of the water laws of British Columbia as they are at present, without knowledge of the various individual parts of separate Acts which constitute component parts of the consolidated laws. To supply such knowledge is the aim of this chapter on water legislation. The author reviews the various governmental water measures, so far as possible, in chronological order.

4. Certificates of Approval

In Chapter 4 further information is given regarding the procedure for obtaining a water license, certificates of approval, fees, the making of surveys, etc. A 5-page table gives a list of the certificates of approval and orders-in-council that have been issued to date relating to the diversion of water for power and other purposes. This table gives the name of the grantee in each case, the name of the stream affected, the date of approval, the date and page of publication in the British Columbia Gazette, and remarks indicating the nature of the undertaking that was approved.

5. Electrical Inspection by Province

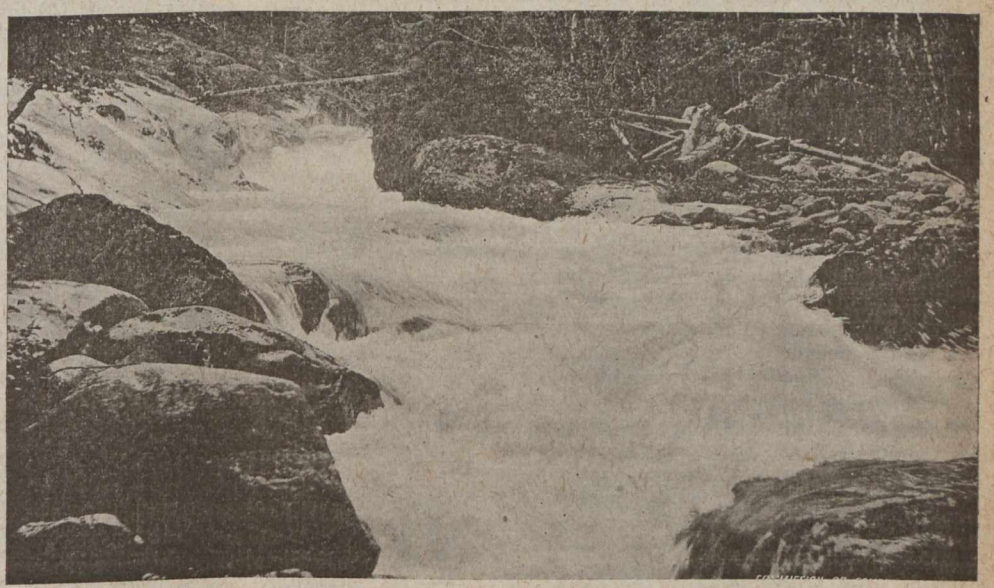
In Chapter 5 the author shows what steps have been taken to protect the public from accidents arising from the increased use of electrical energy, how companies are protected from unjust claims made by injured parties, and how companies are protected from undue pressure by municipalities. The chapter concludes with a list of the principal equipments of power developments in British Columbia which come within the jurisdiction of the Electrical Energy Inspection Act.

TETACHUCK FALLS, BELOW OUTLET OF TETACHUCK LAKE

This picturesque fall on the upper waters of the Nechako River is typical of undeveloped power sites in the interior of British Columbia.

6. Electrical Inspection by Dominion

Chapter 6 deals with the subject of electrical inspection by the Domonion of Canada, chiefly in its bearing upon the exportation of electricity. Commencing with the British North America Act of 1867, the author traces the history of events leading up to the Electrical Inspection Act and to the Electricity and Fluid Exportation Act. There is supplied a list of electric light and power installations in British Columbia falling under Dominion jurisdiction.



RAPIDS ON THOMLINSON CREEK, A TRIBUTARY OF THE TOBA RIVER

A typical coast stream, descending over 600 ft. in 4 miles.

7. Power Developments

In addition to the table of "Power Plants in British Columbia," given in Chapter 5, there are specially described in Chapter 7 twenty of the more important hydraulic developments in the province.

There is in all about 300,000 h.p. at present developed by water power in British Columbia. The aggregate capacity of the installed prime movers is also about this amount, of which 152,000 h.p., or about 50%, is installed at the various plants of the British Columbia Electric Railway Co. and the Western Power Co., to supply the needs of Vancouver and Victoria and surrounding districts, including various municipalities in the Fraser river delta.

