EXCURSIONS

British Association

Winnipeg, 1909

Excursion to Portage la Prairie

Wheat Fields

B

Saturday, August 28th, 1909

Application for Excursion Tickets must be made at the Excursion Counter in the Reception Room, not later than 2 p.m., on Thursday, August 26th

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For Time Table see Back of Cover

Printed at the Public Press Limited, 275-277 Sherbrooke St., Winnipeg

Excursion to Portage la Prairie

The party taking part in this excursion is limited to 100.

Visitors will be driven to some of the Wheat Fields where harvesting operations will be in full progress.

Mr. J. T. Arundel, of the Canadian Pacific Railway, will accompany the party on the train.

Time Table

10 a.m., Special Train leaves Winnipeg, C.P.R. Depot.
11.35 a.m., Arrive Portage la Prairie.

Lunch at Hotel in Portage la Prairie
Drive through Wheat Fields

4.25 p.m., Special Train leaves Portage la Prairie.
6 p.m., Arrive Winnipeg.

Fare $1.65 for the Return Journey.

Number of Party limited to 100.

BRITISH ASSOCIATION, WINNIPEG, 1909

Excursion to St. Andrew's Locks

on the Red River

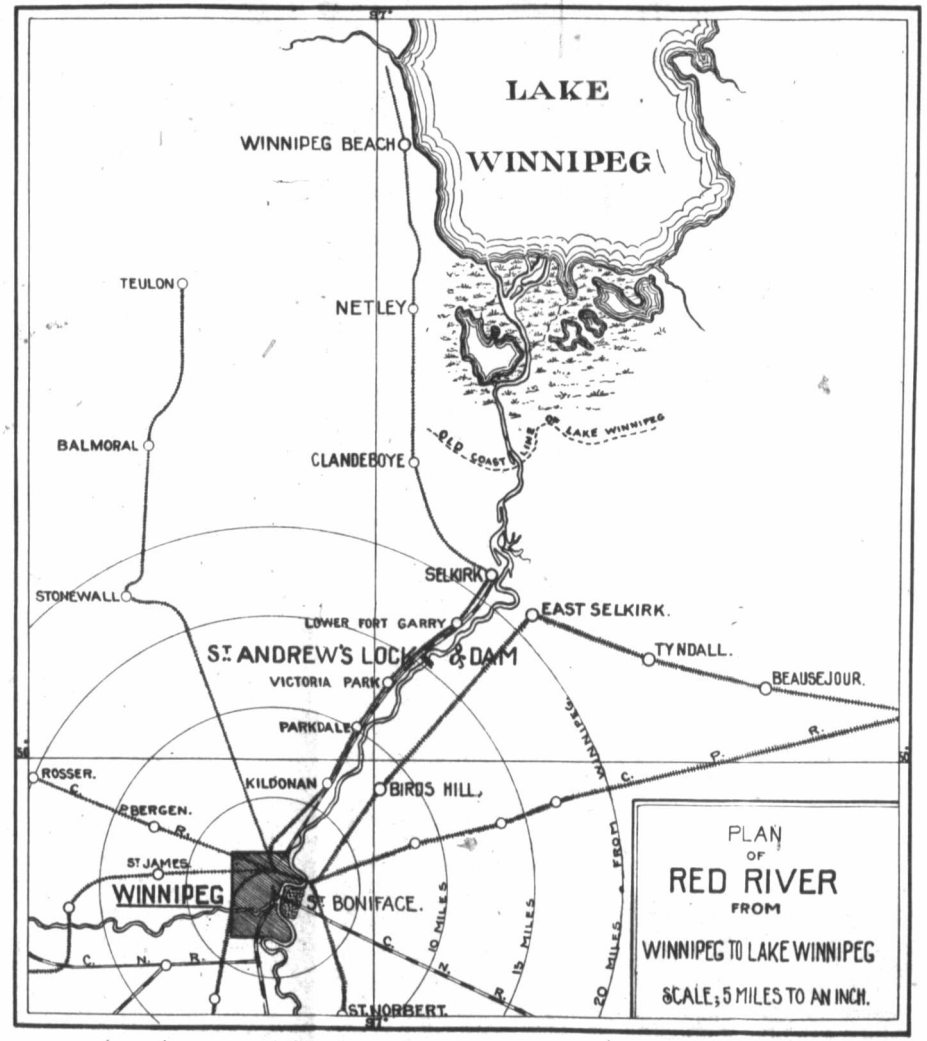
Saturday, August 28th, 1909

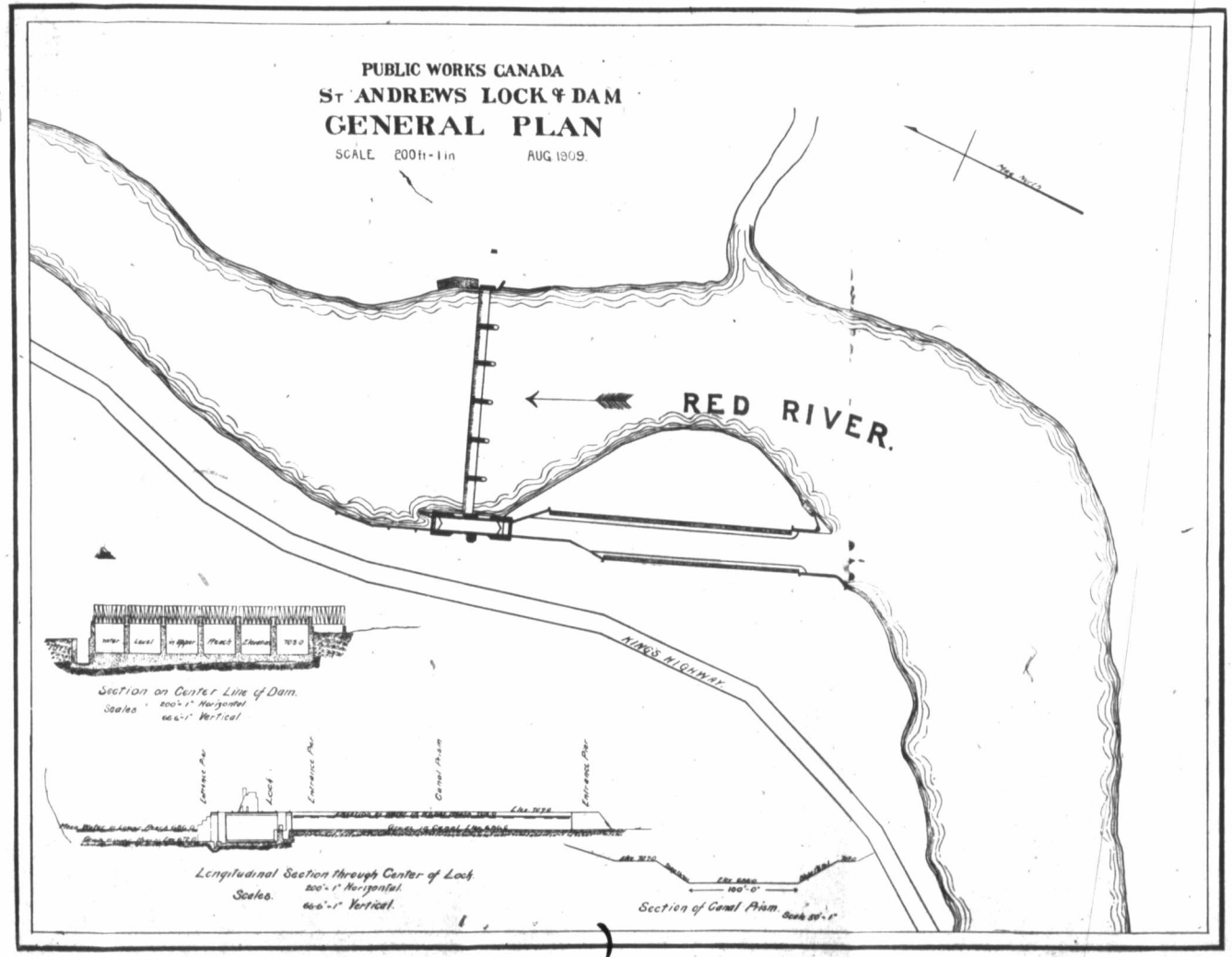
C A. R. Dufresne, Esq., has kindly consented to act as guide for the party.

Application for Excursion Tickets must be made at the Excursion Counter in the Reception Room, not later than 2 p.m., on Thursday, August 26th.

For Time Table see Back of Cover.

Printed at the Public Press Limited, 275-277 Sherbrooke St., Winnipeg


LAKE
WINNIPEG
WINNIPEG BEACH
TEULON
NETLEY
BALMORAL
CLANDEBOYE
RED RIVER COAST LINE OF LAKE WINNIPEG
SELKIRK
STONEWALL
EAST SELKIRK.
LOWER FORT GARRY
TYNDALL.
ST ANDREW'S LOCK & DAM
VICTORIA PARK
BEAUSEJOUR.
PARKDALE
ROSSER.
KILDONAN
BIRDS HILL.
BERGEN.
ST JAMES.
WINNIPEG
ST BONIFACE.
ST NORBERT.
10 MILES
15 MILES
20 MILES FROM LOCK
PLAN
OF
RED RIVER
FROM
WINNIPEG TO LAKE WINNIPEG
SCALE, 5 MILES TO AN INCH.


PUBLIC WORKS CANADA
ST ANDREWS LOCK & DAM
GENERAL PLAN
SCALE 200ft-1in AUG 1909.
RED RIVER.
KING'S HIGHWAY
Section on Center Line of Dam.
Scales: 200'-1" Horizontal
66'-1" Vertical
Longitudinal Section through Center of Lock.
Scales. 200'-1" Horizontal.
66'-1" Vertical.
Section of Canal Prism. Scale 50'-1"

The St. Andrews Lock and Dam

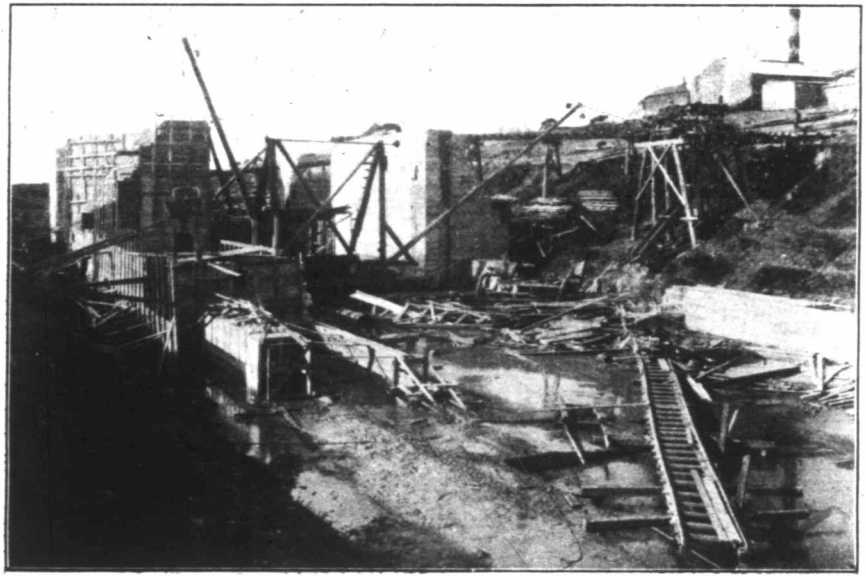
By A. R. Dufresne, Esq., District Engineer,
Department of Public Works,
Dominion Government.

In connection with the widespread interest now taken in Canada in the development of inland waterways for navigation purposes, it may be noted that there are rapidly approaching completion certain improvements on the Red River that will bring into close communication, by water transportation, the resources of Lake Winnipeg, with the City of Winnipeg.

Lake Winnipeg is distant 52 miles north of the City of Winnipeg, and has an area of some 9,460 square miles, being the fifth largest lake in Canada. The principal known resources on the lake are Fisheries, Timber and Minerals.

At the present time, navigation on the Red River, between Lake Winnipeg and the City of Winnipeg, is interrupted by the shallows in the St. Andrews Rapids, occurring in a distance of some ten miles, in which distance there is a fall of 15 feet in the river slope. By the construction of a Lock and Dam in the river, below the St. Andrews Rapids, it is proposed to raise the water above that point, a height of 21 feet, thereby flooding out the rapids and increasing the navigable depth in the channel of the river above the rapids.

The St. Andrews Lock and Dam is located 20 miles, by river, below Winnipeg.



Construction of Locks, St. Andrews Rapids, Red River.

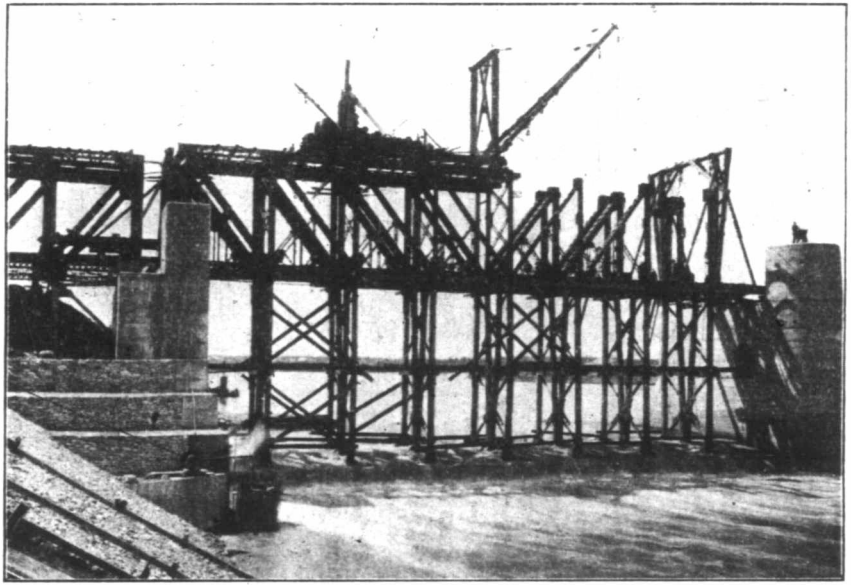
THE LOCK AND CANAL

The Lock has been located in a curved reach of the river, on the convex shore, in order to secure better protection from ice drift during floods, and also to take advantage of slack water for vessels in manœuvring for entrance.

