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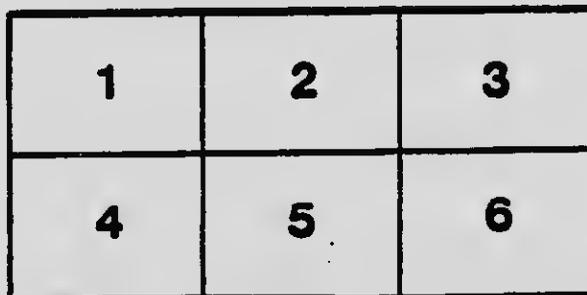
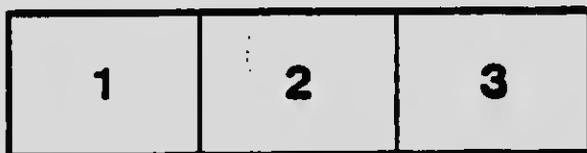
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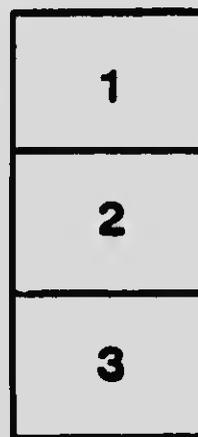
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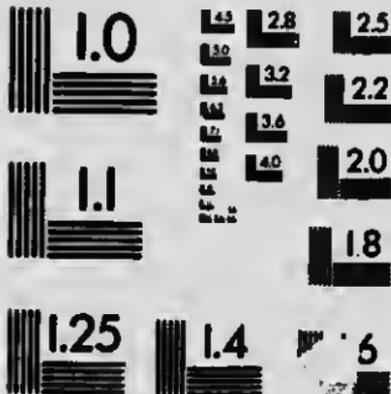
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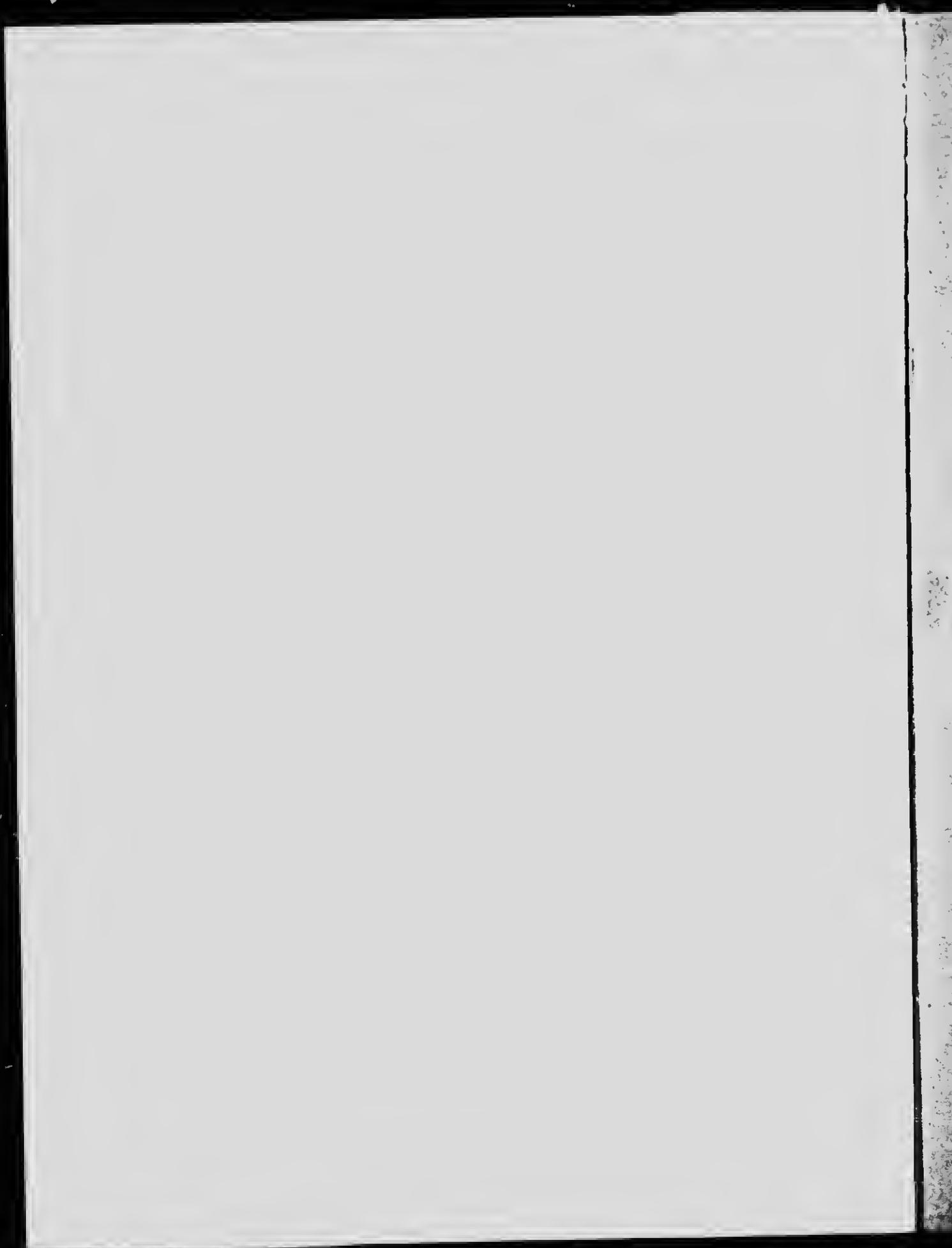
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SEPTEMBER 1920

**CANADIAN FIRE UNDERWRITERS'
ASSOCIATION
MONTREAL
P.Q.**

REPORT

ON THE

CITY OF QUEBEC, P.Q.

(SUPERSEDING PREVIOUS REPORTS)