Another important power-using district is that supplied chiefly by the two plants of the West Kootenay Power & Light Co. at the Bonnington falls on the Kootenay river —namely, the boundary district lying to the south and west of Nelson. The total hydraulic installation in this district is about 50,000 h.p., used chiefly for the mining industry.

Of the larger developments for industrial purposes, about 50,000 h.p. is installed for pulp and paper manufacture, and approximately 40,000 h.p. for mining, in addition to the 40,000 h.p. developed by the West Kootenay Power and Light Co. and used chiefly for mining and smelting purposes.

It is interesting to note that a large development of water power has been found profitable at the mines of the Canadian Collieries, Ltd., on Vancouver Island, where coal is available at pit-head cost. There are about twenty water-

power developments in British Columbia, in which the installed capacity in each case exceeds 1,000 h.p. These are as follows:—

PRINCIPAL WATER-POWER DEVELOPMENTS IN BRITISH COLUMBIA

Development.	Installed h.p.	
British Columbia Electric Railway Co.		
Coquitlam-Buntzen power house No. 1	43,500	
" " " " " 2	40,500	
Esquimalt reservoir plant	4,200	
Jordan river plant	25,000	
		113,200
West Kootenay Power & Light Co.		
Lower Bonnington falls	4,050	
Upper " "	34,000	
Cascade plant on Kettle river	3,900	
		41,950
Western Power Co. of Canada, Stave falls plant		39,000
Powell River Co., plant on Powell river		24,000
Pacific Mills, Ltd., plant at Ocean falls		21,100
Britannia Mining & Smelting Co., plants at Britannia Beach		12,640
Canadian Collieries (Dunsmuir), Ltd., plant on Puntledge river		12,000
Granby Consolidated Mining, Smelting & Power Co., plant on Falls creek		6,600
Whalen Pulp and Paper Mills, Ltd.		
Plants on Mill and Cedar creeks	4,000	
Plant at Swanson Bay	2,500	
		6,500
Nelson City, Upper Bonnington falls		3,400
Hedley Gold Mining Co., plants on Hedley creek and Similkameen river		2,600
Revelstoke City, plant on Illecillewaet river		2,550
Kamloops City, plant on Barriere river		2,400
Prince Rupert City, plant at Woodworth lake		1,650
Surf Inlet Power Co., plant at Surf Inlet, Princess Royal Island		1,260
Granby Mining, Smelting & Power Co., plant on Granby river		1,040
		291,890

In this chapter are also brief descriptions of a few of the large undeveloped powers which have been the subject of special investigation and for which developments are proposed. These include the following:—

Diversion of Bridge river to Seton lake, 1,200 ft. head, 100,000 h.p.; Campbell river, head 125 to 450 ft., depending upon scheme adopted, 100,000 h.p.; Shuswap river, 130 ft. head, 12,000 h.p.; Jones lake diversion to Fraser river, 1,800 ft. head, 25,000 h.p.; Indian (Mesliloet) river, heads about 1,900 ft. and 450 ft. (group development), about 10,000 h.p.; Falls river, 245 ft. head, 16,000 h.p.; Khatada River, 350 ft. head, 10,500 h.p.

8. Surveys and Maps

Chapter 8 is devoted to surveys and maps. To the engineer who requires to assemble data basic to the consideration of any water-power project in British Columbia, it will be a grateful aid to find at hand this classified analysis of the various surveys and maps relating to the province. There is a complete list of maps relating to British Columbia published by the Geological Survey of Canada, the Department of the Interior, the British Columbia Department of Lands and the Admiralty. In almost every case there are given the number of the map, the title, the scale, the price if any, the year of issue, and the approximate size of the map.

9—14. Topography and Power-Site Tables

Beginning in 1911 in the southerly part of the province, the Commission of Conservation inaugurated its reconnaissance water-power survey of British Columbia. In addition to the results obtained by direct field operations, information respecting water-power possibilities of the provincial streams was gathered from exploratory and other reports, from individuals, from corporations and from governmental sources. This information has been assembled and condensed into tabulated power-site tables, which are set forth, together with explanatory notes and topographical information, in Chapters 9 to 14, inclusive.

For the purpose of convenient reference, the province was divided into five districts corresponding in the main to the chief drainage areas. These are: (1) Columbia river and tributaries; (2) Fraser river and tributaries; (3) Vancouver Island; (4) mainland Pacific coast and adjacent islands except Vancouver Island; and (5) tributaries to the Mackenzie river.