The Lock between ends of extension walls is 290 feet in length, and 215 feet in length between hollow quoins, width 45 feet between vertical walls and total lift, or difference between elevation of lower and upper pools, 21 feet. A navigable depth of at least 9 feet at periods of lowest water will be maintained. The Lock is built entirely of concrete, some 17,000 cubic yards having been employed for this purpose. The foundations are on the local magnesian limestone of Trenton formation. The walls of the Lock are 37 feet in height and have a base width of 20 feet.

The side wall culvert system of filling has been adopted, there being a 5 ft. by 6 ft. culvert in each side wall with 8 ports of 2½ feet diameter leading into the body of the Lock from each culvert. The filling and emptying valves are located above and below each set of Lock gates and are automatic cylindrical valves, adapted from the Fontaine cylindrical valve used in France.

These valves are of special interest inasmuch as the working parts are not subject to pressures due to head and the valve will be therefore easy to manipulate under the maximum head of 21 feet.



Erection of Steel Work, St. Andrews Locks, Red River

The Lock gates are of the solid, built up, timber type, constructed of British Columbia fir and Southern oak. A number of 2½-inch vertical bolts run through from top to bottom and in addition each frame is dowelled with oak pins, and cast iron wedge blocks are inserted between each timber.

The gates are further reinforced by built-in girders to resist shock from vessels. Each leaf of the upper gates weighs 90 tons, and each leaf of the lower gates weighs 65 tons.

The gates are stepped on gun metal pivots and are anchored to the masonry by anchor bars imbedded in the concrete.

The gates mitre on 18 inch by 18 inch by 26 feet long oak sills, bolted to the concrete by 7 feet long anchor rods.

In the event of its being found necessary to unwater the Lock to effect repairs, this can be done by putting in stop logs at the upper and lower end of the extension walls, special provision having been made for this purpose by putting in checks in the masonry.

The guide piers at the lower entrance to the Lock are concrete walls of a gravity section, built on prepared rock surface, the west pier being 353 feet, and the east 43 feet in length.

The guide piers at the upper entrance are of a reinforced concrete type with spread base. These piers are built on closely cemented gravel and boulders and are 27 feet in height.

The upper canal is 1200 feet in length, bottom width 100 feet, and side slopes of 1 on 1½. Bank protection of broken stone is laid in a prepared trench to prevent wave erosion.

At the upper end of the canal are the upper entrance piers, constructed of concrete, the pier on west side being of a reinforced concrete type similar of section to those at head of the Lock.

The pier on east side of upper entrance is constructed to withstand ice shoves during spring freshets.

THE DAM

A particular study was made of the conditions of the river with a view to the adoption of a type of dam which would interfere, as little as possible, with the regimen of the stream during freshet period.

The Red River has a drainage basin of some 63,400 square miles and takes its source south of the International Boundary. The River has a discharge varying from 4,000 to 80,000 cubic feet section from periods of low water summer discharge to spring freshets. The conditions during the spring freshets are further aggravated by ice gorging in the lower portions of the stream. The ice gorging is principally caused by the fact that the break up takes place first in the head waters, bringing a rush of water to the lower portion of the stream before the influence of mild weather has been felt. In periods of freshet

the river is bank full and it was found necessary to adopt a movable type of dam which would take care of the comparative large freshet discharge and not cause floods.

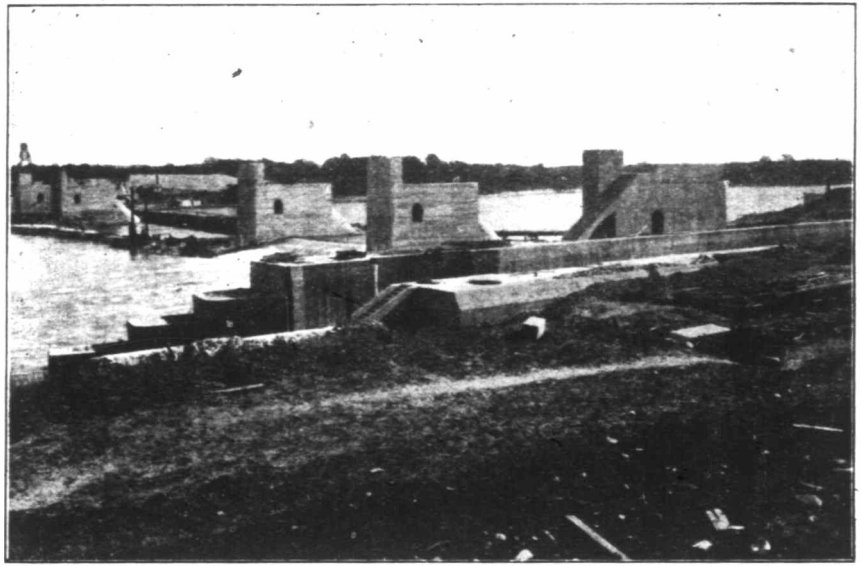
The Dam consists of a sub-structure or permanent dam of concrete on which is operated a movable dam, suspended from a service bridge.

The Dam is 788 feet in length between abutments, consisting of six spans of 119 ft., 8 in., and five piers of 14 feet in width.

Altogether, some 25,000 cubic yards of concrete have been used in the construction of the Dam. The Dam was built in sections, a portion of the river bed being unwatered at a time, excavation being carried down into a solid stratum of rock. The closure in the Dam was effected by diverting the stream over two spans of the completed portion. It is interesting to note that the greater portion of this work was constructed during the last two winters under conditions of temperature that varied as low as 45 degrees Fahr. below zero (–42.8° Cent.). For this purpose, the work was housed in and heated, and at no time were temperatures observed, in the work, below freezing point.

The movable dam is the first of its type constructed in America, and has for its prototype the Cameré curtain dam at Poses, on the Seine, France.

The general principles and mode of operating this dam are as follows:—



Construction of Dam, St. Andrews Locks, Red River.

Curtains consisting of wooden battens, hinged together by brass links, are supported by frames suspended from a bridge.

The curtains have for their base a rolling, cast-iron shoe of the form of an archimedean spiral, and they are rolled by an endless chain by means of a travelling windlass. The curtains have any lateral travel limited by guides in the supporting frames.

The supporting frames are suspended by joints to the lower floor of the bridge. They are formed of built-up members and have their lower ends resting against large cast steel step castings, embedded in the concrete.

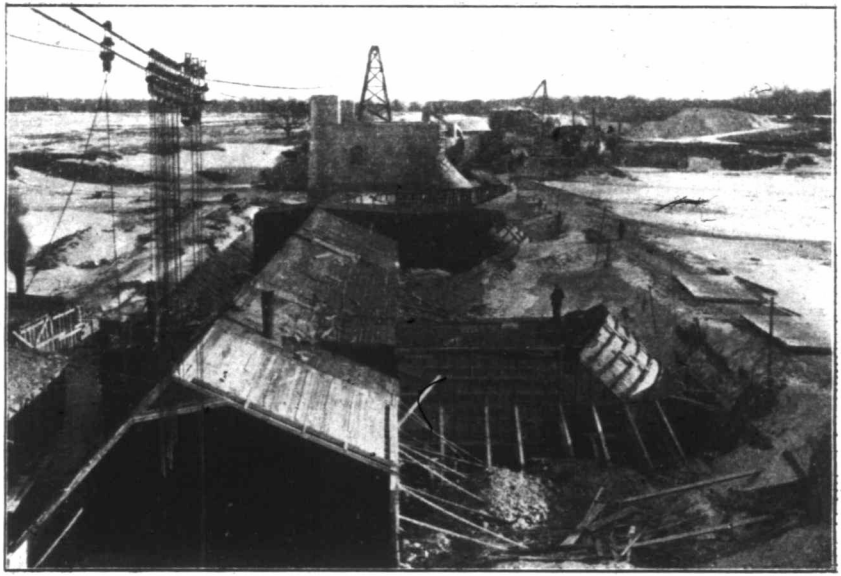
The frames are raised and lowered by means of travelling electric cranes operated from the service floor.

The Permanent Dam will raise the upper level 7 feet, and the further raise of 14 feet will be accomplished by means of the curtain dam.

At the end of the navigable season, the curtains are rolled up, removed, and stored away, and the curtain frames are raised, leaving unobstructed passage for the ice and spring freshet.

On the upper deck there will be a general traffic highway floor of reinforced concrete and a bascule lift will be erected over the lock chamber.

On the east side of the river a repair shop is being erected with a complete equipment to perform all necessary field repairs.



Construction of Dam during Winter, St. Andrews Locks, Red River.

It is expected that the work will be completed this fall and will be in operation on the opening of navigation next spring.

The following are some of the critical elevations, referred to sea level datum plane:—

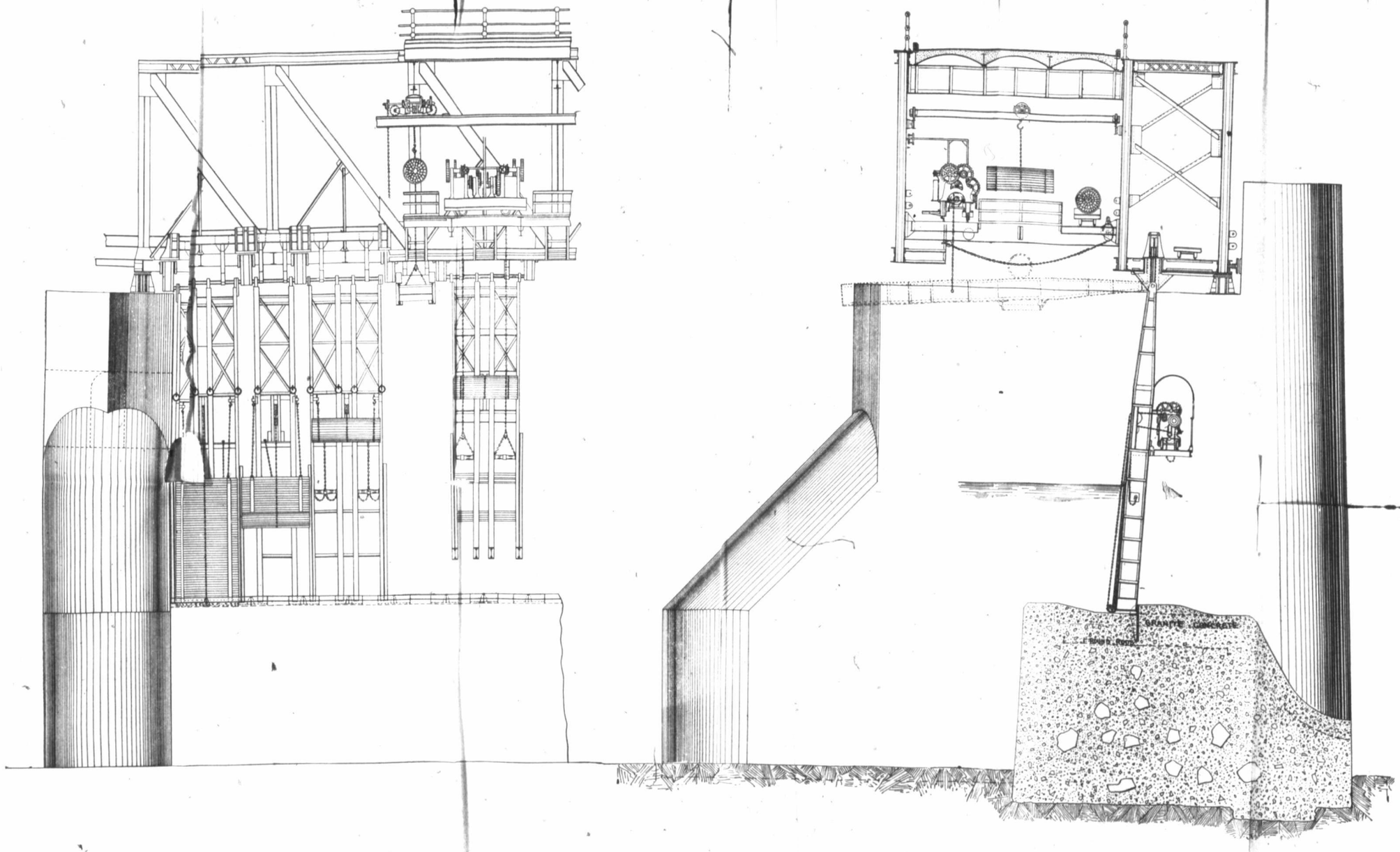
Lower pool—low water	El. 682.0
Upper pool—maintained level	El. 703.0
Lower mitre sill of lock	El. 672.0
Upper mitre sill of lock	El. 686.0
Crest of permanent dam	El. 690.5
Working floor of service bridge	El. 730.6
Highway floor of bridge	El. 748.9

In view of the remarkable progress now being made in the opening up and development of the varied resources of this great Western country, it is perhaps not difficult to foresee, in the completion of the St. Andrews Lock and Dam, a serious consideration of the valuable importance of our inland waterways and their development, in the near future, as natural highways of commerce.