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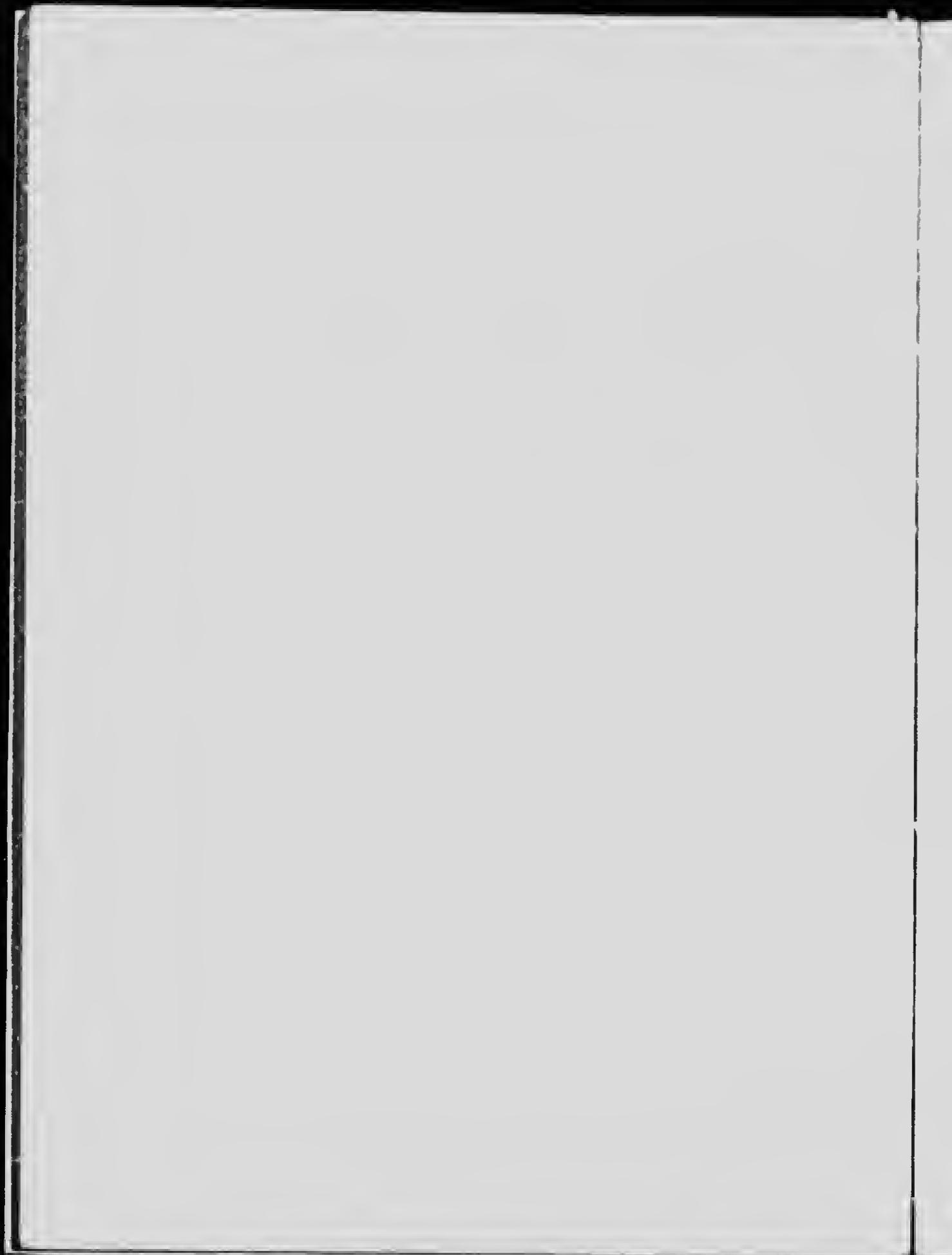
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QUEBEC, P.Q.

(Superseding Previous Reports.)

CITY IN GENERAL

The City is divided into six districts for electoral purposes, designated Champlain, St. Jean Baptiste, Belvedere, Jacques Cartier, St. Roch and St. Sauveur Wards. The city government consists of the Mayor and twelve aldermen (two for each ward), all elected for a two-year term; the *ensemble* being known as the City Council. The administrative duties are vested in a Finance Committee, Waterworks Committee, Fire Committee, Police Committee, Public Works Committee and Health Committee, all of which are formed from the members of the City Council.

Population, as given in the annual report of the City Treasurer of the City of Quebec for the civic year 1919-1920, is 116,850. The more important manufactures consist of boots and shoes, tanneries, lumber, tobacco and corsets, and there are several foundries, general machine and railroad shops, breweries, paper box and bag works, clothing and fur working establishments, beside a variety of small industries. The city is an important inland port, and has an extensive waterfront with large landing sheds, grain elevators and galleries.

The total area of the city is 9.1 square miles and is mostly built upon. It is bounded on the South by the River St. Lawrence; East, in part, by the same river and in part by the municipality of Beauport; West and North by the municipalities of Sillery, Little River and Charlesbourg. That part formerly known as Limoilou and Stadacona is separated from the older part, or City proper, by the St. Charles River, which is spanned at three points by modern steel cantilever bridges, open to vehicular traffic.

The city proper is referred to as "Upper" and "Lower" town, which parts are separated on the St. Lawrence River front by steep bluffs, but united by built-up streets in other parts. The general contour of the ground is steep and inaccessible from Champlain Street in "Lower Town" to the Citadel in "Upper Town," and rising more gradually to other parts in the Northwest by grades varying from 9.5 to 16.5 per cent. The highest part is residential, and at the highest point is at elevation 325.

The principal mercantile district is in "Lower Town," and is comparatively level; elevations

ranging from 16.63 at St. Paul and St. Peter Streets to 59.11 at St. Valier Street and Abraham Hill. A second important but less extensive mercantile district is located in "Upper Town" with grades rising from elevation 107 at Dallice Hill and St. John Street to elevation 235 at St. John and De Salaberry Streets and to elevation 142.16 at Mountain Hill and Port Dauphin. Street widths in the mercantile districts are 30 to 58 feet, being mostly about 50 feet; elsewhere they are mainly 20 to 60 feet with a maximum of 105 feet in "Lower Town," and 80 feet in "Upper Town." There are 97.6 miles of streets, of which approximately 30 miles are paved with sheet asphalt, granite blocks, scoria blocks and stone-filled asphalt; 45 miles are macadamized; the balance are in natural condition. Paved streets are, generally, in good condition; others are mainly fair.

Fuel is anthracite and bituminous coal, wood and gas. Records of Quebec Observatory show that for the past 5 years winds exceeding 25 miles an hour have occurred on an average of 111 times a year; the prevailing direction of all winds is from the North-East and South-West. Snowfall is heavy over 4 months in the year; 22 months in 5 years show a fall in excess of 9 inches. Winter temperatures are severe; records for December, January and February in the past 5 years show that the maximum temperature during 6 consecutive days did not exceed 30 degrees above zero 20 times, 15 degrees 5 times, 10 degrees twice, and 5 degrees once only. In 5 years there have been 6 extended periods of heavy weather; 6 months of the year averaged 66 days, with a minimum temperature of 72 degrees or more.

The total fire loss between January 1st, 1915, and August 31st, 1920, as given in the reports of the Chief of the fire department, was \$2,392,099. The annual losses varied from \$1,900 in 1915 to \$709,145 in 1919. The annual number of fires averaged 263, varying from 357 in 1915 to 222 in 1919. The average loss per fire was \$1,910, a very high figure. Based on an average population of 100,000, the average annual number of fires per 1,000 of population was 2.63, a high figure, and the average annual loss per 1,000 of population was \$4.24, a very high figure.

FIRE-FIGHTING FACILITIES

WATER SUPPLY

GENERAL.—The city is supplied by two systems owned and operated by the municipality, one system supplying the City Proper and the other, which is of minor importance, Belvedere Ward from Cartier Avenue, West to the city limits. Each system covers the occupied territory within its respective part of the city. Construction was first commenced by the city in 1854 by laying an 18-inch diameter supply main from Lorette; distribution, however, did not fairly commence until 1870, since which year the service has been gradually extended. The more important extensions and work of improving the system has taken place during the past twelve years, a number of main arteries having been laid and many minor distributors replaced by mains of greater carrying capacity. Of the pipe originally laid, about 15 per cent is still in service.

ORGANIZATION.—**General.**—The administration is under the control of a committee consisting of six members of the City Council, the Council being elected every two years by popular vote. C. P. Casgrain is the executive head of the department and is a member of the American Waterworks Association. J. A. Tremblay, C.E., is the department engineer. Employees consist of 75 men, including head foreman, six assistant foremen, waterworks guardians in charge of valves on main lines, plumbers, etc.; appointments are made by the Water Committee; long terms of service are the rule.