The general topography of the whole province is broadly and clearly described in Chapter 9. With the aid of the physiographic map that accompanies that chapter, one obtains a comprehensive understanding of the chief topographical features, especially of the various mountain systems which modify the climate, and influence precipitation and stream flow. The power possibilities of the five districts above mentioned are then dealt with in order, a chapter being devoted to each district. In each chapter the power-site tables are introduced by a description of the topography of the district, supplemented where necessary by brief notes descriptive of the chief tributaries and their respective watersheds.

Preceding the first group of power-site tables is a description which explains their scope and limitations. In the tables the streams are tabulated in ascending order. The power sites are numbered, those on the main streams being first given, followed by the tributaries taken in their respective order as each main stream is ascended. This arrangement permits easy reference both from the tables to the index map and from the map to the tables.

In the tables one finds the name of the stream and site; the watershed area (in square miles) as derived from the latest map or estimated from special survey data; the head (in feet); the estimated horsepower; and remarks respecting the characteristics of the site, such as the character of the fall, gradient of the rapids, the nature of the stream bed and banks, the possibilities for storage, the practicability of dam construction, etc.

The estimates of horsepower are said to be conservative. They are, for the most part, on a 24-hour basis at 80% efficiency and for an ordinary low-water month. Where storage sites are definitely known, weight has been given to this possibility in making the estimates. It is pointed out, however, that owing to lack of precise information the storage possibilities yet to be discovered will be an important factor in increasing the power.

In round numbers, the horsepower totals derivable from the various estimates presented in the power-site tables are as follows:—

		24-hr. h.p.
1.	Columbia river and tributaries north of the international boundary. This comprises the portion of the province lying between its eastern boundary and the watershed of the Fraser river	610,000
2.	Fraser river and tributaries. This includes practically the entire area of the great interior plateau	740,000
3.	Vancouver Island	270,000
4.	Mainland Pacific Coast and adjacent islands, except Vancouver Island. This includes all the rivers north of the Fraser which drain into the Pacific	630,000
5.	Mackenzie river tributaries. A rough estimate made for inclusion in this summary	250,000
	Total	2,500,000

Statements made show that there are about 500,000 h.p. which, at least for many years to come, can hardly be economically developed because interference with the fishing industry or the proximity of railways renders development impracticable. There are also some other qualifying statements applicable to portions of the power tables, but in round figures the grand total of estimated 24-hr. power, in-

cluding an allowance for storage possibilities, has been placed at about 3,000,000 h.p.

With regard to this total estimated horsepower, it is emphasized that "grand totals purporting to represent horsepower possibilities for large sections of a country, are apt to be very misleading. They are especially misleading when used to make comparisons with other totals when, as a matter of fact, no real basis for comparison has been established. The unique character of many of the water-power possibilities of British Columbia, with its exceptional physical features, such as mountain systems, glaciers, snowfields, and widely variant precipitation, necessarily makes it difficult to effect comparisons between the total water-power possibilities of this province and those of other areas differing markedly in physical characteristics."

The engineers who chiefly assisted in the field work from which the above-mentioned data were compiled were G. H. Ferguson, C. J. Vick, D. C. Jennings, C. C. Lyall, A. W. Campbell, L. G. Mills, T. G. Bird, R. Westover, W. A. Wand, F. R. Macdonald, B. Corbould, B. N. Simpson and C. C. Cowan; also A. J. McPherson, who was attached to one of the field parties in 1913 as representative of the Provincial Water Rights Branch. On account of the topography of the province and the difficulty of reaching some portions of it, the work of many of the field engineers was arduous and hazardous and evidently also required a high degree of ability and judgment.

15—18. Stream Flow and Meteorological Data

Stream flow and meteorological data occupy Chapters 15 to 18 inclusive. This collection of records furnishes the engineer with data which would take him much time and effort to assemble independently. Much of the stream flow data is gathered from the Water Resources Papers issued by the Water Power Branch of the Department of the Interior, and due credit is given to that department for same, but other sources of information have also been used and receive credit, many of the records having not hitherto been published.

Chapter 15 contains the stream flow data available for British Columbia, while Chapter 16 supplies similar data for a number of stations in the neighboring states of Washington, Idaho and Montana, on such streams as the Columbia, Pend-d'Oreille, Kootenay and other rivers of an international character. The records have apparently been selected with special reference to their serviceability for water-power development, as some streams serviceable only for irrigation purposes have not been included.