Of particular interest are the possibilities of the development of the Saskatchewan River, from the foot hills of the Rocky Mountains to Lake Winnipeg, and thence, by way of the Nelson River, to the Hudson Bay.

A. R. DUFRESNE,
District Engineer.

WINNIPEG,
AUGUST 19TH, 1909.



PUBLIC WORKS - CANADA

ST ANDREWS RAPIDS

MANITOBA

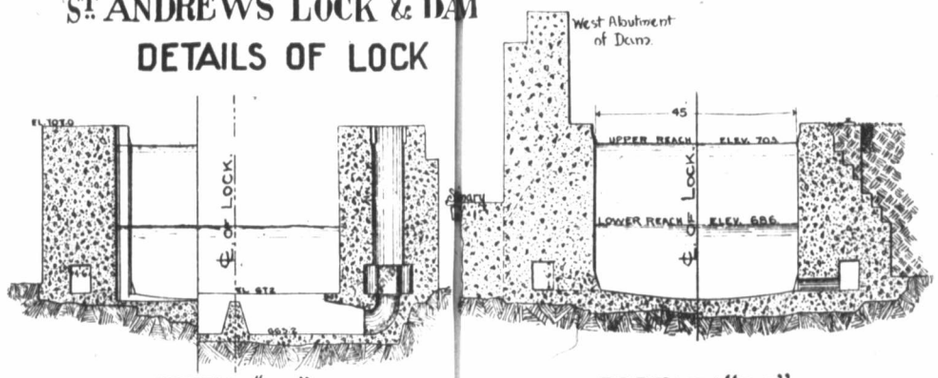
MOVABLE DAM

Scale = ¼ inch = 1 foot

PUBLIC WORKS, CANADA

ST. ANDREWS LOCK & DAM

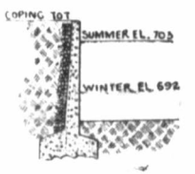
DETAILS OF LOCK



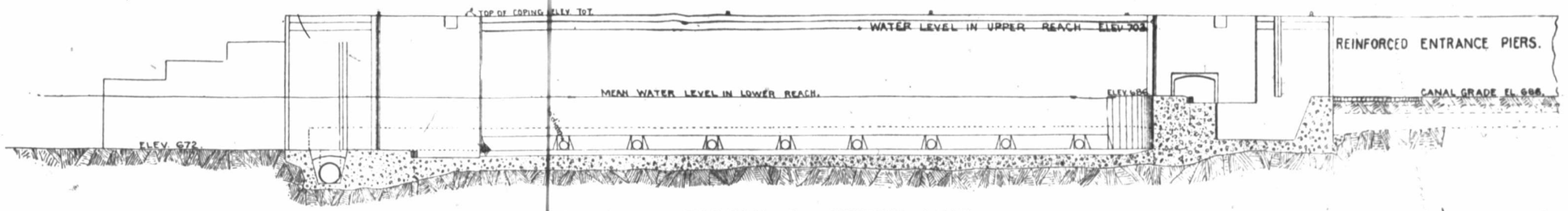
SECTION "A.A."

SECTION "B.B."

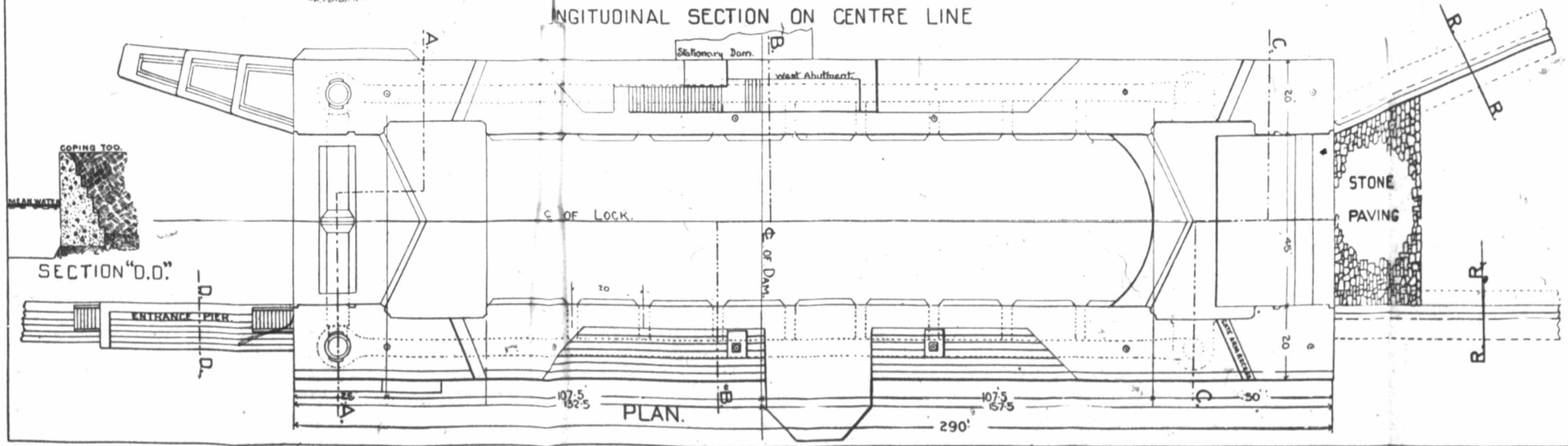
SECTION "C.C"



SECTION R.R.



LONGITUDINAL SECTION ON CENTRE LINE



Time Table

2 p.m., Special Train leaves Winnipeg,
C.P.R. Depot.
2.30 p.m., Arrive Gonor.

4.30 p.m., Special Train leaves Gonor.
5 p.m, Arrive Winnipeg

Return Fare 45 cents.

The number of the Party is limited to 150.

Excursion to Stony Mountain

Saturday, August 28th, 1909

Dr. Hunter of Teulon has kindly consented to act as guide to this party.

Application for Excursion Tickets must be made at the Excursion Counter in the Reception Room, not later than 2 p.m., on Thursday, August 26th

For Time Table see Back of Cover

Printed at the Public Press Limited, 275-277 Sherbrooke St., Winnipeg

Trip to Stony Mountain

By Dr. George Bryce

Stony Mountain, as it is locally called, lies slightly West of North of the City of Winnipeg, at a distance of about fourteen miles, being connected with the city by the Teulon Branch of the Canadian Pacific Railway. On account of the dead level nature of the open prairie about Winnipeg, this elevation, which at its highest part is only sixty feet above the surrounding plain, becomes interesting. Being several miles in circuit and in somewhat of a horseshoe form Stony Mountain became noted in affording the Selkirk Colonists shelter in the notable flood of 1826. It was further useful in supplying the Scottish Settlers, in the winter of 1852, with the stone for Kildonan Church.

In later times Stony Mountain is chiefly associated with the fact that the Manitoba Penitentiary was established there in 1872, and it remained until recent years the penal settlement for the whole of Western Canada to the Rocky Mountains. For the erection of the first Penitentiary building, it is worthy of

notice that though Stony Mountain quarries have supplied much stone and lime toWinnipeg, yet the stone was laboriously hauled by ox carts over the prairies from the quarry on Red River some eight miles distant. This was certainly "carrying coals to Newcastle."

Of interest to the visiting scientists is the fact that during the building of the Penitentiary in 1872 and following years, there was the discovery by the workmen of a deep fissure in the rock, which was inhabited by vast numbers of snakes. These were the harmless "garter snakes" (Eutænia sirtalis). They in hundreds came out at noonday to sun themselves upon the rocks, and were finally extirpated by the workmen.

Before the building of the railway to Stony Mountain it was a favorite drive from the city, and Warden Benson of the Penitentiary did much to make it a place of resort, by his geniality and hospitality.

Here in 1878 the Governor-General of Canada, the Earl of Dufferin, with Lady Dufferin and their daughters, received an unique reception. At the foot of the mountain a Red River ox cart was in readiness, drawn by

twelve oxen, in tandem, and decorated with leaves and flowers, The Governor-General was required to ascend the cart and take a seat upon a robe upon the bottom of the equipage. A carriage was provided to take up the ladies, but they insisted—mother and two daughters—on entering the cart, and rode in triumph to the top of the hill. Three years ago in Belfast, at the unveiling of Lord Dufferin's monument, Lady Dufferin, in speaking to the writer, referred to the incident known as the "ascent of the Mountain." Warden Benson also maintained a herd of buffaloes at the Mountain for several years, and the writer remembers well seeing a buffalo chase on the plain for the benefit of a later Governor-General—the Earl of Aberdeen—which he witnessed from the top of the Mountain.

THE MOUNTAIN

Stony Mountain is of great interest to the visiting geologists. In early days, it was suggested that it was not composed of rocks in situ, but was probably an enormous boulder, yet that opinion has been given up. The more generally accepted theory is that during the Ice Age, through some special cause not yet

made out, a vast ice field, possibly several miles high, stretched across the whole north of the American continent. As the several northern rivers, Red River, Nelson, etc., had poured their waters northward toward Hudson Bay, the slope was in that direction. The ice-lobes stopped the egress northward, and a great lake was formed, covering a larger area than that of the five great lakes of North America now known to us. This lake, which was five hundred feet deep, where the City of Winnipeg now stands, is called the Glacial Lake Agassiz. In the post-glacial period the ice mountains gradually melted away, and great ice-capes or glaciers slid down the rocks, denuding them, tearing away mountain masses, and grinding down the rock surfaces; so were carried away great quantities of detritus and this was spread on the lake bottom to form the drift deposits of our plains.

Careful observation of Stony Mountain shows that on the West and Northerly sides numerous striæ are found running from N.N.W to S.E., showing that a glacier was moving in that direction. East of Stony Mountain and far east on the Lake of the Woods rocks, hun-

dreds of striæ are found in the direction from N.E. to S.W. It is now maintained that these two denuding glacial masses coming from opposite directions impinged on the E. and W. sides of the limestone mass, and while all the rocks to the height of Stony Mountain and probably higher were carried away by denudation, this mountain mass remains—"like an island of limestone." The exposure on the West side of the mountain is overtopped by a few feet of drift. Underneath this are layers of a hard dolomitic limestone mixed with a few thinner beds, and these make up forty feet of the escarpment, the lower six or eight feet of it running into yellow ochreous rock. While this forty feet of white rock is largely without fossils, below it is a most interesting rock deposit, interpenetrated with iron, of a deep reddish color, and full of fossils. From a well dug in the rock it is found that this yellowish, reddish mass goes down for some depth. The upper dolomitic limestone is suited for building stone, the red stone is quite soft, though, as is usual, the red fossils in it are much harder.

FOSSIL REMAINS

In the red layers the prevalent fossils are as follows:

Corals—Chætetes lycoperdon.
Streptelasma corniculum (abundant).
Favorites basaltica.
Favistella favosidea.
Petraia profunda.

Crinoids—A few smooth stems.

Trilolites—Cheiruru.
Calymene senaria.

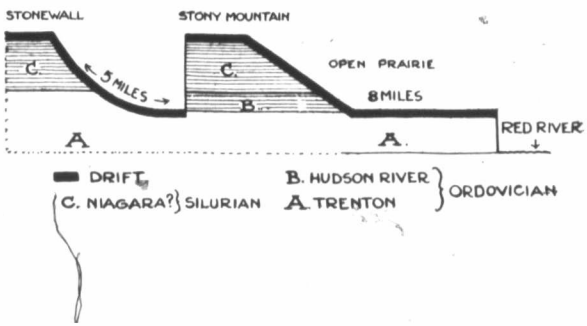
Brachiopods—Orthis (2 species).
Rhynconella (abundant).
Strophomena (3 species, abundant).

Gasteropods—Murchisonia (2 species).
Pleurotomaria.

While the grouping of these fossils is not quite the same as that of the Lower Silurian (Ordovician) found in Eastern Canada or Great Britain, yet the consensus of opinion is that these red layers are of **Hudson River** age (Caradoc of Great Britain). In the upper white layers, while the fossils are few, they seem to indicate an approximation to the **Niagara** age (British Wenlock), though not

quite certainly. An examination of the limestones eight miles east on the banks of Red River, seem to point to Trenton age, a lower formation than Hudson River.

Vertical Section—The following diagram shows generally the position of the rocks of the district.



Time Table

2 p.m., Special Train leaves Winnipeg,
C.P.R. Depot
2.30 p.m., Arrive Stony Mountain

5 p.m., Special Train leaves Stony
Mountain.
5.30 p.m., Arrive Winnipeg.

Return Fare 40 cents.

The number of the Party is limited to 100.

Excursion to The City Hydro-Electric Plant

Point du Bois

Saturday, August 28th, 1909

E

Mr. Cecil B. Smith, the Construction Engineer, has kindly consented to conduct the party over the works

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Application for Excursion Tickets must be made at the Excursion Counter in the Reception Room, not later than 2 p.m., on Thursday, August 26th.