RECORDS.—Plans of supply works and general and detail plans of mains, gates and hydrants are fairly complete and up-to-date and stored in fire-proof vaults. Indexed gate and hydrant location books are provided for operative purposes. Service records are kept on file, but not in card index form. Proper records of consumption are lacking.

QUARTERS.—The executive offices of the department are in the City Hall, which is located on Fabrique Street. The foremen's office, storehouses, repair shops and yards are located on St. Roch, between St. Valier and Des Prairies Streets.

FIRE SERVICE AND EMERGENCY OPERATIONS.—An automobile is provided in case of emergency, also a horse and wagon stationed at the department repair shops. In the event of the department being notified of a second alarm or serious fire, increased pressure is obtained by the concentration of supplies. The manipulation of valves for this purpose is carried out under the direction of the Chief Waterworks Guardian. The offices of the department are equipped with public telephones; a private line extends from headquarters offices at the City Hall, along the route

of the supply pipes to the intake at Lorette, connecting with the dwellings of the various guardians; a portable telephone is used in connection with outside repairs. Constant watch is maintained at the yard; a kit of emergency tools is on hand and a crew can be summoned at short notice.

GENERAL OUTLINE OF THE SYSTEM.

There are two sources of supply. The first and most important source is Lake St. Charles, about 16 miles north-west from the city. The outlet from the lake is the River St. Charles, which flows into the St. Lawrence River, and is dammed at a point nine miles from the lake, seven miles from the city, and at elevation 483.4. This elevation is 438 feet above Massue Street, St. Sauveur, 251 feet above the junction of St. John and De Salaberry Streets in "Upper Town" and 467 feet above Champlain Street in "Lower Town." The second source is from Lake des Roch, about 10 miles north-east of Belvedere Ward, from which supplies are carried by a brook, about six feet wide, to a point seven miles due north from and at an elevation of 242 feet above the ward just referred to, where the brook is dammed and enlarged to form a small settling basin, and which settling basin is 100 by 50 feet and an average depth of 2 feet, containing when full 62,500 gallons. Owing to shallow depth, this capacity would be largely reduced in winter, and in any case is of such capacity as to afford no reserve. Suitable connections have been provided so that all parts of the city can be supplied from the main source of supply, gate valves being placed for the purpose at Commissioners Road for Limoilou Ward and St. Foye and St. Louis Roads for Belvedere Ward. The system is gravity from the sources referred to.

Elevations in the city range from 5 feet along the water front in "Lower Town" to 325 feet in the built-up portions of "Upper Town."

All elevations in this report are in feet above city datum, the bench mark, which was established by the Royal Engineers when contour plan of Quebec and vicinity was prepared, being approximately 1.10 feet above mean water level in the St. Lawrence River.

Quantities of water are expressed in Imperial gallons.

SUPPLY WORKS.—**Source.**—Lake St. Charles has an area of 700 acres and lies in a watershed comprising an area of 140 square miles of granite formation, generally wooded and mountainous, but with regard to which the city has not exclusive rights. The supply is augmented from Lake Beauporte with area of 400 acres. Lake Laron with area of 180 acres, and also many smaller lakes in the watershed. The outlet from Lake St. Charles is the St. Charles river, across which a solid masonry

dam 200 feet long, 14 feet thick at the bottom, 7 feet 6 inches thick at the top and 12 feet high, has been constructed at a point 9 miles from the lake and with crest at elevation 486. The elevation of the lake averages 488 and has never fallen below 486. The minimum and maximum rainfall for one year during the past 5 years amounted to 25.36 and 42.40 inches respectively. The minimum stream flow recorded in St. Charles River is about 40,000,000 gallons per day.

Intake House.—The intake house at Lorette consists of a solid stone and concrete building; roof, plank; metal covered, one storey and detached; separate tunnels direct from river to 18, 30 and 40-inch supply mains; provided with inside and outside double metal screens and intake gates to each for closing and opening as necessary; heated by stove and lighted by oil lamps. A caretaker is constantly in attendance in a house adjoining same, and has telephone on private line direct to the city.

The intake in connection with the 10-inch supply main, from the less important source of supply at Lake des Roch, is provided with gate and suitable metal screens and protected by cribwork; not covered.

tion from the dam on St. Charles River at Lorette, the 18 and 30-inch to the intersection of St. John and De Salaberry Streets, and the 40-inch to the intersection of Sherbrooke Street and St. Foy's Road, a distance of about 40,850 feet. The Riviere des Meres is crossed about 3 miles from the intake and St. Charles River just before entering the city. The mains are carried across the river in each case inside a rectangular steel bridge, 10 feet wide by 12 feet high by 162 feet long, originally designed for the 18 and 30-inch mains, but later reinforced for the carrying of the 40-inch main. At each crossing the 18-inch main is connected by an 18-inch by-pass laid through the bed of the river, and provided with valves at each side. Eleven scouring valves are placed on these mains, at Chateau D'Eau, near Lorette; Riviere des Meres, and the east and west side of the St. Charles River. Stop valves have been placed at a number of points, also air and relief valves at various necessary points.

Since inspection of Jul. 4th, 1914, there has been no trouble with the 18-inch main, but, according to department records, breaks have occurred in the 30 and 40-inch mains, as follows:—

DIAMETER OF MAIN.	DATE OF BREAK.	LOCATION OF BREAK.	TIME FOR REPAIRS.
30-inch.....	August 24th, 1915.....	Tozer's Farm.....	22 hours.
".....	April 25th, 1916.....	Aqueduct and Bagot Streets.....	30 "
".....	June 28th, 1920.....	Moore's Farm.....	25 "
40-inch.....	June 1st, 1918.....	Julien's Farm, near C.P.R. Line.....	27 "
".....	December 14th, 1919.....	Moore's Farm.....	48 "
".....	January 5th, 1920.....	Mongeau's Farm.....	52 "
".....	February 2nd, 1920.....	Moore's Farm.....	72 "
".....	June 5th, 1920.....	W. W. Bridge, South end (St. Charles River).....	30 "
".....	August 8th, 1920.....	Pepin's Farm.....	30 "

Supply Mains.—The supply mains from the principal source are 18, 30 and 40 inches diameter and of cast iron. The larger pipe line from the intake to a point situated at a distance of 3,000 feet is 44 inches, with a thickness of one inch. The remainder of this line is of a uniform diameter of 40 inches with a thickness varying from 1½ to 2 inches, according to the water pressure it has to withstand. The 18-inch main, manufactured by D. J. Stewart & Co., Glasgow, Scotland, was laid in 1853, the 30-inch main, manufactured by the same firm, was laid in 1883, and the 40-inch main, manufactured by Robt. McLaren & Co., Ltd., Glasgow, Scotland, was laid in 1912. All three mains are laid alongside in a south-easterly direc-

The breaks in each case above referred to consisted of a cracked length of pipe, the cause of which has not been definitely established, some minor troubles have also been experienced with defective joints.