The records are arranged in alphabetical order, and each one is introduced with a brief description of characteristics appertaining to it. To assist in quickly turning to the more detailed records, which include gauge heights, etc., there is an index to stream flow data elsewhere published.

In the meteorological data there is very complete tabulation of precipitation records for all stations in British Columbia, including monthly and annual total precipitation, and, where length of record warrants, the mean monthly and mean annual precipitation (Chapter 18). A summary of snowfall record is also given. Meteorological data is also supplied from portions of Alberta, Yukon, Alaska, Washington, Idaho and Montana, where such data is specially pertinent to some of the watersheds of British Columbia.

In order to convey an understanding of the general trend of meteorological and hydrological phenomena as revealed by the precipitation, temperature and stream flow records, a number of special diagrams (Chapter 17) summarize these data.

An inspection of these diagrams reveals the manner in which the outstanding physical features of British Columbia modify the climate and precipitation in various parts of the province. Due to the great mountain barrier formed by the coast mountains, British Columbia is climatically divided broadly into two main divisions: The Pacific littoral, west of the summit of this range; and the interior, to the east. The other great mountain systems, the Columbia system and the Rocky mountains, modify the climate of the interior and to some extent reproduce the contrasting phenomena as found on the western and eastern side of the coast range in so far as precipitation is concerned. It is, however, the coast mountains that constitute the dominating influence and that control the climate of the interior. The diagrams demonstrate that the Pacific littoral is a region of great precipitation, especially in the winter months. It is characterized, moreover, by a mild and equitable climate, while the run-off from the streams is heavy; and where fed by glaciers, the run-off is well distributed throughout the year.

In the interior the precipitation, except on the western slopes of the eastern mountain systems, is relatively small, the yearly temperature has a much greater range, and the run-off of the streams exhibit different phenomena. All streams in the interior reach their maximum discharge for the year in the earlier summer months and have lowest water conditions in January and February. On the coast the low water is usually at the end of the summer, in August and September, and the maximum floods obtain at the time of the autumn rains in November, although a second peak flood occurs in the early summer on those streams fed in part from glaciers and elevated snowfields.

The influence upon run-off of latitude, elevation, storage and other factors is also shown by the diagrams.

Bibliography

The volume concludes with handy hydraulic conversion tables, a list of certain bench marks, and an extensive bibliography which will be valuable in studies concerning the development of agricultural areas, mining industry, timber industry and fisheries as well as of other provincial resources. In greater or less degree these various branches of activity have been linked up with and are dependent upon the beneficial utilization of inland waters.

About 230 publications are described, some having special explanatory notes. They are classified under the following broad subject headings:—(1) General reference works; (2) Guides, handbooks and other publications giving descriptive information and historical data relating to various natural resources of the province; (3) government and other publications containing descriptions of the physical characteristics of various watersheds; (4) travel and exploration, mountaineering and other sport; (5) works of historical interest, including northwest coast voyages, Hudson Bay Co. affairs, international waters, boundaries and treaties.

In the case of references to the publications of such organizations as the Geological Survey of Canada, the Royal Society of Canada, the Royal Geographical Society of Great Britain, etc., the bibliography quotes "chapter and verse" for such data as have direct bearing upon the natural resources of British Columbia.

The Turbine Equipment Co., Ltd., have moved their offices to the Dack Bldg., 73 King St. W., Toronto. R. M. Austin, manager of the company, is the Canadian representative for Ontario and Western Canada of the De Laval Steam Turbine Co., of Trenton, N.J.

The following Canadians have been invited by the General Electric Co. to inspect a new 265-ton, 3,000-volt, direct-current, gearless electric passenger locomotive which the company has constructed for the Chicago, Milwaukee & St. Paul Ry., and which is now being exhibited at Erie, Pa.: J. A. Shaw and W. H. Winterford, of the Canadian Pacific Railway; C. B. Walker and C. P. Price, of the Canadian National Railways; J. G. Baukat and W. G. Hewson, of the Hydro-Electric Power Commission of Ontario; S. B. Clement, chief engineer, Temiskaming and Northern Ontario Railway; and representatives of the Canadian General Electric Co., Ltd. At the company's test track at Erie, Pa., a speed of 65 mi. per hr. has been obtained and the tests indicate that the locomotive will operate at much higher speed, but that is the limit permissible on the test track. For continuous operation the locomotive is designed to exert 42,000 lbs. tractive effort at a speed of 25 mi. per hr.