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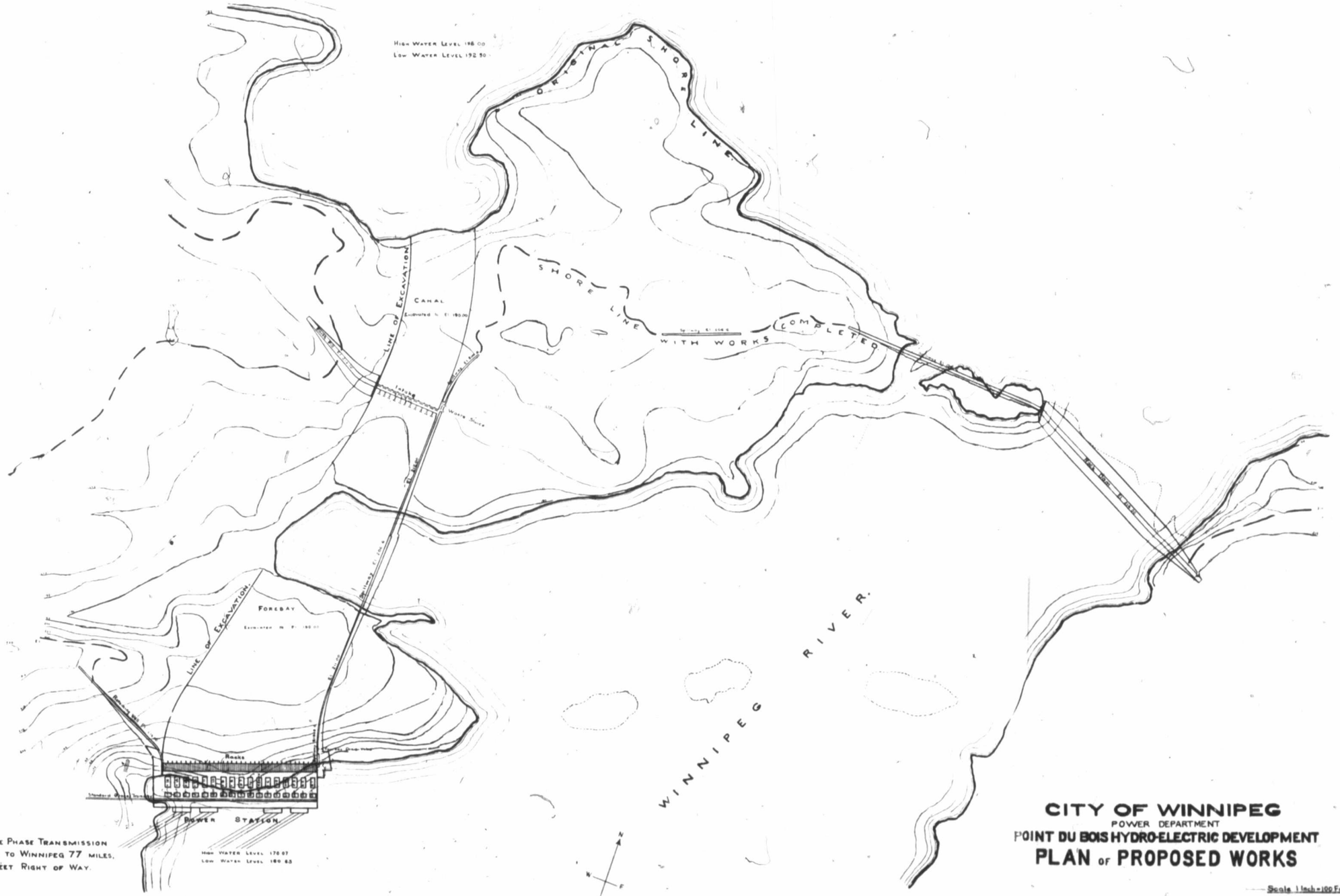

High Water Level 198.00
Low Water Level 192.50
Original Shore Line
Shore Line with Works Completed
Canal
Line of Excavation
Forebay
Line of Excavation
Racks
Power Station
High Water Level 170.07
Low Water Level 160.62
Winnipeg River
4 Three Phase Transmission Lines to Winnipeg 77 miles, 100 feet Right of Way.
City of Winnipeg
Power Department
Point du Bois Hydro-Electric Development
Plan of Proposed Works
Scale 1 Inch = 100 Feet
C. A. Smith Engineer

The Municipal Hydro-Electric Works of the City of Winnipeg, now under construction at Point Du Bois Falls on the Winnipeg River, with transmission and delivery of Electric Energy in the City.

The present Public Utilities Company, which is operating in and around the City of Winnipeg, has a monopoly of such a nature that the Municipal Authorities have decided not to await the expiration of the present franchises, which would enable the City to assume control either of these present properties, or to arrange new agreements for further control of rates. The only other course logically open was to create competition, for the reason that the cost of fuel in Winnipeg is excessive and does not offer effective means of competition in itself by the private production of Electric Energy. This competition might have been created by chartering a second company for the production and sale of Hydro Electric Energy, but the history of such efforts has usually been that of amalgamation, and a repetition of monopoly. Whether or not such or any monopoly, is or is not, when regulated, for the best interests of a city, need not be discussed here, but the decision was reached in 1905 to construct Municipal Works, for the purpose of creating the competitive condition desired.

In that year a careful examination was made of the hydraulic resources of the Winnipeg River, which has its chief gathering grounds

in the lake country of Western Ontario, and which flows through the eastern portions of the Province of Manitoba and empties into Lake Winnipeg, after passing through a rock-ribbed country very suitable for such works as were contemplated. The report presented justified the City Authorities in making contour surveys of the most promising power sites, which were performed during the following winter, after which followed engineers' estimates of cost in April, 1906, and a popular vote of $3,250,000 in June, 1906, which indicated clearly the then desire of the property owners of the City, which was to expend the above mentioned sum on Municipal Hydro Electric Works.

In October, 1906, the designs for works were begun, and it was then contemplated to complete the same in two and a half years, but some delay has been occasioned by various events, chief of which might be instanced the financial stringency of 1907, which caused a set back of over a year; but the construction is now being vigorously prosecuted, over $500,000 has been expended, and further contracts of over $1,000,000 are now in process of completion, whilst further contracts for equipment and distribution are soon to be placed, and it is contemplated to have the works in operation ready for delivering power within the next eighteen months.

The undertaking will consist, when completed, of the following:

(1) A 60,000 h.p. Generating Station, operating under 45 feet to 46 feet of hydraulic head.

(2) A Seventy-seven Mile Transmission, consisting of four three-phase circuits carried on two series of double circuit steel towers with concrete footings.

(3) A Terminal Station in the City, at which the pressure of the current transmitted will be reduced to 11,000 volts.

(4) An Underground Cable Distribution to sub-stations.

(5) Three or more Sub-Stations where the voltage will be reduced to 2,200 volts and or 550 volts.

(6) A Secondary Underground and Overhead Distribution to customers.

It is proposed to describe briefly the component parts (1), (2) and (3) above enumerated. The distribution has not yet been studied in detail.

(1) Generating Station at Point du Bois: Nature has here been beneficent, and the following imporatnt features are in evidence:—

(a) A large lake adjacent to the head gates, with consequent favorable operating conditions;

(b) A contour favorable to economical works;

(c) Rock foundations for all constructions;

(d) A difference of hydraulic level wihch will be practically constant;

(e) A water free of silt, or any other objectionable matter, either dissolved or in suspension.

After studying various possible designs, it was decided to build concrete overflow walls, a rock-filled dam, and a power house with wheel pits built as an integral part of the head block, and a transformer station, also integral with the power house itself. Further consideration of cost and climate gave as a result an enclosed forebay room, and double runner turbine units of 5200 h.p. capacity each, at a speed of 164 r.p.m., also motor operated head gates protected by stop log arrangements; the whole power house being again protected by head gate piers in the canal, by which the canal can be unwatered by the use of stop logs.

The Generating Room will ultimately contain two turbine driven exciters, 250 k.w. each, and two motor driven exciters of the same capacity, and sixteen main generator units of 3,000 k.v.a. each, operating at 6,600 volts, 60 cycles, three phase; of the above five main units and two exciters are to be now installed. These generating units will be so arranged as to be operative in groups of three per bank in accordance with a similar grouping of the step up transformers. Electric travelling cranes of suitable capacity will be installed in the generator and turbine rooms.

The Generating Station will be built throughout of reinforced concrete upon plain concrete tailrace walls. A cross section of the building is shown in the cut, upon which will be observed the natural arrangement of the equipment and the resulting simplicity of the station design.

The Transmission system will be constructed upon a one-hundred foot private right-of-way, and by the shortest feasible route. The towers are built up of structural shapes in an economical design and are of two types,—braced in which the spread of the base is about one-fourth the height of the tower) and flexible, consisting of channel irons supported in a plane normal to the axis of the wires; both types will be supported upon rigid concrete footings. Each line of towers will support two three phase circuits of aluminum cable mounted upon pin type insulators.

A single circuit telephone line will parallel the Transmission Line, but upon cedar poles.

The Terminal Station in Winnipeg will receive power at 60,000 volts, and will deliver it to sub-stations at 12,000 volts, by means of a three conductor underground cable system.

The Transformers will be of the water cooled type in both Generating and Terminal stations, but of the water circulating class in the former, and of the oil circulating type in the latter station.

The high tension busbar system in both stations will be of the open type. In both stations a very complete system of switching will afford the maximum of flexibility.

The accompanying plan will indicate clearly the geographical relation of the Hydro-Electrical Plant to the City of Winnipeg. It was proven advisable that the railway system existing at the time of beginning work should be extended, and that the site of the works should be made easily accessible. To this end twenty-five miles of standard gauge railway, including two bridges over channels of the Winnipeg River, were constructed from Lac du Bonnet to the power station site. A small equipment, the property of the City, is now in operation thereupon.

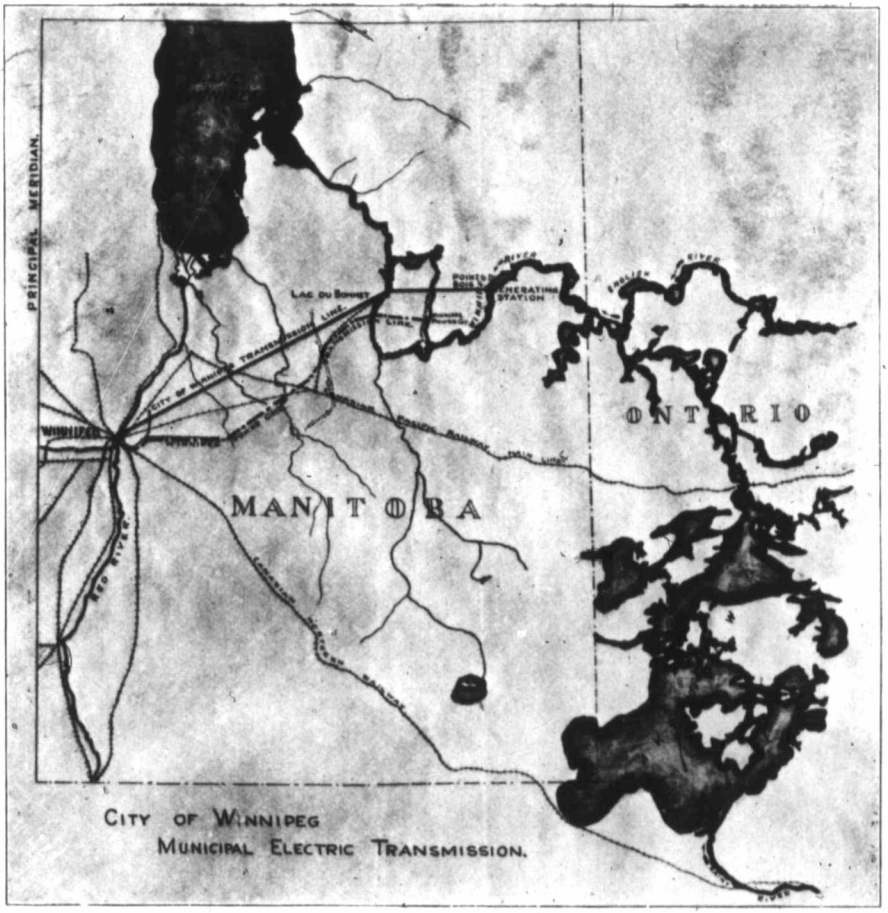
Upon completion of construction of the plant, there will be an immediate market for a considerable block of the generated power, as the City is widely spread and is rapidly growing. Its street lighting and public building services will be supplied, as also will it use its own electric power for pumping its water supply. This supply is obtained from a series of artesian wells, each already equipped with electrically driven pumps. The problems of sewage disposal will also require the use of a pumping system before many years.

In addition to the municipal and other public services, there is a rapidly growing demand for electric power for manufacturing, and to this market the City supply will be offered at attractive prices. Even now there

are in operation in Winnipeg steam plants whose aggregate demand approximates fifteen thousand horse power; and the development of the vast country to the west of the City, combined with the very high freight rates from the east to Winnipeg, and the consequent cost of fuel all tend to force a rapid increase in the application of electricity here.

Upon deciding to invest municipal funds in this Hydro-Electric development, the Authorities placed the design and construction in the hands of Mr. Cecil B. Smith, Ma.E., of Toronto, Ontario, now of the engineering firm of Smith, Kerry and Chace. The City Council has also retained as a Board of Consulting Engineers, Messrs. Col. H. N. Ruttan, C.E., of Winnipeg; William Kennedy, Jr., C.E., of Montreal, and Prof. L. A. Herdt, E.E., of Montreal, Canada.

Winnipeg, July 15, 1909.



CITY OF WINNIPEG
MUNICIPAL ELECTRIC TRANSMISSION.