Gauges attached to the 18-inch, 30 and 40-inch mains in the caretaker's house at St. Charles River Bridge indicate, respectively, a pressure of 142, 135 and 197 pounds per square inch. Caretakers are on duty day and night at the intake, Riviere des Meres, St. Charles River, Massue Street and at the intersection of St. John and De Salaberry Streets. There is a private telephone at each caretaker's station, the one to Lorette being over a private line; also in the dwelling of the Chief of Fire Brigade,

FIRE-FIGHTING FACILITIES. (WATER SUPPLY.)

City Hall, Waterworks Engineer's Office and Residence, and at St. Valier and Boisseau Streets.

From Lake des Roch the water is conveyed in a single 10-inch diameter cast iron pipe from the reservoir to an 8-inch on St. Foye Road in Belvedere Ward, a distance of 37,000 feet, where distribution commences. The St. Charles River is crossed by this main at a point about one mile from St. Foye Road, in double line, with valves each side.

Consumption.—No data is available for the consumption within the City of Quebec. It is

Pleasant, and in the different fire stations. Between September 14th and 17th, 1920, pressure readings were taken at 124 hydrants well distributed throughout the entire system. (See Table No. 4.) The observed pressures under same method of supply, i.e., with the 18 and 30-inch mains supplying "Lower Town" and the 40-inch main supplying "Upper Town," are generally considerably lower than those tabulated in re-inspection report of July, 1916. Comparative average minimum and maximum pressures are shown in Table No. 1.

TABLE No. 1—PRESSURES

DISTRICT.	POUNDS PRESSURE PER SQUARE INCH, WITH HYDRANT OUTLETS CLOSED.					
	JULY, 1916.			SEPTEMBER, 1920.		
	Average.	Minimum.	Maximum.	Average.	Minimum.	Maximum.
Upper Town.....	65	42	85	61	25	95
Lower Town.....	86	47	104	80	40	117
Belvedere Ward.....	71	57	85	66	50	85
Limoulou Ward.....	83	55	135	90	77	104
Whole City.....	77	42	135	75	25	117

estimated by the Water Department, however, that the consumption is 15,000,000 gallons per day—a per capita rate of about 126 gallons. Observations made at time of inspection would indicate that the rate of consumption is higher than that given, and in connection with which the department has made little effort in the past to control.

The maximum consumption occurs when temperatures are at the lowest, and continues for extended periods when water is allowed to run in order to prevent the freezing of the plumbing, much of which is installed in buildings of frame construction.

Of the 11,000 service pipes throughout the city, 65 only are metered; these are mostly set on large services such as cold storage plants, charitable, religious and educational institutions.

Pressures.—Recording pressure gauges located in the caretaker's dwelling at St. Charles River Bridge, at elevation 20, show a fairly uniform pressure of 142 pounds on the 18-inch, 135 pounds on the 30-inch and 195 pounds on the 40-inch supply mains. Gauges located in No. 8 fire station, Massue Street, at elevation 45 and attached to the 18-inch, 30-inch and 40-inch mains, show pressures of 115, 110 and 175 pounds, respectively. Pressures at St. Charles River Bridge indicate a loss of head from Lake St. Charles of 59 pounds on the 18-inch, 66 pounds on the 30-inch and 6 pounds on the 40-inch main. Gauges are also installed in caretaker's dwelling at Mount

A portable automatic pressure recording gauge was attached for a period of 24 hours to a hydrant in a number of important districts; the location and elevation of each hydrant outlet, together with fluctuation in pressure, follow:—Hydrant, corner of Palace Hill and St. John Street, elevation 107; difference between day and night pressure about 5 pounds. Hydrant, corner Dambourges and St. Paul Streets, elevation 18; difference between day and night pressure about 3 pounds. Hydrant, corner Boisseau and Bayard Streets, elevation 50; difference between day and night pressure about 10 pounds. Hydrant, corner St. Valier and Caron Streets, elevation 50; difference between day and night pressure about 8 pounds. Hydrant, corner Grand Allee and Scott Street, elevation 324; difference between day and night pressure about 3 pounds.

DISTRIBUTION SYSTEM.—General.—Distribution is practically in two services, the upper levels of the city being supplied by the 40-inch main and the lower levels by the 18 and 30-inch mains. A number of valves along the south side of St. John Street are closed in order to increase the pressure at high points. Limoulou, formerly supplied by the 40-inch, is now supplied by the 18-inch main, and Belvedere Ward, from the old waterworks system of Montcalmville (Lake des Roch source) reinforced by the 6-inch main laid on St. Cyrille from the intersection of Bourlamaque Street.

The 18, 30 and 40-inch supply mains are, as previously stated, laid alongside to the St. Charles

FIRE-FIGHTING FACILITIES. (WATER SUPPLY.)

QUEBEC, P.Q.

River Bridge, and a 14-inch main is laid along Commissioners Road to Limoilou, for the supply of that portion of the city. This 14-inch main is connected to the 18, 30 and 40-inch mains so that in the event of the failure of one the others can be immediately used for this supply. This connection is about 500 feet north of St. Charles River Bridge; after crossing the said bridge for a distance of about 1,000 feet south, another 14-inch main is connected directly to the 40-inch main and extends along St. Valier Street, etc., for the supply of "Lower Town," which main is also connected through St. Sauveur and Massue Streets, to the 30-inch supply main at Massue and Aqueduct Streets, thus giving a supply from either in case of necessity. The 40-inch supply main continues up Aqueduct Street to Boisseau Street, where another 14-inch pipe connects for supply west of Boisseau Street. The pipe then extends along Aqueduct Street to St. Foye Road, where it connects with a 24-inch for supply East and South to Grand Allee and "Upper Town"; the said 24-inch pipe passes East on St. Foye Road to Cartier Avenue, and South on Cartier Avenue to Grand Allee; connected through Lee Street with the 18-inch pipe on De Salaberry Street for supply to St. John Ward, if necessary, and connected through Grand Allee with the 18-inch pipe at the intersection of Grand Allee and De Salaberry Street for supply East on Grand Allee. An 18-inch pipe from the 18-inch pipe on Grand Allee is connected through Observatory Road with an 18-inch pipe to Laurier Avenue, thence East on Laurier Avenue to Tache Avenue, reducing to 14-inch at Tache Avenue, thence to Lausdowne Avenue, reducing to 12-inch there, and thence East to Skating Rink, and North to Grand Allee, connecting with the 12-inch on that street. The 18 and 30-inch supply mains are, after leaving the St. Charles River Bridge, laid along Aqueduct Street, and, except for an 8-inch supply pipe to St. Malo Ward, are not drawn from until they reach Massue Street. St. Sauveur (which is 438 feet below and 37,000 feet from the intake at Lorette), where a branch from each connects to a 14-inch distributing main on that street. The next connection is at Arago Street, 2,000 feet further, and about 400

feet below, where another 14-inch pipe is supplied there for direct gravity to "Lower Town." The third and last take-off is from the terminus of the 18 and 30-inch mains at St. John and De Salaberry Streets (St. John Ward, "Upper Town"), 240 feet below and about 40,850 feet from the intake, where a 14-inch main is connected East along St. John Street and an 18-inch South along De Salaberry Street to Grand Allee, and continuing East along Grand Allee to the city, within the walls. An 8-inch main is laid along Grand Allee from De Salaberry Street to 1,800 feet West of Maple Avenue; the whole of the residential district is otherwise supplied by smaller mains as per plan attached to this report. The 18 and 30-inch mains usually supply "Lower Town," while the 40-inch main usually supplies "Upper Town." This, however, by a system of valves can be reversed, or the 40-inch main can be used to supply the whole city. At Massue Street there is an arrangement of valves which enables a supply of water to be turned into the pipes running along that street, either from the 18, 30 or 40-inch mains, and at Arago Street a similar arrangement exists. At Mount Pleasant is an extended system of valves by means of which the pipes passing along St. John Street, St. Foye Road, and also De Salaberry Street, can be supplied from either the 18, 30 or 40-inch mains.