The Canadian Engineer

Established 1893

A Weekly Paper for Civil Engineers and Contractors

Terms of Subscription, postpaid to any address:

One Year	Six Months	Three Months	Single Copies
$3.00	$1.75	$1.00	10c.

Published every Thursday by
The Monetary Times Printing Co. of Canada, Limited

President and General Manager JAMES J. SALMOND — Assistant General Manager ALBERT E. JENNINGS

HEAD OFFICE: 62 CHURCH STREET, TORONTO, ONT.
Telephone, Main 7404. Cable Address, "Engineer, Toronto."
Western Canada Office: 1206 McArthur Bldg., Winnipeg. G. W. Goodall, Mgr.

PRINCIPAL CONTENTS

WATER POWERS OF BRITISH COLUMBIA

IN 1910 the Commission of Conservation undertook an inventory of the water power resources of Canada. As a result, in 1911 the Commission's first report on this subject was printed, "The Water Powers of Canada," covering in summary form the information then available for Ontario, Quebec, and the Maritime Provinces. In 1916 a second volume appeared, "The Water Powers of Manitoba, Saskatchewan and Alberta." The report on British Columbia, which was being compiled under the direction of Arthur V. White, consulting engineer to the Commission, was delayed by circumstances owing to the war, and has just been issued, completing the Commission's series of reports on this great natural resource.

The volume just issued is more than a report on the water powers of British Columbia; it is also a valuable textbook and an interesting account of all the factors that must be considered in connection with the utilization of water resources. It is written in Mr. White's usual forceful, lucid and logical style, and covers thoroughly all cognate phases of the subject under investigation. Not only is it comprehensive but also compact, no space being wasted despite the large number of pages in the volume. In illustrations, topography and general arrangement, the volume leaves nothing to be desired, and both text and tables bear evidence of painstaking care.

Advantage was sensibly taken by Mr. White of all existing information upon the subject, and of all contemporaneous work done by federal and provincial departments as well as by private companies. Naturally, therefore, some of the data contained in the present report is to be found in other previous publications, notably (so far as the stream-flow data are concerned) in the Water Resources papers of the Water Power Branch, Department of the Interior, but full credit is given to all such sources of information. By making use of others' records wherever they could be obtained and were deemed reliable, Mr. White avoided duplication of effort and saved money for the Commission and for the province, which co-operated in financing the report. Nowhere else has so much data pertinent to the water resources of British Columbia been brought within the compass of one book and so well summarized and correlated. In gathering his own field data, Mr. White had several parties of engineers engaged for a considerable period, and these men had many obstacles to overcome in performing their work, owing to the rough and mountainous sections covered.

The paucity of information concerning British Columbia's water powers existing when the Commission undertook its inventory, is well expressed in the British Columbia Year Book for 1911, which states: "Speaking generally, there is no field of economic interest in connection with the exploitation of the provincial resources respecting which there is less known than the extent to which our water powers may be rendered available." Any person reviewing Mr. White's report will readily perceive how radically different is the present status of British Columbia with regard to knowledge of water resources as contrasted with the status in 1911.

The engineer who has to deal with water power projects will be gratified to find such a complete assemblage of physical data as are presented in tabular form in various parts of the report. These include tables giving the estimated possibilities of water power sites throughout the province, which lists are based chiefly upon results obtained from the special field investigations conducted by the Commission of Conservation. There are also extensive digests of stream-flow, meteorological and other hydrometric records.

The report estimates that a total of 3,000,000 h.p. (24-hour power) is available in British Columbia, and states that "the conditions affecting powers in the province are unique, and do not closely correspond to those existent in other portions of Canada. This is especially true of the mainland Pacific coast. One cannot but be impressed with the fact that coastal water powers in British Columbia, which to the casual observer appear to be of comparatively small amount, nevertheless, may, when economically and fully developed, yield several-fold the estimate of power if appraised upon the same basis as similar streams in Eastern Canada. Glaciers, snow-fields, and heavy rainfall abound, and, with many storage possibilities, constitute unique factors which contribute to enhance the values of powers."