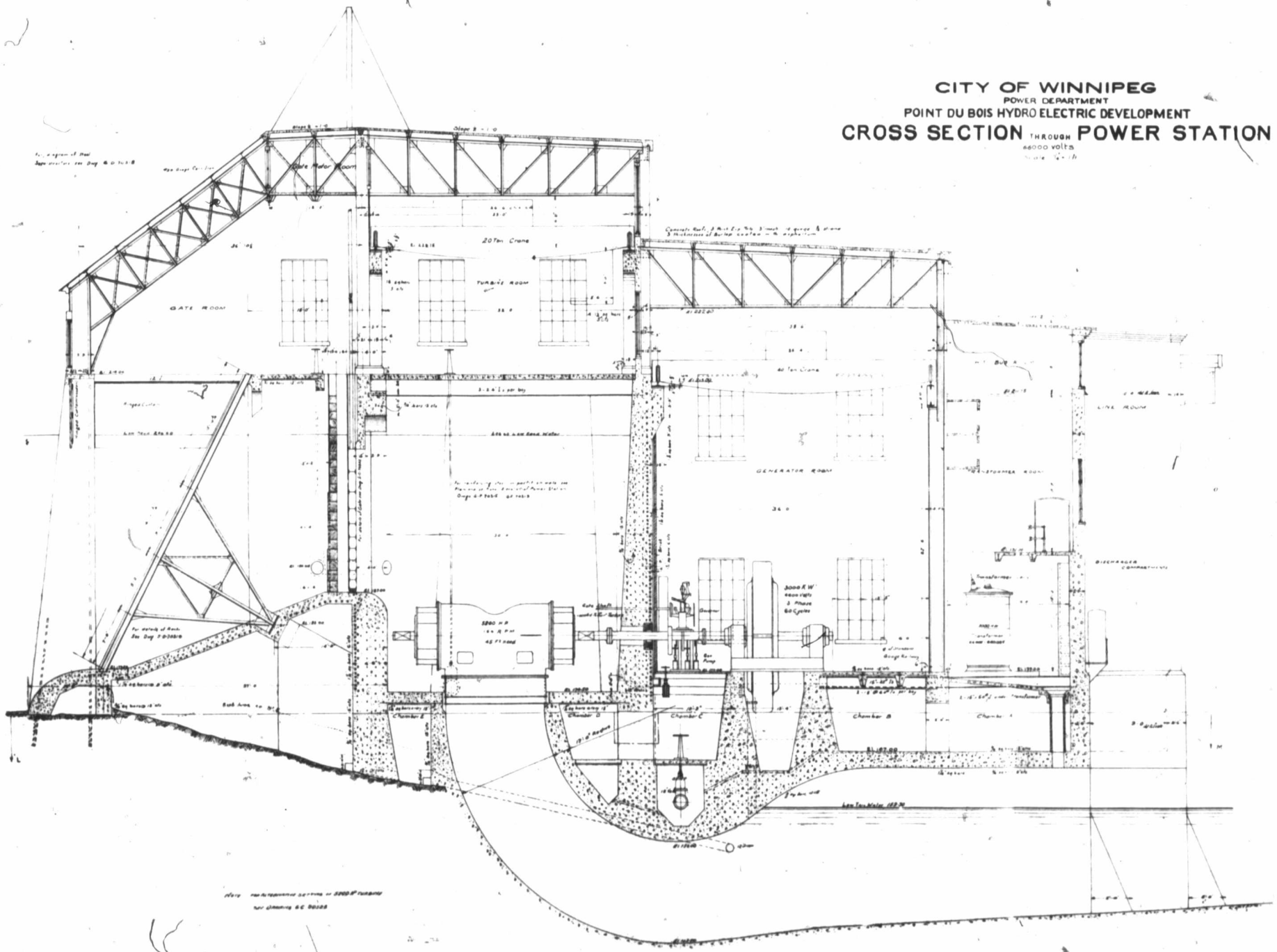
CITY OF WINNIPEG

POWER DEPARTMENT

POINT DU BOIS HYDRO ELECTRIC DEVELOPMENT

CROSS SECTION THROUGH POWER STATION

66000 volts



Time Table

9 a.m., Special Train leaves Winnipeg,
C.P.R. Depot.
10.35 a.m., Arrive Lac du Bonnet.
12 noon, Arrive Point du Bois.

2 p.m., Luncheon.

2.45 p.m., Leave Point du Bois.
4.20 p.m., Leave Lac du Bonnet.
6 p.m., Arrive Winnipeg.

Return Fare $1.85.

The number of the Party is limited to 200.

BRITISH ASSOCIATION, WINNIPEG, 1909

Excursion to Winnipeg Beach

A

Saturday, August 28th, 1909

Application for Excursion Tickets must be made at the Excursion Counter in the Reception Room, not later than 2 p.m., on Thursday, August 26th.

For Time Table see Back of Cover

Printed at the Public Press Limited, 275-277 Sherbrooke St., Winnipeg

Excursion to Winnipeg Beach

This excursion is specially arranged
for Botanists.
The party is limited to 100.

Lunch may be obtained at
the Empress Hotel, at
Winnipeg Beach.

Guide for Botanical Section of excursion
Professor A. H. R. Buller

Time Table

Special Train leaves Winnipeg
C.P.R. Depot 10.00 a.m.

Leave Winnipeg Beach 5.00 p.m.

Return Fare $1.00

The Party is limited to 100

BRITISH ASSOCIATION, WINNIPEG, 1909

Visit to Manitoba Agricultural College

Garden Party

Monday, August 30th, 1909

From 4.00 p.m. to 6 p.m.

Printed at the Public Press Limited, 275-277 Sherbrooke St., Winnipeg

Manitoba Agricultural College

The Manitoba Agricultural College was opened in November, 1906.

The governing body is a Board of Directors of ten members, elected as follows:—two by the University of Manitoba; three by the Lieutenant-Governor-in-Council; four by the Agricultural Societies of the Province, and the Minister of Agriculture, who is ex-officio a member.

The faculty at present consists of a Principal and ten professors, who are heads of the following departments:—Animal Husbandry, Field Husbandry, Chemistry, Physics, Biology, Veterinary Science, Horticulture, Dairying, Agricultural Engineering and English.

The College presents several courses, (a) The general course, which extends over two winters of 5 months each, beginning the last week of October, and ending the last of March. This course is open to all young men from the farm over 16 years of age, and possessing sufficient knowledge of the English language to profit from the lectures; (b) A short summer course in Steam and Gasoline Engineering for threshermen and farmers; (c) Two courses in Dairying

—one in home dairying for farmers' wives and daughters, and the other for operators of creameries and cheese factories; (d) Two short courses each year in nature study, school gardening, and elementary agriculture for teachers; (e) Beginning next summer, the College expects to put on its first course in Home Economics.

The College is affiliated with the University of Manitoba, and gives two courses leading to the degree of Bachelor of Science in Agriculture, one in Dairying and the other in Field Husbandry.

The cost of the five months' general course is $120, which includes tuition, board and room, books, laundry, and laboratory fees. For the short courses board and room is charged for at the rate of $4 per week. Since November last 391 students have been enrolled in the various courses.

The College, too, carries on work through the country in connection with the Agricultural Societies and Farmers' Institutes. Speakers are sent out from the College to address farmers meetings, to judge at the summer fairs, and to assist in the Good Farming Competitions. In February of each year an annual convention of the Agricultural Societies, Horticultural Society and Beekeepers' Association is held at

the College, and at the same time the Provincial Exhibition of Seed Grains is held. During the week of convention the College gives a short course in Stock Judging and Seed Selection.

The buildings consist of an administration building located in the centre of the campus, with the students' residence on the west, and the mechanical building, dairy and science building, power house, greenhouses, and principal's residence on the east. The student's residence will accommodate 200 students, On the south of the main drive leading to the City Park are the barns, which contain representative animals of 13 different breeds of live stock, horses, cattle, sheep, pigs, and poultry. In the stable will be found three imported Clydesdale mares and a pure-bred Percheron Gelding. South of the barns is the College farm, where may be seen growing wheat, oats, barley, peas, corn, clover, alfalfa, roots, etc.

The College calendar, which gives full information of the college courses, may be had on application.

BRITISH ASSOCIATION, WINNIPEG, 1909

Visit to the Canadian Pacific Railway Company's Yards and Shops

Mr. J. T. Arundel, of the Canadian Pacific Railway Company, has kindly consented to conduct the party.

Thursday, August 26th, 1909

Special Train leaves C.P.R. Depot at 2.30 p.m.
Return from shops at 5.30 p.m.

Printed at the Public Press Limited, 275-277 Sherbrooke St., Winnipeg

The Canadian Pacific Railway Company's Workshops at Winnipeg, Manitoba

Yards.—The main shops were commenced in August, 1903, and completed in July, 1905. Since this date, the following have been added:—One car shop, tender and wheel shop, extension to power house, foundry, freight car shop and mess building. They are situated about 2½ miles west of the depot on the main line. The area fenced in comprises 160 acres, and there is also a provision of 160 acres for the future extension north of the present fenced area, not yet fenced in.

The main shops face on a roadway, which is central to the shop site, and each building is placed so that it can be extended indefinitely without disturbing the layout of the works as a whole.

Tracks.—There are about 15 miles of standard gauge tracks inside the fence for handling cars and materials to any portion of the works, and in addition there are about 5 miles of 20-inch narrow gauge tracks for handling light materials between buildings and stores.

Telephones.—All shops are equipped with a local telephone system connecting with all foremen's offices, yards, etc., with general offices; also two private lines to freight yards and general offices at depot.

Fire Protection.—The shops and yards are equipped with up-to-date fire fighting appliances. Every building is equipped with automatic sprinklers, and there are located at convenient places in the yards, 29 3-way independent gate hydrants, each hydrant being housed, and having 150 feet of fire hose, with nozzles and fittings.

There are about five miles of fire mains laid in yards, ranging in size from 12 inch to 8 inch.

A constant pressure of about 45 lbs. per square inch is kept on mains and automatic sprinklers, which in

the event of fire is increased to 100 lbs. per square in. by fire pumps situated in the Power House.

A volunteer fire brigade is organized among the workmen, and a rigid inspection is made every day of all fire equipment, a report being sent in daily to the officials of the state of every valve and hydrant, etc.

In addition, the yards are eqipped with telegraphic fire stations, connecting with the power house and from thence to the City fire alarm system.

Sewage System.—The Company has a complete sewage system inside the yards, having branches from all buildings feeding to a trunk sewer, 3 feet 0 inches by 2 feet 4 inches, egg shaped, which is connected to the City system near the stock yards.

Buildings.—All the main buildings (except one car shop and tender and wheel shop, which are all concrete) are of local brick on concrete foundations, and of mill construction, having "lean-to's" for fan-houses and lavatories.

Water.—The water for power, fire and shop service is pumped from the Red River through an 8-inch C.I. pipe, connection being made to the City high pressure plant at the river, which supplies to the C.P.R. on an average, 1,000,000 gallons per day. The 8-inch pipe discharges into a concrete reservoir holding 500,000 gallons, from whence the water is pumped by service pumps in the power house into an elevated water tower, 180 feet high, and having a capacity of 125,000 gallons. This tower is connected to the fire service system, maintaining an even pressure of about 45 lbs. per square inch on the sprinkler system.

Water for drinking purposes is pumped from an artesian well, 100 feet deep, situated in the power house, supplying a separate system of piping in the yards and to the various buildings.

Steam.—Steam for power purposes is carried to the various shops through concrete tunnels from the power house, these tunnels being large enough for men to work in when repairs are necessary. The main steam pressure in the power house is 120 lbs. per square

inch, but this is reduced when it leaves the power house by an automatic pressure reducing valve to 80 lbs. per square inch, into an 8-inch main.

A 14-inch pipe at the power house supplies exhaust steam at 5 lb. pressure for heating purposes, this system of piping is also carried through the concrete tunnels with the high pressure steam pipes. The exhaust steam from engines provides all the heating for the shops during the winter months.

Through the same tunnels are carried the piping for supplying compressed air to the various buildings, also the pipes carrying the returned condensed water from the heating system; these returns are operated upon the vacuum system; which is again pumped into the boilers.

Oil Service.—Three wrought-iron tanks containing each 10,000 gallons of fuel oil are buried below the surface of the ground, west of the blacksmith shop, and this supplies the fuel for the oil furnaces in the blacksmith and boiler shops, being carried thither in pipes under the ground.

Employees.—The shops on an average employ 2,000 men of all trades.

Lighting.—The shops and yards are lighted entirely by electricity, generated in the power house attached to the works, arc, vapor and incandescent lamps being used.

Watchmen.—The shops are patrolled at night by watchmen who register at stated intervals on clocks located at all points in the grounds; these register time and location at a centre master clock in the offices.

Rail Yard.—In the yards west of the shops is situated the rail yard, which prepares all second-hand rails and curves them for construction on Western lines.

Wrecking Yard.—Adjoining this is the wrecking yard for freight cars, where all good material is dismantled from cars condemned from service.

Stores Building.—Facing the main gate upon entering the yards is the stores building, which is 252 feet long by 85 feet wide, and two stories in height. The

stores building is fitted with shelving and bins suitable for storing railway supplies, sufficient to meet the demands for Western lines from Fort William to Vancouver, including branches. It has a two-ton hydropneumatic elevator for conveying materials from the lower to the upper floor. The lower floor is at a height of 4 feet above rail, level with the floors of the cars, to facilitate unloading. Outside and all around the building and level with the floor is a platform 10 feet in width, on the north and south sides, 70 feet on the west end, and 200 feet on the east end, for storing material. This, and the lower floor of stores, are provided with a system of narrow gauge tracks for handling material.

Offices.—At the west end of this building are situated the offices in connection with the shops. This portion of the building is three stories in height.

Foundry.—Opposite this building on the west side of the midway, is the Iron Foundry. This building is 216 feet by 90 feet, and has a capacity of 12 tons per day. It is equipped with a three motor travelling crane, 38 feet span and 20 feet lift; a five-ton jib crane operated electrically, a 40-feet cupola with No. 8 Sturtevant pressure blower operated by a 30 h.p. A.C. motor.

There are two core ovens, one 9 feet by 16 feet, and one 9 feet by 7½ feet. One grinder and two tumblers (group driven by a 10 h.p. motor) for cleaning the castings are provided.

Provision is made for a second cupola. The charging room for cupola is all steel and concrete construction, the material being carried up to the charging floor from the ground by a two-ton pneumatic elevator.