In the principal business streets the mains are largely 8, with a few 12 and 14-inch diameter, as will be seen by reference to plan at end of this report.

In Belvedere Ward (formerly the Municipality of Montcalmville) an entirely new distribution system has been carried out. Mains in this ward are largely 6-inch and 8-inch diameter; no less than 6-inch is laid unless to connect up dead ends.

PIPES.—Length and Age.—See Table 2. All pipe is cast iron. The oldest distributing pipes in service were laid in 1857, and it is said that about 15 per cent. has been in service for over 50 years. About one-third of the pipe in service has been laid during the past 10 years; 6-inch pipe is the minimum size now laid.

TABLE No. 2—PIPES IN THE DISTRIBUTION SYSTEM SEPTEMBER 1st, 1920

DIAMETER, INCHES.	LENGTH IN FEET.	PER CSNT. OF TOTAL	INCREASE IN FEET SINCE 1914.
4.....	191,404	35.5	705
6.....	99,160	18.4	24,321
8.....	155,902	28.9	23,846
12.....	34,402	6.3	5,391
14.....	48,777	9.0	3,500
18.....	7,765	1.5	.....
24.....	2,150	.4	.....
TOTAL.....	539,580	100.0	57,763

FIRE-FIGHTING FACILITIES. (WATER SUPPLY.)

Condition and Cover.—From examination of old pipes removed, there appears to be considerable tuberculation. Mains are flushed frequently through hydrants and scouring valves; the difference in the levels of the city enables this to be carried out with ease, the gates being located mainly at the foot of hills and close to the river side. The discharge from hydrants during fire flow tests was exceptionally clear. Mains are laid in trenches about 7 feet deep and hydrants have 8 ft. 9 in. barrels; very little trouble has been experienced from frozen mains, a few short lengths only of 4-inch pipe having been so affected during the winter of 1919-20. The 18, 30 and 40-inch supply mains have a minimum covering of about 2½ feet.

Specifications.—Pipe is purchased from Canadian foundries under the specifications of the American Waterworks Association and are Class C weight. An ample stock of pipe and fittings is on hand. Hydrostatic tests are not made before backfilling.

Electrolysis.—No electrolytic surveys have been made, and it is said that no apparent damage has manifested itself.

GATE VALVES.—General.—Records of the exact number and sizes of valves in the distribution system are lacking; the water department estimate the total number at 1,000. All are of the solid wedge type; the smaller gates are accessible through the customary extension valve box and the larger sizes are set in brick vaults with iron tops. All in the distribution system and supply lines are direct acting and open by turning to the right. All of the valves are provided with bronze spindles and there is a supply on hand to replace others when they fail.

Location and Spacing.—Gate valves are generally set at street intersections. In the principal mercantile districts the average length of main that would be cut out in case of a break is 600 feet with a maximum of 1,000 feet. In a representative residential district the average is 800 feet, with 10 sections out of 45 in excess of 1,000 feet and a maximum of 3,000 feet.

Inspection and Condition.—No complete inspection of valves has been made by the water department. It is stated, however, that no difficulty has been experienced in getting valves tight when it is necessary to close them. At time of inspection a number of valves were manipulated; all were easily located and in operative condition.

Closing of Valves.—The fire department is notified by telephone, followed by confirming notice in writing, when valves are operated affecting hydrant supply. The concentration of supplies for the purpose of providing increased pressure, and which is resorted to in case of a serious fire, is under the direction of a waterworks guardian

stationed at De Salaberry Street. Specially appointed firemen in certain stations are also authorized to operate valves in case of fire, and when this practice is resorted to it is their duty to advise the guardian by telephone as to the exact action taken.

In the event of a fire in "Lower Town" pressure is increased by opening a 14-inch valve, in connection with the 40-inch supply main, at the intersection of St. Valier and Marie de l'Incarnation Streets. In "Upper Town" pressure is increased in the mercantile district by closing an 8-inch valve at the top of Mountain Hill, and in the more important residential section by closing an 8-inch valve at the intersection of St. Louis Street and Citadel Hill. With exception of the 8-inch valve above referred to, at the top of Mountain Hill all valves between the "Upper Town" and "Lower Town" distributing mains are normally kept closed, also, in "Upper Town" all valves in cross streets immediately South of St. John Street are kept closed.

All service connections are equipped with gates or shut-offs in close proximity to the street main.

HYDRANTS.—Number and Type.—There were 957 public and 6 private hydrants in service, September 1st, 1920. All are of post type; the majority were made locally by F. X. Drolet, while a few only are of Ludlow make; 927 have 4½-inch foot valve, 4½-inch barrel, and two 2½-inch outlets, and are set with 4-inch connection; 20 with 6½-inch foot valve, 6-inch barrel, and three 2½-inch outlets are set with 6-inch connections; the remaining 10 have 9½-inch foot valve, 8-inch barrel, four 2½-inch, also 4½-inch steamer outlet, and are set with 8-inch connection. Hydrants are provided with a frost jacket, open in a uniform direction by turning to the right and a gate is set in connection to the main.

How Located.—Hydrants are generally located at street intersections and frequently in the middle of long blocks; their location is determined by the Manager of the waterworks department and Chief of the fire department.

Drainage.—Hydrants have automatic drip valves, with drainage pipe from each connected to sewers; drainage is generally good.

Inspection.—Members of the fire department are required to make a weekly inspection of all hydrants, their written and signed reports being sent to the Manager of the waterworks department; these reports specifically state that hydrants are in good order, or, if otherwise, describe in detail the defects observed. Hydrants appear to be in good operative condition; of 140 opened at time of inspection, none were found defective. A portable steam boiler is provided for thawing any hydrants found frozen.

FIRE-FIGHTING FACILITIES. (WATER SUPPLY.)

QUEBEC, P.Q.

Distribution.—The average linear spacing of hydrants in the principal mercantile districts is 225 feet, and the area served by each hydrant is 32,000 square feet. In a representative residential district the average linear spacing is 360 feet, and the area served by each hydrant is 82,000 square feet. Of the 120 hydrants within the principal mercantile districts 101 have two 2½-inch outlets, 11 have three 2½-inch outlets, and 8 have four 2½-inch outlets.

Use by Street Department and Others.—Hydrants are used indiscriminately for filling sprinkler carts and by the several municipal departments; little damage is reported from such use.

Fire Engine Water Supply.—Is from the hydrants and also 5 underground tanks for "Upper Town," and from suitable approaches to the river for "Lower Town." Tanks are located as follows:

	Gallons Capacity.
1. Garden and Fabrique Streets, opposite the City Hall.....	120,000
2. At Good Shepherd Convent, St. Amable Street.....	70,000
3. At St. Louis and Parlor Streets.....	46,000
4. On the Esplanade.....	110,000
5. At the Chateau Frontenac.....	120,000

These tanks are filled by springs and the supply augmented from hydrants.