A study of the "Remarks" column of the power-site tables, and of comments throughout the report, reveals the diversified uses to which hydro-electric power in British Columbia has already been applied. The report is replete with references to the extensive and varied natural resources of the province. When one considers the mining, agricultural, lumbering, fishing, navigation and other activities, it is evident how great are the future possibilities for increased utilization and conservation of British Columbia's inland waters, and especially of the power derivable therefrom. In such development *The Canadian Engineer* believes that Mr. White's report will not disappoint the aim of the Commission of Conservation in providing a valuable compendium of data upon this subject.

INTER-PROFESSIONAL CONFERENCE AT DETROIT

WITH the purpose of bringing together the professional men of the United States in order to plan more effective relations and to act together on matters pertaining to the public good, an Inter-professional Conference is being called to meet in Detroit November 28th and 29th. The conference was suggested by the Post-War Committee of the American Institute of Architects, which was established to study the new obligations thrust upon the architectural profession by the war.

It is the hope of those fostering the movement to perpetuate to an appreciable degree the enthusiasm of the war-time service rendered to the public by the professional men. The subjects which are to be taken under consideration have been classified under three heads:—The functions and inter-

relations of professional organizations; relations of professions to the public; and educational obligations of the professions. Representatives of the medical, legal, and engineering professions have accepted membership on the organizing committee.

HYDRO-ELECTRIC POWER DEVELOPMENT AT HIGH FALLS

(Continued from page 454)

ment, of which Henry G. Acres is the hydraulic engineer; Thos. H. Hogg, assistant hydraulic engineer; and Max V. Sauer, designing engineer. E. T. Brandon is the electrical engineer of the Commission; and Arthur H. Hull, assistant electrical engineer. The resident engineer at High Falls is A. L. Malcolm. E. V. Trimble, engineer of the Commission's construction department, is represented on the work by E. F. Lynn.

SWIMMING POOL MANAGEMENT

(Continued from page 460)

Referring again to outdoor pools, it is unfortunate that some cities, even large ones, are not sufficiently careful to select suitable sites for their public baths. When a city goes so far as to fence off and equip some portion of a river or bay, setting aside the same as a public bathing place, the bathers have a right to assume that the site has been selected with care and that the water is hygienically safe, but sometimes the assumption is distinctly risky. In one instance a great metropolitan sewer emptied on the upstream side of a public bath (now closed), and so near that when the sewage was colored by a red dye, the bathers were startled by the bloodlike tint of the bath water.

It is vain to hope that high bacterial counts and the presence of "gas formers" can always be avoided. The human animal is not quite clean enough to insure that, but, nevertheless, it is entirely feasible so to run a public swimming pool as to keep its appearance attractive and its use within what may be termed "proper and reasonable risk."

PERSONALS

F. S. LAZIER, resident engineer of Section 2, Welland Canal, has been elected president of the Engineers' Club of Thorold.

MAJ. J. C. JOHNSTONE, MAJ. J. R. COSGROVE, FRANK H. ALLWOOD and J. E. MILNE are being considered by the Saanich, B.C., council for the position of municipal engineer.

G. H. DUGGAN, president of the Dominion Bridge Co., Ltd., Montreal, has been elected chairman of the newly appointed Quebec Division of the Canadian Manufacturers' Association.

FRED J. MATTHEWS has opened an office at 33 Richmond St. W., Toronto, as sales representative of the H. H. Robertson Co., Ltd., of Sarnia, Ont., manufacturers of building products and highway materials.

BRIG.-GEN. C. H. MITCHELL AND PROF. J. C. MCLENNAN received the honorary degree, Doctor of Laws, last week at the University of Toronto, in recognition of their distinguished services during the war.

J. L. THOMAS, formerly sales manager of the building supply department of the N. J. Dinnen Co., Winnipeg, is president and general manager of the recently organized Manitoba Clay & Building Supplies Co., Winnipeg.

COL. ALEX. P. DEROCHE, of Napanee, Ont., has resigned his commission in the Canadian Engineers to accept appointment as general manager of Bate, McMahon & Co., contractors, Ottawa, succeeding the late Col. R. S. Low. Col. Deroche is a civil engineer and a graduate of the Royal Military College, Kingston.