In the south bay of the foundry is erected a gravity moulding machine with overhead system of tracks and switches for distributing the flasks and metal for pouring the work done on this machine.

Outside, and at the west end of the foundry are the sheds, 200 feet by 60 feet, for storing coke and sand for foundry use.

The foundry is heated with Sturtevant hot blast, the fan being driven by a 15-p.h. motor, exhaust steam being used and all condensed water returned to power house.

Pattern Shop and Storage.—The next building to the left of the midway is the pattern shop and pattern storage building. The pattern shop is at the east end, one story in height, provided with the necessary saws, surfaces, jointers, etc., driven by electric motors. Through the fireproof door at the west end of this shop is the pattern storage building. This is a two-storied building equipped with racks, etc., for storing patterns. This building has ribbed and wired glass set in iron frames as a protection from fire from the outside; both pattern shop and pattern storage building are heated by steam coils, supplied with steam from the exhaust steam main in the yards.

Blacksmith Shop.—The next building to the left is the blacksmith shop, 216 feet by 100 feet. This has a capacity of 32 fires and 14 oil furnaces; it is equipped with 12 jib cranes with a varying capacity of from ½ to 3 tons each, one 3,000 lb. single frame hammer, one 3,300 lb. double frame hammer, one 1,200 lb. single frame hammer, one 700 lb. single frame hammer, and one 250 and one 150 lb. automatic hammers, all the hammers being steam driven. It is also equipped with sawing and screwing machines, punches, shears and bulldozers, all motor driven.

A system of narrow gauge tracks is provided to facilitate handling heavy materials. Forges and oil furnaces are fitted with Sturtevant blast system, carried in pipes under the floor. It also has an exhaust system of piping overhead for taking fumes from fires, etc., operated by two Sturtevant fans, motor driven. An outside lean-to contains the Sturtevant heating plant "blower system" which also serves to cool the shop in summer.

Scrap Yard.—Outside this shop, at the west end, is the scrap sorting yard. All damaged and bent rods and bolts are straightened here and delivered to store for future service.

Locomotive Shop.—Opposite the blacksmith shop, on the east side of the midway, is the locomotive repair shop, 164 feet by 792 feet. This shop has a capacity for handling 32 engines for general repairs. The shop is sub-divided as follows:—The west end is portioned off for the machine shop; the south side, east

end and a portion of the north side are used as the erecting shop; a portion of the north side for the boiler shop, and one span the full width of the shop as tube shop.

The machine portion is equipped with a fully modern plant of machinery, including about 50 lathes of all classes, 6 planing machines, 12 milling machines, 8 drills and various slotting, shaping and boring machines.

All machines are motor driven, the large machines individually, and the smaller ones divided into groups. The machines are distributed so as to make each department of the shop self-supporting.

Over the machine shop, at the west end, is a gallery where all the repairs are done in connection with air brakes, pumps, etc. This gallery is served with a 2-ton hydro-pneumatic lift, operating between the ground floor and the gallery.

The north and south bays of the machine shop are each served with a 7½-ton three motor electric travelling crane, 56 feet span and 27 feet lift, running the entire length of the building.

Over the centre of the machine shop is a hand travelling crane of 1-ton capacity for handling side rods, and bench work generally. In addition, there are a number of jib cranes placed where necessary.

The erecting shop is arranged with transverse concrete pits, over which the engines are dismantled and re-erected. At the east end of the shop 6 of the pits have drop pits for unwheeling trucks; for this purpose a hydraulic jack is used.

An electrically driven transfer table, 52 feet span, running for a length of 440 feet in the centre portion of the building, serves the erecting pits on each side for placing locomotives. Over the transfer pit at the west end are two 50-ton electric hoists by which the locomotives are lifted off the transfer table for stripping wheels, etc. With this apparatus a locomotive can be re-wheeled in half an hour. The 7½-ton travelling cranes in each bay also serve the erecting shop. For convenience in handling repairs the erecting shop is subdivided into five gangs, each gang being apportioned several pits.

Engines are taken into the shop either through a door at the south-east end round a 20 degree curve,

or through the door at the south side about the centre over a 70 ft. half-through turntable.

The boiler shop is situated on the north side at the east end. This has an up-to-date plant of pneumatic and hydraulic machinery, oil furnaces, etc. Over the boiler shop is a rivetting tower, with a 20-ton electric rivetting crane and 5-ton auxiliary hoist. It also has one 20-ton 3 motor electric travelling crane, 56 feet span and 27 feet lift, which will travel the whole length of the building.

The plant for the tube shop includes tube welding machines, oil furnaces, tube cleaners, etc.

The whole of the locomotive shop is served with a network of 20-inch narrow gauge tracks.

The shop is heated with four Strutevant hot blast machines, each driven by independent steam engines, which are housed in separate lean-to's attached to the sides of the main building. The hot air is delivered to the shop by means of longitudinal ducts running round the entire side of the building, delivering the heated air about 12 inches above floor level on the outside walls.

Planing Mill.—The next building to the north of the locomotive shop is the planing mill, 216 feet by 100 feet. This has all the necessary machines for wood working, nearly all machines being driven by individual motors. Each machine has vacuum connection for taking away shavings and chips, etc. The shaving exhaust system is operated by two Sturtevant fans and electric motors in the mill, and by exhaust fan and motor in a special building near the power house, the shavings and chips being drawn from the planing mill and discharged direct into two boilers in the power house specially prepared for this purpose. The planing mill has Sturtevant hot blast heating system in lean-to annex.

Electrical Shop.—Opposite this to the west of the midway, is the electrical repair building. This is a frame building (heated with steam coils) 90 feet by 20 feet.

Iron Rack.—Near to the above building is the iron rack, which is covered by a frame building, 130 feet by 50 feet, with racks for storing some thousands

of tons of bar iron; the racks are supported by concrete piers of reinforced concrete base.

Freight Car Shop.—North of this building, on the same side of the midway, is the freight car repair shop, 312 feet by 117 feet, which has a capacity for general repairs (including renewals) of about 375 cars per month. The tracks are run longitudinally with the shop; the building is heated with the Sturtevant hot blast in independent housing. A portion of the north side of the building is set out for light machine work for wood working, and forge work in connection with steel cars.

Car Transfer Table.—To the east of this shop is the car transfer table, in line with the midway. This has a span of 70 feet and travel of 450 feet, electrically driven, having four hydraulic jacks on table for re-wheeling passenger cars. This table serves the two passenger car shops, east and west, and also the freight car shop.

Passenger Car Shops.—There are two passenger car shops, each 240 feet by 100 feet, having a capacity for general repairs of about 180 cars per month. The west one is built entirely of concrete, while the east shop is of brick, similar to the other buildings. Both are heated by Sturtevant hot blast and kept at a temperature of about 75 degrees Fahr., for drying varnish. The upholstering work is done in a separate frame building, north of the east car shop, 20 feet by 130 feet.

Power House.—The power house is situated east of the east passenger car shop, 125 feet by 101 feet, with wing 50 feet by 85 feet addition to boiler room. The power epiuqment includes eight 250 h.p. Babcock & Wilcox water tube boilers, two of which are hand fired and arranged for burning the chips and shavings from exhaust system of planing mill. Four of the boilers are equipped with Babcock & Wilcox mechanical chain stokers; the other two have Rooney mechanical stokers. The boilers have a working pressure of 120 lbs. per square inch, all connected to a main steam header, 12 inches diameter. Each of the boilers is equipped with a William's feed water

regulator, thereby maintaining a constant level in all boilers. Two outside packed horizontal steam pumps serve for boiler feeding purposes.

The water for the boilers is taken from the service main, passed through a mechanical filter, thence to a Webster automatic vacuum feed water heater, heated in this to about 200 degrees Fahr. by exhaust steam from engines. It is led by gravity to the feed water pumps, from which it is pumped through two batteries of Green's economizers, heating it to 300 degrees Fahr. before being delivered to the boilers. The boilers are provided with an underground ash pit, with tram rail and air hoist for loading the ashes directly on to flat cars.

Power Plant.—The power generating plant consists of two 500 K.W. unit driven Corliss cross compound non-condensing engines, each unit direct coupled an A.C. generator, 60 cycle, 550 volts. Two 30 K.W. direct current exciter units are used for exciting generators. These are driven by vertical single cylinder open type engines. The power lines are operated at 550 volts., and the incandescent lighting lines at 110 volts. The switchboard has an automatic regulator and is fully up-to-date with all recording instruments, etc.

For compressed air service there is a steam driven cross compound air compressor of a capacity of 1,800 cubic feet of free air per minute, at a pressure of 80 lbs. per square inch; also one of a capacity of 1,300 cubic feet of free air per minute at a pressure of 100 lbs. per square inch, belt driven from a 250 h.p. motor.

The pumps for fire service are located in this building; they consist of 2 underwriter steam pumps of a capacity of 1,000 gallons per minute each; there are also two smaller ones for domestic service.

The engine room is provided with a hand travelling crane of 15-ton capacity, 46 feet span and 25 feet lift.

Lumber Shed.—East of the power house is the lumber shed, 24 feet by 100 feet, for storing kiln dried lumber. East of this again is the

Dry Kiln.—This building is a Morton moist air down draft kiln; it has two compartments, each 85 feet by 19 feet, and has capacity for four cars of

lumber. The heat for the building is obtained from the exhaust steam from the engines by means of coils, the condensed water returning to the power house through the vacuum system. To the east of this building is the lumber storage yard in connection with the stores department.

Repair Yard.—Further east, to the left of the main lead, is the repair yard, capable of handling 150 cars daily for light repairs. This yard is self-contained with the necessary light repair work shops, paint and lumber stores and facilities for removing wheels and trucks. Two of the tracks are under umbrella roofs for protection in bad weather. The whole of this yard is served with a system of narrow gauge tracks, and air service lines for testing brakes, etc.

Wheel Storage.—Back again, on the other side of the lead is the wheel storage yard, and wheel and tender shops.

Wheel and Tender Shop.—The wheel and tender shop is 114 feet by 221 feet, the walls and foundations being of concrete. The main portion is used for repairing and rebuilding of tenders and steam shovels; this is served by a 20-ton three motor electric travelling crane having 54 feet span and 22 feet lift.

The lean-to portion of the building is used for wheels and all work in connection with same. It is equipped with modern lathes, wheel borers, hydraulic presses, drills, etc. This shop has 5 jib cranes for handling materials. Outside the building, all around, is a platform level with floor for storing materials for tenders and steam shovels, and wheels. The building is heated by Sturtevant hot blast system with exhaust steam from power house, a 20-h.p. motor being used for driving fan. The hot air is carried round the inside walls of building in concrete ducts, delivering the hot air about 12 inches above floor level.

East of the locomotive shop is the storage yard for locomotives repaired and waiting for repairs.

Clock House.—Returning to the main entrance gate. To the left of this is a frame building containing 28 Dey Time registers. The men register themselves in and out from work on these. It also contains

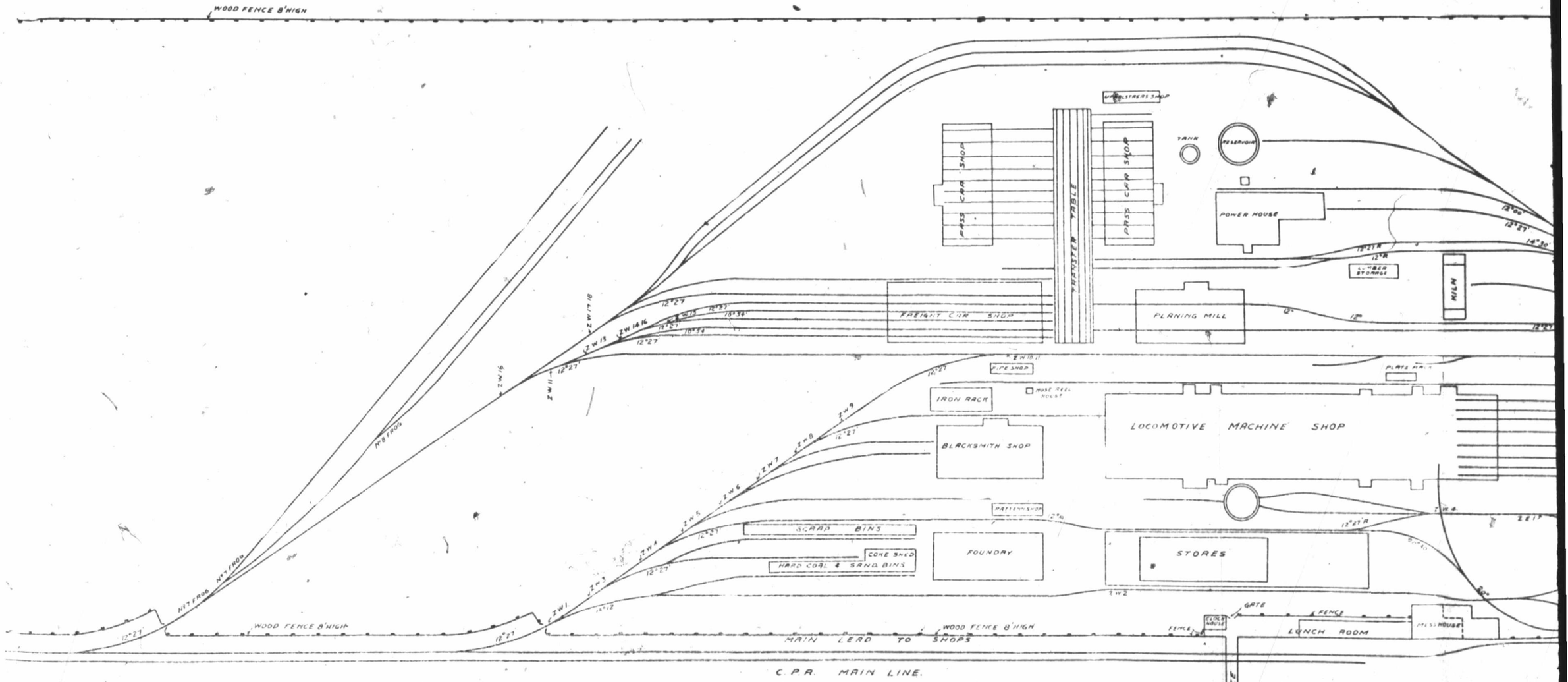
headquarters for the watchmen, and a branch bank of the Bank of Montreal, where the men cash their cheques on pay day.