Fire Flow Tests.—In order to ascertain the amount of water which would be immediately available in case of a serious fire in the principal mercantile and residential districts, tests were made by laying a number of lines of hose with various sized nozzles. An automatic pressure recording gauge from which hydrant pressures were obtained was attached for a period of 24 hours to a hydrant in the immediate vicinity where test was being conducted. The details of each test are shown in Table No. 3; also by Charts A, B, C, D and E, taken from automatic pressure gauge above referred to. These Charts show the difference in pressure at the various levels where tests were made, variation in pressure during a 24-hour period, and also the extent to which pressures were reduced with streams flowing.

TABLE No. 3—HOSE LINE TESTS

Test No. 1.—Dambourges and St. Paul Streets, "Lower Town." See also Chart "A," page 11.

No. of Streams.	DIAMETER OF NOZZLES IN INCHES.	PRESSURE IN POUNDS PER SQUARE INCH.			Approximate Discharge in Gallons.	Diameter of Mains in Inches.
		Normal.	Running.	Nozzles.		
One	1.....	62	62	.....	2,080 per minute, or 2,995,200 per 24 hours.	8.
Five	3 of 1½, 1 of 1½ and 1 of 1.....	62	60	.....		8.
Seven	5 of 1½, 1 of 1½ and 1 of 1.....	62	58	.....		8.
Nine	5 of 1½, 3 of 1½ and 1 of 1.....	62	56	.....		8.
Ten	4 of 1½, 5 of 1½ and 1 of 1.....	62	54	1" = 30		8.
Eleven	6 of 1½, 4 of 1½ and 1 of 1.....	62	52	1½" = 26 to 28		12.
Twelve	2 of 1, 4 of 1½ and 6 of 1½.....	62	50	1½" = 24 to 26	12.	

Test No. 2.—St. Valier and Caron Streets, "Lower Town." See also Chart "B," page 12.

No. of Streams.	DIAMETER OF NOZZLES IN INCHES.	PRESSURE IN POUNDS PER SQUARE INCH.			Approximate Discharge in Gallons.	Diameter of Mains in Inches.
		Normal	Running.	Nozzles.		
One	1½.....	87	86	.....	2,484 per minute; or 3,576,960 per 24 hours.	8 of 12.
Five	3 of 1½ and 2 of 1½.....	87	85	.....		"
Seven	3 of 1½, 2 of 1½ and 2 of 1.....	87	83	.....		"
Nine	5 of 1½, 2 of 1½ and 2 of 1.....	87	82	1½" = 30 to 35		"
Ten	6 of 1½, 2 of 1½ and 2 of 1.....	87	81	1½" = 40 to 42		"
Twelve	6 of 1½, 4 of 1½ and 2 of 1.....	87	77	1" = 47		"

FIRE-FIGHTING FACILITIES. (WATER SUPPLY.)

TABLE No. 3—HOSE LINE TESTS—Continued.

Test No. 3.—Boisseau, between Bayard and Durocher Streets, "Lower Town." See also Chart "C," page 13.

No. of Streams.	DIAMETER OF NOZZLES, IN INCHES.	PRESSURE IN POUNDS PER SQUARE INCH.			Approximate Discharge in Gallons.	Diameter of Mains in inches.
		Normal.	Running.	Nozzles.		
One	1½.....	97	96	.....	.....	8 off 14.
Five	3 of 1½ and 2 of 1½.....	97	93	.....	.....	"
Seven	3 of 1½, 2 of 1½ and 2 of 1.....	97	91	.....	.....	"
Nine	5 of 1½, 2 of 1½ and 2 of 1.....	97	89	1½" = 36 to 40 1" = 45 1" = 54	2,643 per minute, or 3,808,920 per 24 hours.	"
Ten	6 of 1½, 2 of 1½ and 2 of 1.....	97	87			4 off 14.
Twelve	6 of 1½, 4 of 1½ and 2 of 1.....	97	85			"

Test No. 4.—St. John Street and Palace Hill, "Upper Town." See also Chart "D," page 14.

No. of Streams.	DIAMETER OF NOZZLES IN INCHES.	PRESSURE IN POUNDS PER SQUARE INCH.			Approximate Discharge in Gallons.	Diameter of Mains in inches.
		Normal.	Running.	Nozzles.		
One	1½.....	57	55	.....	.....	14.
Three	3 of 1½.....	57	53	.....	.....	14.
Four	4 of 1½.....	57	50	1½" = 22 to 24.	1,096 per minute, or 1,578,240 per 24 hours.	14
Six	6 of 1½.....	57	47			14.

Test No. 5.—Grand Allee and Scott Street, "Upper Town." See also Chart "E," page 15.

No. of Streams.	DIAMETER OF NOZZLES IN INCHES.	PRESSURE IN POUNDS PER SQUARE INCH.			Approximate Discharge in Gallons.	Diameter of Mains in inches.
		Normal.	Running.	Nozzles.		
One	1.....	48	47	.....	.....	8 off 18.
Three	2 of 1½ and 1 of 1.....	48	44	1½" = 25 to 28 1" = 27 to 30	749 per minute, or 1,078,560 per 24 hours.	8 off 18.
Five	3 of 1½ and 2 of 1.....	48	42			4 off 18.

Test No. 1, with 12 streams; the volume obtained was 17 per cent. short of what is required for 12 Standard streams.

Test No. 2, with 12 streams; the volume obtained was 7 per cent. short of what is required for 12 Standard streams.

Test No. 3, with 12 streams; the volume obtained was 6 per cent. in excess of what is required for 12 streams.