WILLIAM WORTH PEARSE, city architect of Toronto, has resigned in order to accept appointment as business administrator of the Toronto Board of Education at a salary of $8,000 per annum. Mr. Pearse was born December 4th, 1872, in Toronto and was educated at the Toronto public schools and Jarvis St. Collegiate. He studied architecture for 3 years under Kennedy & Holland, and for about 2½ years under Wm. G. Storm, who was architect for University of Toronto and other large buildings. Mr. Pearse passed the final examinations of the Ontario Association of Architects and then went to New York to study civil engineering, taking the degree of B. Sc., and later a 3-year post-graduate course in structural engineering. While in New York he was connected with a number of engineering companies and architects of more or less prominence, among whom were the American Bridge Co.; Levering & Garrigues, construction engineers; and the Radley Steel Construction Co., of which Mr. Pearse became chief engineer and vice-president, in which position he was connected with the construction of a number of important buildings in New York. In May, 1914, Mr. Pearse returned to Toronto to accept the position of city architect at a salary of $5,000 per annum. During his 5½-years' stay in the city hall, he revised the building by-law, the printing of which has just been completed. Particular attention was given in its preparation to flat-slab concrete construction and to brick work, and much research work was done and many tests were made before writing some portions of the new by-law. Mr. Pearse is an associate member of the American Society of Civil Engineers and a member of the Ontario Association of Architects.

M. B. WEEKS, formerly Director of Surveys of Saskatchewan, has been appointed Director of Town Planning, and W. A. BEGG, formerly townsite engineer for the Department of Highways of that province, has been appointed Town Planning Engineer by the Dominion government.

D. H. MCDOUGALL AND THOMAS CANTLEY, who are respectively president and chairman of the board of directors of the Nova Scotia Steel & Coal Co., Ltd., are on a tour of the coal mines and steel plants in England, France and Italy, and of the iron mines in Spain, Norway and Sweden.

GEORGE B. MITCHELL, who is well known in Montreal, where he resided a number of years, and who for the past eighteen months has been construction engineer with the Foundation Company at Port Huron, expects to sail this month for Peru in the interests of the Foundation Company.

COL. H. R. LORDLY, consulting engineer, Montreal, has been awarded the McGraw Fellowship in civil engineering by Cornell University. Col. Lordly is a Cornell graduate and a Fuertes gold medal winner. He is now at Ithaca doing research work. He expects to receive the degree of Master of Civil Engineering next June.

LT.-COL. W. G. MACKENDRICK, president of the Warren Bituminous Paving Co. of Ontario, was one of a number of veterans who were decorated at the Parliament Buildings, Toronto, last week by the Prince of Wales. Col. MacKendrick received the Legion d'Honneur. During the war he was Director of Roads for the Fifth British Army.

CONSTRUCTION NEWS SECTION

Readers will confer a great favor by sending in news items from time to time. We are particularly eager to get notes regarding engineering work in hand or proposed, contracts awarded, changes in staffs, etc.

ADDITIONAL TENDERS PENDING

Not Including Those Reported in This Issue

Further information may be had from the issues of *The Canadian Engineer*, to which reference is made.

PLACE OF WORK	TENDERS CLOSE	ISSUE OF	PAGE
Baintree, Alta., erection of frame school building	Nov. 18.	Nov. 6.	48
Montreal, Que., briquetting machinery	Dec. 14.	Nov. 6.	54
St. Clements, B.C., bridge	Nov. 19.	Oct. 16.	48
Toronto, Ont., water meters	Nov. 18.	Oct. 30.	45

BRIDGES, ROADS AND STREETS

Dundas, Ont.—The ratepayers passed a by-law to provide $3,500 for the construction of a new bridge over the creek at Head St. Engineer, J. W. Tyrrell, Hamilton.

Enderby, Alta.—Tenders will be received by the Honorable the Minister of Public Works up to noon of Wednesday, November 19th, 1919, for the erection and completion of a highway bridge over the Shuswap River at Enderby, B.C. Plans and specifications may be seen or obtained at the Department of Public Works, Parliament Buildings, Victoria, B.C.; at the offices of the district engineer, Court House, Vancouver, B.C., and at the offices of the assistant district engineer, Vernon, B.C.

Erickson, B.C.—Tenders will be received by the Hon. the Minister of Public Works, Parliament Buildings, Victoria, B.C., up to noon of Tuesday, November 25th, 1919, for the erection of a highway bridge over the Goat River, near Erickson. Plans and specifications may be seen at the Department of Public Works, Parliament Buildings, Victoria, B.C.; at the office of the District Engineer, Court House, Vancouver, B.C., and the office of the District Engineer, Nelson, B.C.