Lunch Room.—To the right of the entrance is a commodious lunch room, 35 feet by 220 feet, heated with the Sturtevant hot air system, and capable of seating over 1,000 men. It also has conveniences for heating the men's luncheons, if they so desire.

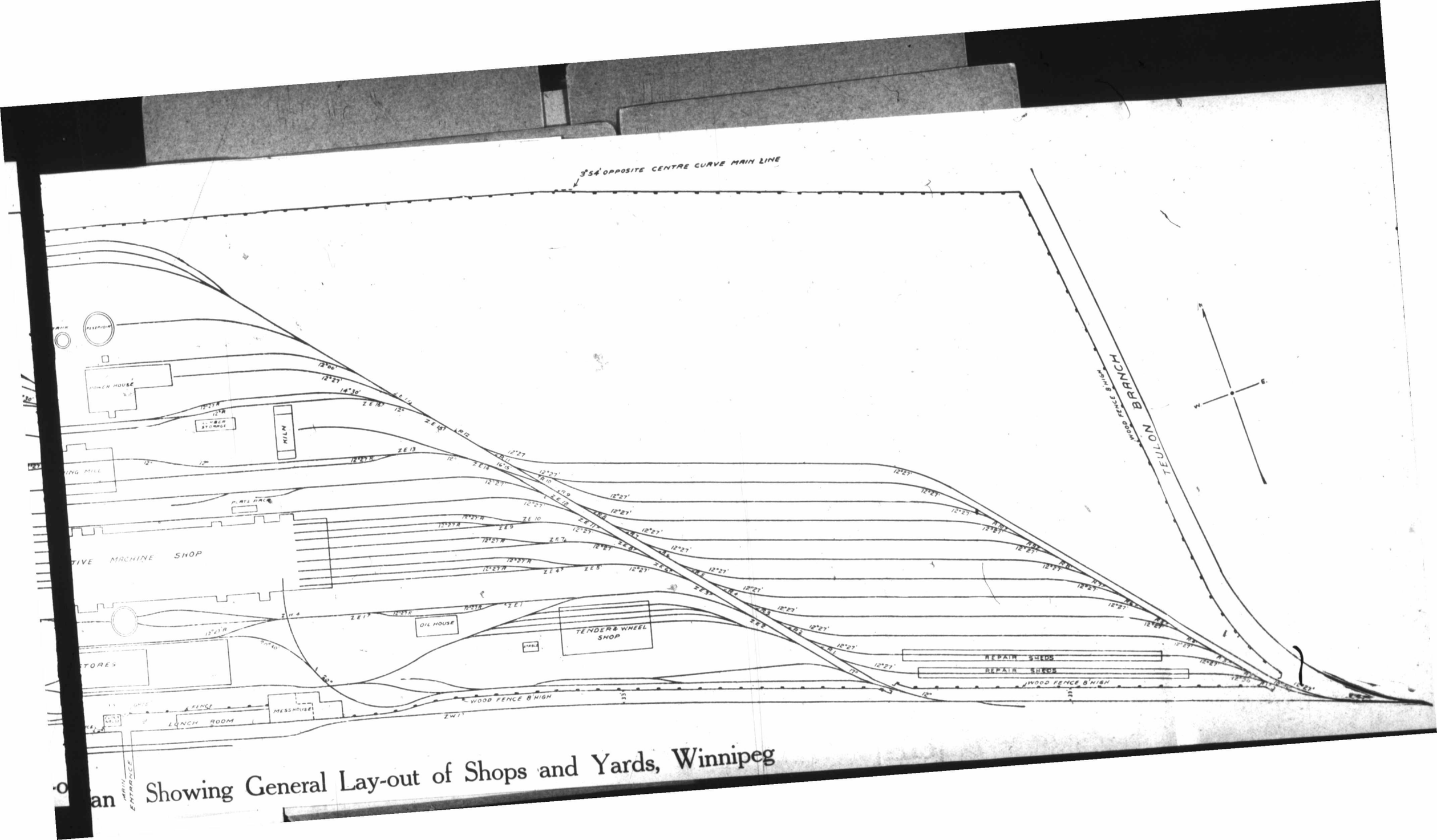
Dining Room.—Adjoining this, to the east, is the dining hall, capable of seating about 450 men, with kitchen fully equipped for providing meals for about 500 men.

Apprentice Room.—At the east end of this building is the apprentice class instruction room. This is an up-to-date, well lighted class room, with all facilities for teaching about 100 apprentices. All apprentices attend this class room twice a week between the hours of 7 and 9 a.m., whilst under pay, to receive intruction in arithmetic, geometry, mechanical sketching, mechanical drawing, geography, electrical engineering, English and C.P.R. biography. Expert mechanics and instructors are provided to insruct the boys in the shops and class room.

Night School.—About 250 men will also be instructed in the above subjects at the night school during the winter months.



Canadian Pacific Railway Plan Showing General Lay-o



an Showing General Lay-out of Shops and Yards, Winnipeg

BRITISH ASSOCIATION, WINNIPEG, 1909

Visit to the Canadian Northern Railway Company's Shops

Mr. R. B. Pratt and Mr. A. Shields
have kindly consented
to accompany the party.

Monday, August 30th, 1909

Special Train leaves C.N.R. Depot at
2.30 p.m., for Western Canada
Flour Mills and thence
to C.N.R. Shops

Printed at the Public Press Limited, 275-277 Sherbrooke St., Winnipeg

Description of Canadian Northern Railway Shops, Fort Rouge Winnipeg, Canada

The accompanying plan shows the layout of the Canadian Northern Railway shops, just completed, at Fort Rouge, Winnipeg.

The Company has provided in the location and construction of the buildings everything in the line of convenience and facility for handling cars and locomotives, and the new shops are up-to-date in every respect. Provision has been made for future extension and additional buildings.

They are located on the main line of the railway, just west of Pembina Street, in Fort Rouge, Winnipeg, and within easy reach of the new Fort Garry terminal station of the City.

They are constructed of concrete, brick and steel, and of the latest type of fire-resisting materials.

The height of the buildings range from 20 to 60 feet, giving ample room for the handling of large locomotives, coaches, etc. All

the buildings are provided with large iron and wired glass skylights, and the latest type of ventilators; also inside gutters to take off condensation, thus providing for the most essential features of railway shops, namely, ample light and ventilation. Space has been arranged for future extension of all buildings.

The lighting throughout is electric, and fitted with the Cooper-Hewitt Mercury Vapor lamp. All machinery is electric driven, with separate motors to each machine.

The buildings throughout are heated by the Miller Vacuum Heating system. The mains, air lines and returns are carried on overhead trestles and are therefore easily accessible at all points.

Coaling Facilities.—The coal chutes are operated by the gravity bucket system and are so constructed that engines may be coaled on either side of chute.

Ash Pits.—The two ash pits are each eighty feet long, with fire brick floors and walls. Through tracks are carried on cast iron pedestals with depressed tracks for handling cinders on either side.

Engine House.—The Engine House has a capacity of twenty-one stalls, which can be increased to a forty-stall capacity with annexes for repair rooms. The offices of the locomotive foreman are situated near the incoming and outgoing tracks from Engine House, giving complete oversight of incoming and outgoing engines.

Machine Erecting Shops.—The Machine Erecting Shop is 164 feet by 572 feet long, with annexes for Air Brake Equipment, Tool Room and Lavatories, and is one of the most complete buildings of its kind, having all the facilities necessary for the complete overhauling and repairing of the heaviest type of locomotives. It has a capacity of twenty-five locomotives in the west bay in connection with the electrically controlled transfer table. On this side there is 120 ton locomotive hoist, also five 2½-ton hand cranes running full length of the building. The centre bay has a 7½-ton crane the full length of building, and the east bay has two 3½-ton cranes. These cranes are so arranged that all parts of the locomotive can be quickly distributed to the various repairing machines.

Adjoining this shop, on the east side, is the Tube shop annex complete with rumbler.

Blacksmith Shop (140 ft. by 100 ft.) is accessible to Machine Erecting shop and equipped with steam hammers, forges, etc. Forges are operated by forced draught.

Foundry.—The foundry is 130 feet by 100 feet long, and is situated east of the Blacksmith shop. It contains a complete equipment for moulding, casting, brass work, etc., and is provided with a 10-ton crane in centre bay running full length of building.

Store Building.—Store building (two stories and basement) is 150 feet by 90 feet long, and is conveniently located for communication with all shops and transfer table, so that all necessary material may be quickly distributed to the various departments. A portion of the main floor is laid out for offices of general storekeeper and his staff. At the east of the building on the main floor is the Oil Supply room, with large storage tanks for different kinds of oil in basement. The Bowser system complete with pumps, gauges, etc., has been installed. Surrounding the Store Building is

a large storage and distributing platform, 600 feet long by 120 feet wide, complete with lorry tracks and turntables. Another special feature is the Scrap Bins, which are located at the east end of the platform with storage and sales tracks on each side.

The proposed Boiler, Tank, Repair and Paint shop will be situated on the west side of transfer table, and is so arranged it can be served by transfer table adjoining Machine Erecting shop.

Freight Car Repair Shop, 200 feet by 100 feet, is at west end of yard and connected with Freight Car Repair tracks.

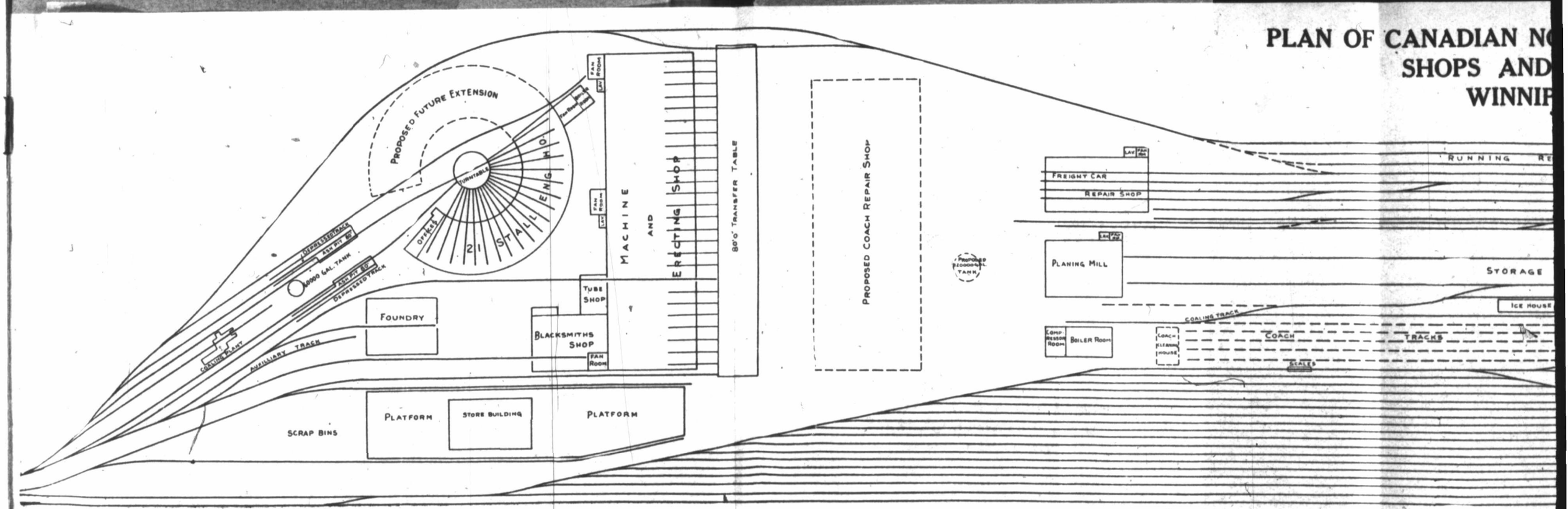
Planing Mill, 145 feet by 100 feet, is situated between the Freight Car Repair shop and Power House, complete with wood working machines and Shaving Exhaust system connected to boilers in Power House.

Power House, including boilers and compressors, 125 feet by 55 feet, has two batteries of boilers equipped with economizers and forced draught system. The Compressor room has motor generators, transformers, switch board and air compressor, etc.

Water Supply.—The water for tanks and general use throughout these shops is taken from the Red River with hydrants throughout yard, and fire hose connections in all shops, giving complete fire protection to both inside and outside of building. For drinking purposes there is an independent supply from City to all shops, with emergency fire equipment and connections so that yards and buildings have two complete systems of fire protection.

West of these shops are located the Distributing and Sorting yards for east and west bound freight with ample grounds for future extension of yards.