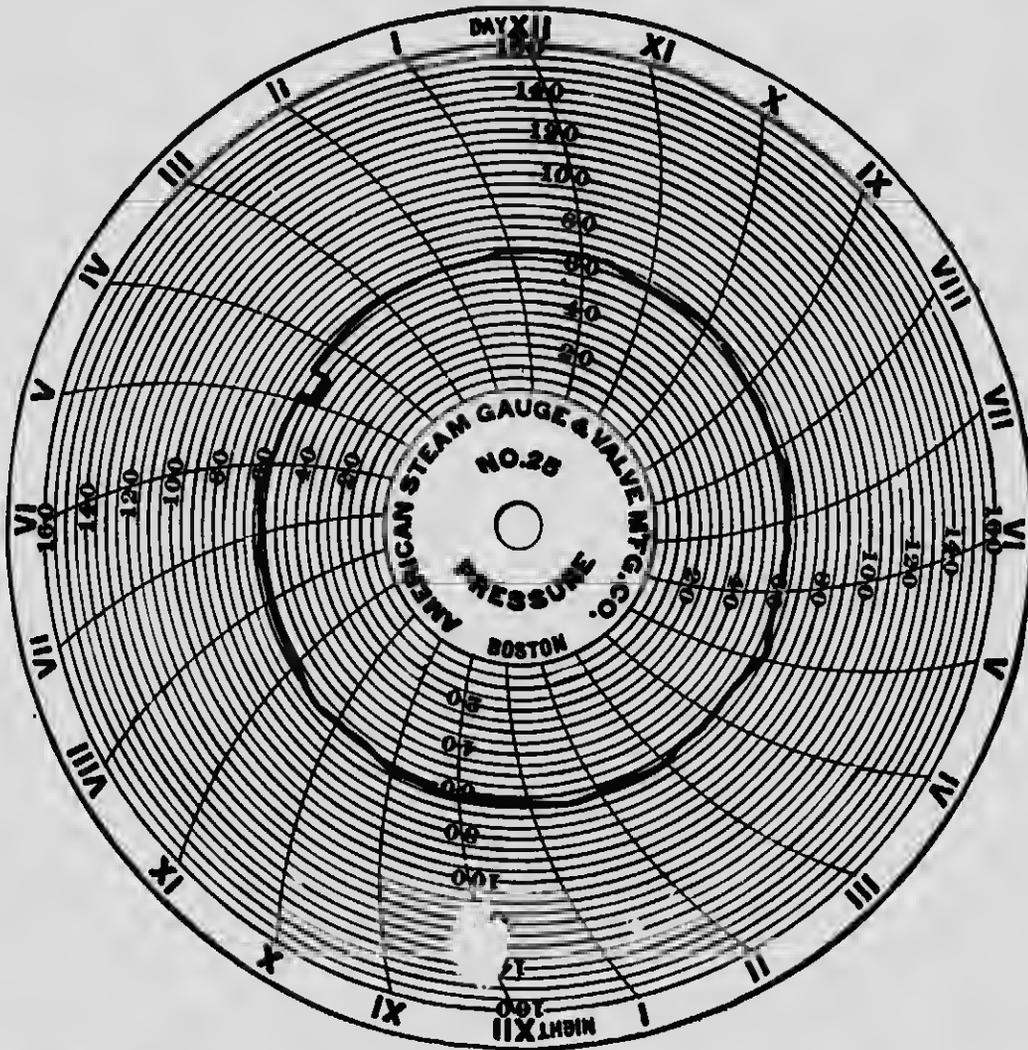
Test No. 4, with 6 streams; the volume obtained was 13 per cent. short of what is required for 6 Standard streams.

Test No. 5, with 5 streams; the volume obtained was 28 per cent. short of what is required for 5 Standard streams.

Note.—A Standard fire stream is that discharged through a 1½-inch plain nozzle at end of a single line of 250 feet of 2½-inch rubber or rubber-lined hose with running pressure of 50 pounds at nozzle, which means 80 pounds running pressure at hydrants, under which conditions each stream will be discharging at rate of 300,000 Imperial gallons per 24 hours.

CHART "A"

From automatic pressure recording gauge attached to hydrant at corner of Dambourges and St. Paul Streets, U. S. B., Plan S. 13, Blk. 102, September 18th, 1920; elevation of hydrant outlet, 18.



Hose lines laid.—12.

Length, each line.—250 feet.

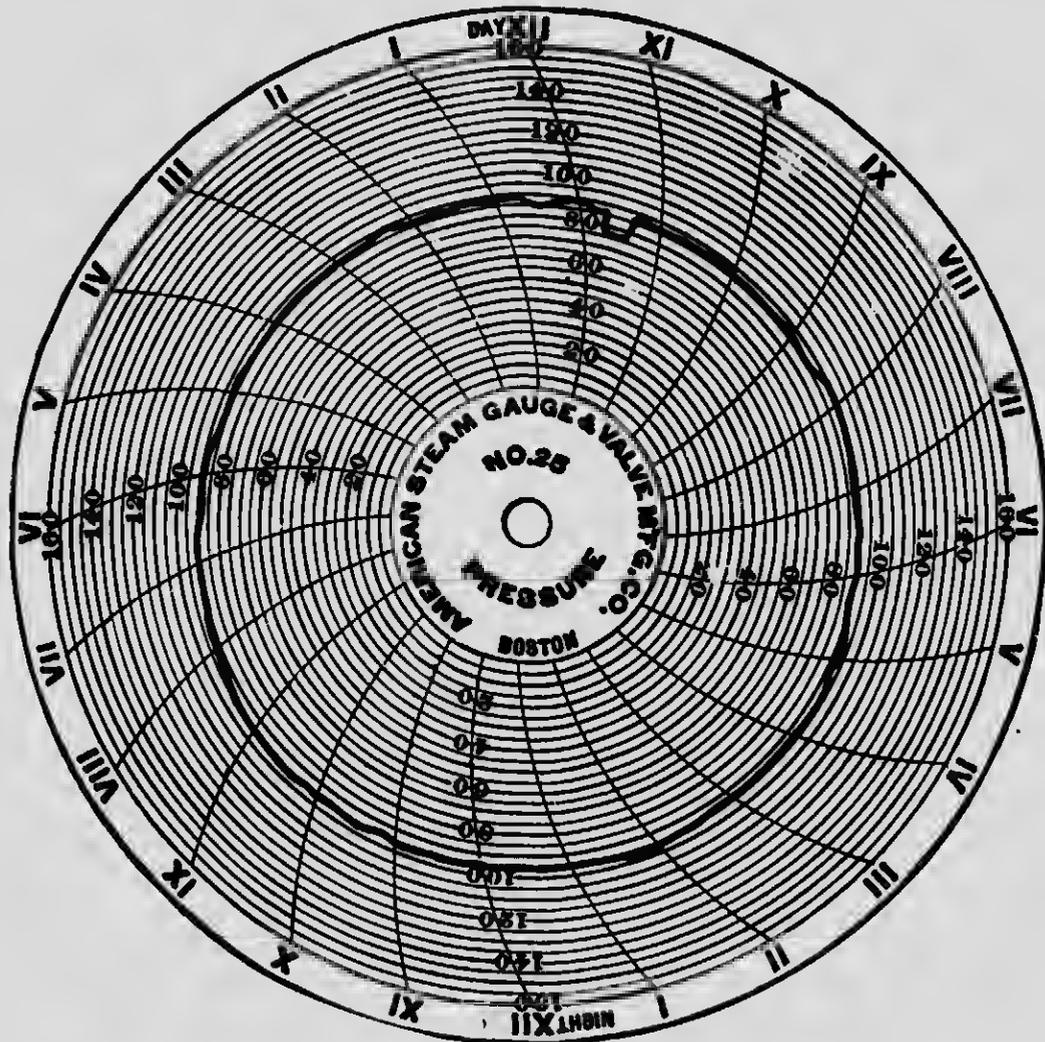
Diameter of Nozzles.—1 to 1½ inches.

Pressures.—Normal pressure at hydrant, 62 pounds; with 12 streams flowing between 4.30 and 5 p.m., reduced to 50 pounds.

FIRE-FIGHTING FACILITIES. (WATER SUPPLY.)

CHART "B"

From automatic pressure recording gauge, attached to hydrant at corner of St. Valier and Caron Streets, U. S. B., Plan S. 20, Blk. 215, September 22nd, 1920; elevation of hydrant outlet, 50.



Hose lines laid.—12.

Length, each line.—250 feet.

Diameter of Nozzles.—1 to 1½ inches.