Fredericton, N.B.—Tenders are being called by the Provincial Department of Public Works for flooring for the highway bridge at Andover, Victoria County, and rebuilding the Lucas bridge, parish of Chipman, Queens County.

Fredericton, N.B.—The Canadian National Railway authorities have had plans and specifications prepared for the erection next spring of a new bridge near here. Tenders will be called.

Galt, Ont.—Ald. S. J. McLane, chairman of the Board of Works, introduced by-laws at a recent meeting of the city council, providing for the construction of cement sidewalk on the south side of Oxford St., from Bond St. to Dundas St., and a sidewalk on the west side of Forest Rd., from Cedar St. to Waterloo Ave. Ald. McLane will also introduce a by-law to construct a sidewalk on Hobson St.

Kitchener, Ont.—At a special meeting of the Waterloo county council held recently, by-laws were passed establishing the township road between Elmira and Floradale as a county road. This road will be a continuation of the provincial county road from Elmira to Hamilton.

Niagara Falls, Ont.—City Engineer D. T. Black's estimates for pavement on Palmer and Kitchener Streets were passed by the city council. St. Clair Ave. may also be paved as far as Queen St.

Oakville, Ont.—Town council will obtain an estimate on a Tarvia pavement for Park Ave. Clerk, W. E. M. Crawley.

Pembroke, Ont.—Town council is considering the construction of a concrete walk on the south side of Elizabeth St., from Moffat St. to Indian River. Town engineer, W. J. Moore.

St. Barnabe de Gatineau, Que.—Tenders will shortly be called for by A. A. Gelinas, St. Barnabe, Nord, Que., for gravelling the municipal road at a cost of $16,000. Engineer, M. Henry, Roads Department, Parliament Buildings, Que.

Stanbridge East, Que.—Municipal council decided to send delegates to meet the Provincial Minister of Roads, to urge immediate action by the government for the construction of the proposed highway between Lacolle and Knowlton. Mayor, H. Beatty.

Toronto, Ont.—Tenders, addressed to the Chairman, Board of Control, City Hall, Toronto, will be received up to noon, Tuesday, November 25th, 1919, for the construction of asphalt pavements, concrete curbings and concrete sidewalks on several streets. Specifications may be obtained at the Department of Works, City Hall.

Toronto, Ont.—The board of control decided to hold over the construction of the St. Clair pavement to Keele St. until the spring.

Toronto, Ont.—The Civic Works Committee decided to revive the Teraulay St. extension scheme, which was abandoned during the war period. It is suggested that the street be opened to a width of 86 ft., from College St. to Davenport Rd. Works Commissioner Harris will make a further report on the matter.

Victoria, B.C.—A petition has been presented to the provincial government by J. E. Armishaw, of Sayward, Salmon River, Vancouver Island, for an appropriation for the building of a main highway, from Campbell River, 38 miles north to Salmon River, and the erection of a bridge across the Campbell River,

Victoria, B.C.—The streets committee of the city council, on recommendation of City Engineer F. M. Preston, ordered that the matter of improvements for Lang St. be referred to next year's council.

Welland, Ont.—City council passed a by-law authorizing the opening of Pine St. through to Aqueduct.

WATER, SEWAGE AND REFUSE

Assiniboia, Man.—The rural municipality of Assiniboia intends to undertake the following improvements: The laying of water mains along Emo St. and Oakdean Rd., and the erection of a pumping station, the sinking of a well and supplying same with all necessary machinery, on Woodhaven Boulevard. Secretary-treasurer, Frank Ness, Kirkfield Park P.O., Man.

Brandon, Man.—City council decided to have several water mains laid in the east end of the city. City clerk, H. Brown.

Bridgeburg, Ont.—Tenders addressed to R. A. Land, clerk, Bridgeburg, Ont., will be received up to 6 p.m., November 17th, for the supply and installation of a 24-in. Bell and Spick cast-iron intake pipe 200 ft. long. Also the supply and installation of an intake crib. Plans and specifications may be seen at the clerk's office.

Galt, Ont.—Ald. S. J. McLane, chairman of the Board of Works, introduced by-laws at a recent meeting of the city council, providing for the construction of a sewer through Dickson Park and on James St., Myrtle Ave. and Huron St., and on Portland St., from Cambridge to Oxford St., and on Oxford St., from Portland St. to Dundas St.