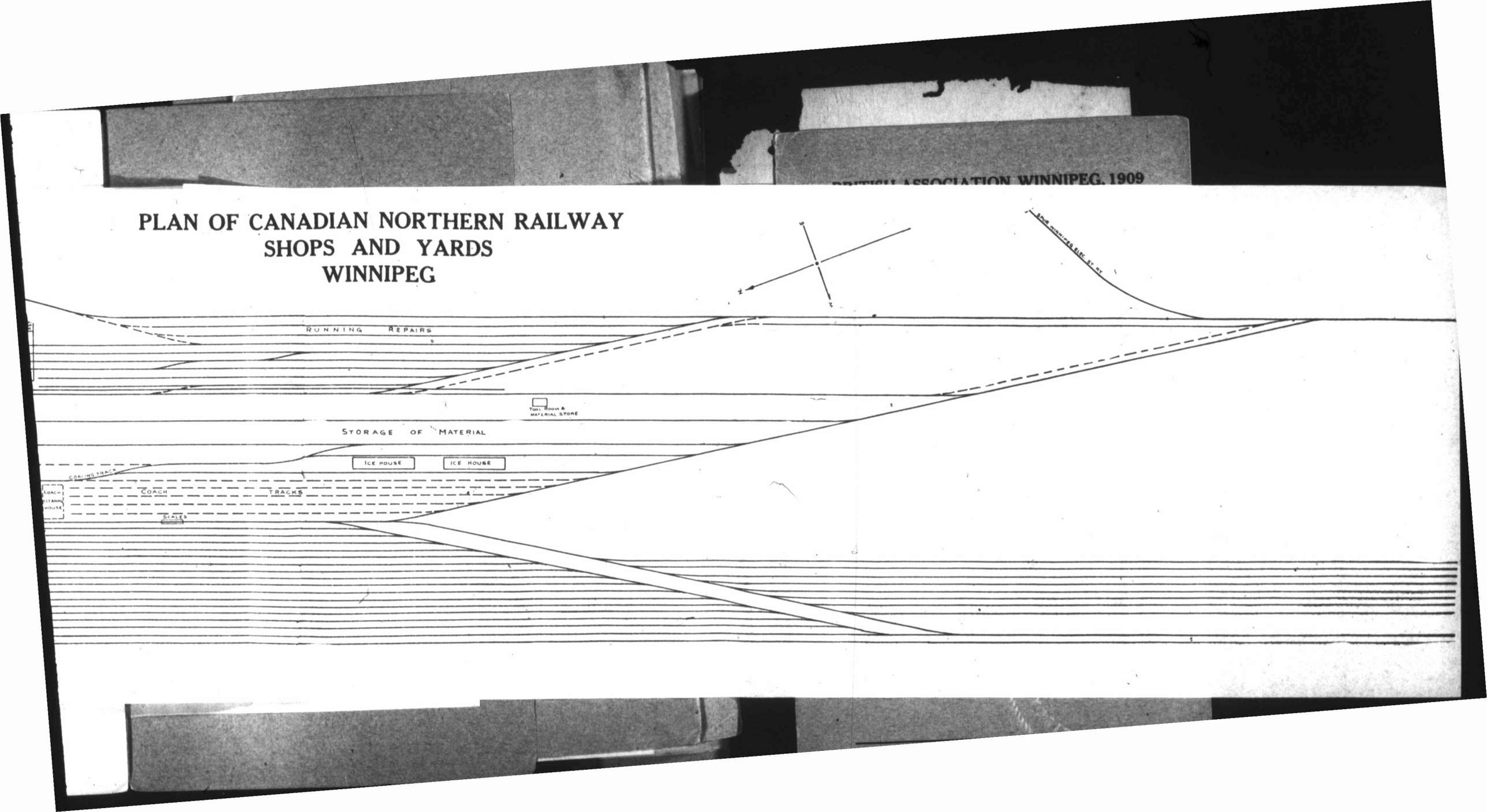
This Yard Layout and Shops were prepared and designed by R. B. Pratt, railway architect, and under the direction of Mr. M. H. MacLeod, General Manager and Chief Engineer of the Canadian Northern Railway Company.



PLAN OF CANADIAN NO
SHOPS AND
WINNIP

From 2.30 p.m. to 5 p.m.

PLAN OF CANADIAN NORTHERN RAILWAY SHOPS AND YARDS WINNIPEG



BRITISH ASSOCIATION, WINNIPEG, 1909

Visit to The City Water Works

High Pressure Plant

Artesian Well System

Colonel H. N. Ruttan, City Engineer, has kindly consented to act as guide to the party.

Monday, August 30th, 1909

From 2.30 p.m. to 5 p.m.

Printed at the Public Press Limited, 275-277 Sherbrooke St., Winnipeg

Winnipeg's Water Works

Col. H. N. Ruttan, C.E.
City Engineer

The City of Winnipeg, Manitoba, Canada, with 140,000 population, is situated at the confluence of the Red River of the North and the Assiniboine River. The general level is 757 ft. above sea level, and is 33 ft. at low water, and 10 ft. at high water, above the water level of the Rivers. The soil consists of one to three feet of black loam resting upon some fifty feet of sedimentary clay, below which is about 5 feet of glacial drift and boulder clay resting upon the rock, a magnesian limestone. On boring through the impervious clay into the rock, the water rises from it, and sometimes even from a boulder clay, to a height of some feet above the surface of the ground, indicating that it is a true Artesian Supply.

The City now has five wells in operation, from which may be obtained about 12,000,000 gallons per day. The wells are situated in the Northern portion of the City, 4 on the West and one on the East side of the Red River.

Domestic Water Works.—The principal pumping station is situated on McPhillips Street near Logan Avenue, and contains the following equipment:—

*1-5,000,000 gal. 125 lbs. pressure. Triple Expansion pump.
1-5,000,000 gal 80 lbs. pressure. Triple Expansion pump.
1-5,000,000 gal. 125 lbs. pressure. Electric driven centrifugal fire pump.

1-750 K. W. Curtis Turbine generator set.
1-1000 K. W. Parsons Turbine generator set.
1-300 K. W. Steam Engine and generator set.
11-250 H.P. Babcock & Wilcox Boilers.
1- Pump reservoir, capacity ..... 300,000 gals.
1- Storage Reservoir, capacity ... 6,000,000 gals.
* Not at present in use.

The 5,000,000 gals. electric fire pump and the pumps at wells 3, 4 and 5, are connected with the power system of the Winnipeg Electric Railway Co., the generating plant, above mentioned, being held in reserve. Each of the wells 3, 4, 5 and 6 is fitted with electrically driven pumps of a capacity of 2,500,000 gallons per day. Wells 3 and 4, as at present operated, will not furnish this quantity of water. Well No. 5 supplies from 2½ to 3 millions of gallons per day, with a depth of 60 ft. of water remaining in the well. In this well is being installed a second 2½ million gallon pump. Well No. 2 is served by the 5,000,000 gallon 80 lb. pump above mentioned, working at about 50 per cent. of its capacity.

The ordinary pressure carried in the mains is 50 lbs. This is increased to 80 lbs. pressure on alarm, in case of fire, the time required to raise the pressure being from one to two minutes.

With the 6,300,000 gallons reserve in the reservoirs, the following quantities of water can be pumped into the mains:—

For a period of	3	hours	.....	7,800,000	gals.
" " "	6	"	.....	9,300,000	"
" " "	9	"	.....	10,800,000	"
" " "	12	"	.....	12,300,000	"
" " "	24	"	.....	18,300,000	"

The distribution system consists of 185 miles of pipe, with 1,200 hydrants.

A Softening Plant has been installed, but is at present not being used.

Fire Service Water Works System.—In the year 1905, the City of Winnipeg was subject to very excessive fire insurance charges, due largely to the fact that the development of the Water Works system had not kept pace with the extraordinary growth of the City. As a means of relief, and to place the City in the highest class of fire risks, the City Council, backed by the Board of Trade, had a thorough investigation made of fire fighting Water Works.

Committees of the Council with the City Engineer made several visits to the principal Cities in the United States and Canada where special systems were in use, and after a careful consideration, determined that the gas engine pumping plant offered, for the conditions of Winnipeg, the most economical and satisfactory solution of the problem of fire protection.

It was essential, from the Fire Underwriters' point of view, that any plant adopted should be provided with two independent sources of power. Electricity would have been an ideal power, if the above condition could have been fulfilled. Steam was, on account of the heavy standby losses, out of the question. It may be explained that the pumping station of the Domestic Water Works System is about two miles from the business centre of the City, and from the bank of the Red River, from which the water for fire protection was to be obtained. Had it been

possible to use the steam plant of the Domestic System with additional boiler capacity, it is probable that steam would have been adopted as the motive power.

Steam and electricity being out of the question, gas power, filling all of the requirements, was finally adopted. For alternative sources of power, there are available, Producer Gas and City Gas, in addition to a large reserve of Producer Gas in the holder.

Standby losses in fuel in this system are practically nothing.

The first of the pumping units was placed in service in November, 1907, and has been available for fire protection since that time. The remaining units were completed, and placed in service between that time and the 1st July, 1908, when the whole plant was practically completed, and its operation taken over by the City.

The distribution is made by 8 miles of mains from 10 to 20 inches in diameter, and 85 fire hydrants. It covers the central, closely built, business section of the City.

Pumping Station.—The pumping station is situated on the banks of the Red River at the foot of James Street, and contains the following equipment:—

4 Crossley, 2 cylinder Tandem Gas Engines of 540 H.P. each.
2 Crossley, 2 cylinder Tandem Gas Engines of 250 H.P. each.
Air compressing starting plant in duplicate.
1 Producer gas main supplying all engines.
1 City gas main, in reserve, supplying all engines.

The engines above described drive 6 Triplex double acting pumps, made by Glenfield & Kennedy, of Kilmarnock, Scotland.

The pumps are furnished with suction and discharge mains, 20 inches in diameter, in duplicate, all pumps being connected with both mains, either main being of sufficient capacity for the whole plant.

The pumps take their water from a well, which is divided into two compartments, either of which will supply the whole plant.

The water is conducted to the well by an intake pipe 3 feet in diameter, which extends for a distance of 425 ft. from the well to the deep water in the River, where it ends in a stone ballasted crib.

Producer Gas System.—The Gas Producer Plant may be described as follows:

It consists of 4 Crossley type Producers; 2 of 500 Horse Power, each 8ft. 6 in. in diameter, by 18 ft. in height, and 2 of 1,000 Horse Power, each 11 ft. in diameter by 18 ft. in height, with necessary platforms, hoppers and piping.

This plant has an overload capacity of 50 per cent. with selected coal, and readily makes gas from Anthracite, Lignite or any non-caking bituminous coal; the latter can, however, be burned to a limited extent under certain conditions.

The coal for use in the plant is delivered on track adjoining the building, and unloaded into a hopper having a capacity of 100 tons.

Elevator and Conveyor.—An elevator fitted with a rotary feeding gear to ensure regular feed without choking, raises the coal to a horizontal conveyor placed above the producer hoppers.

The elevator and conveyor are operated by an 8 Horse Power System Engine.

Air Superheaters.—Two air superheaters 18' 10" by 5' 3", and two 18' 10" by 4' 3", with gas and air connections and dust collectors, are attached to the Producers.

Hot Gas Boilers.—Each unit is supplied with a hot gas tubular boiler.

Wet Scrubbers.—Four wet scrubbers each 30 ft. high by 5 ft. in diameter fitted with tar sieves and filled with coke, remove the condensible hydro-carbons from the gas.

Tar Extractors.—Three Centrifugal tar extractors 5 ft. in diameter complete the removal of the tar from the gas.

Dry Scrubbers.—Two sawdust scrubbers 9 ft. by 22 ft., either of which is capable of removing any remaining impurities from the gas, are placed near the inlet to the gas holder.

In addition to the above, centrifugal circulating pumps and Root air blowers are provided.

The cleaning plant is operated by two 18 H.P. Crossley Gas Engines, either of which is of sufficient capacity to drive the whole plant.

The plant is provided with all piping, valves, shafting, pulleys and belting necessary for its operation.

An important feature of the installation is that there is a spare unit of each type of machine, so that in case of a breakdown, the plant can still be operated to its rated capacity.

Two steam boilers, of about 50 H.P. each, furnish what additional steam is required for the Producer, and, also, drive the elevator and blowing engines, and supply steam for heating the buildings.

City Gas System.—The gas holder and Pumping Station are connected with the City gas mains by a special 12 inch pipe. If, for any reason, the Producer Gas System should be out of Service, a full supply of City gas may be at once conducted to the holder, or directly to the Engines, by a special main provided in the pumping station for that purpose.

Gas Holder.—A gas holder of 250,000 cubic feet capacity stores a reserve of gas, either Producer or City, gas, sufficient to operate the whole plant for from 1½ to 5 hours. This will give ample time to fire additional producers, or to make provision for the use of the City gas, in case of a long continued fire. It is not likely that more than half the capacity of the plant will be required except in extra-ordinary cases.

The Distribution System.—Two 20 inch mains lead from the Pumping Station to Main Street by different routes, connecting with sub-mains on the way. Either of these mains in case of accident to the other, is sufficient to take the water from the pumps when working at their rated capacity.

The mains are designed to withstand the ordinary working pressure of 300 lbs. per square inch, and water hammer. They were tested to 700 lbs. per square inch at the Foundry, and

after being laid, were tested to from 500 to 700 lbs. The pipes were provided with extra heavy hubs and 2 lead grooves. These joints have given entire satisfaction.

Hydrants.—The hydrants are connected to the mains by 8 inch flanged pips. They are provided with four 4½ hose nozzles with independent gates. These nozzles are, when required, reduced to 3½ and 2½ inches by suitable reducers, 3½ inch being the largest hose now used.

The hydrant valve is 8 inches in diameter, and is provided with one inch pilot valve to fill the hydrant before opening the main valve against the pressure. Both the valves are operated by the same stem. Each hydrant connection is provided with a gate valve so that the hydrant may be cut out from the system in case of necessity.