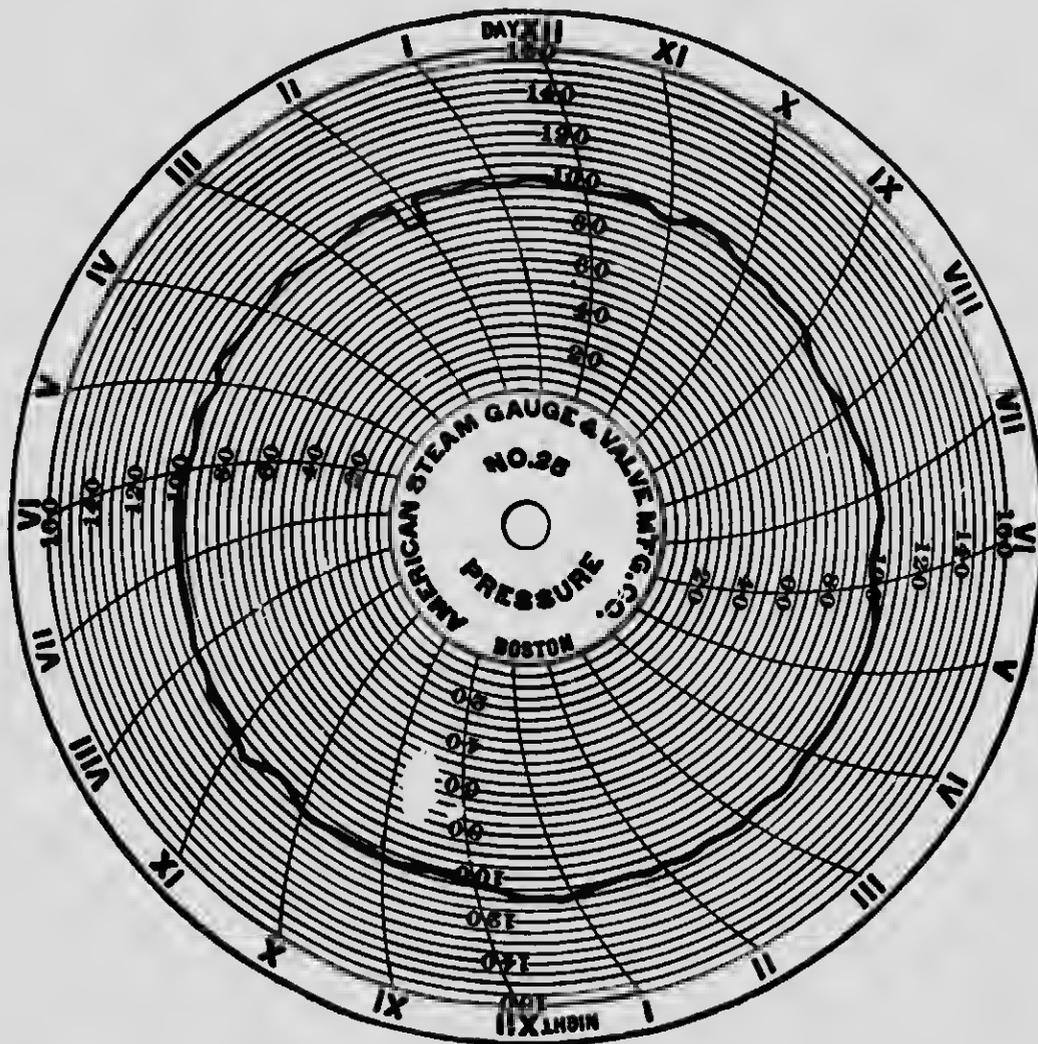
Pressures.—Normal pressure at hydrant, 87 pounds, with 12 streams flowing between 11 and 12 a.m., reduced to 77 pounds.

FIRE-FIGHTING FACILITIES. (WATER SUPPLY.)

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CHART "C"

From automatic pressure recording gauge attached to hydrant on Boisseau Street, between Bayard and Durocher Streets. U. S. B., Plan S. 35, Blk. 575, September 23rd, 1920; elevation of hydrant outlet, 50.



Hose lines laid.—12.

Length each line.—250 feet.

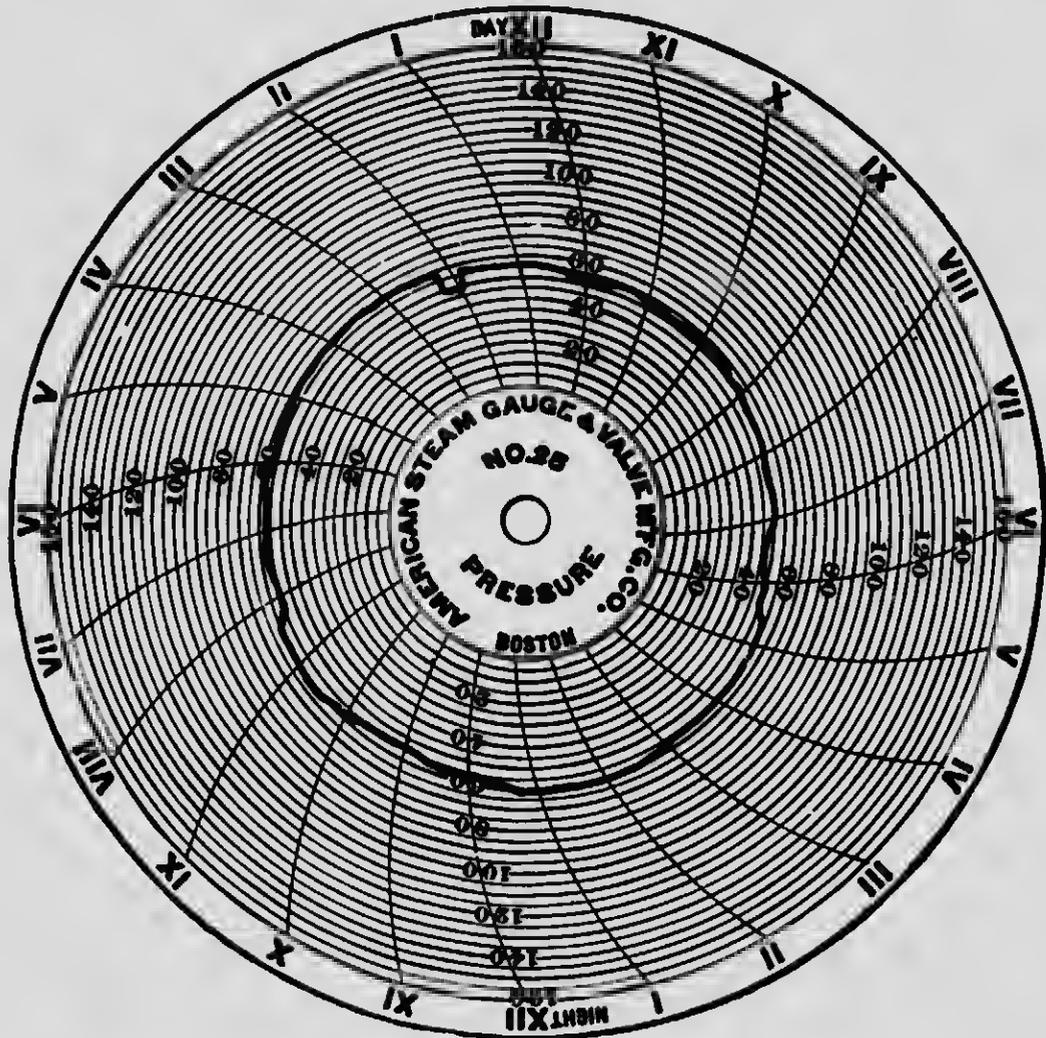
Diameter of Nozzles.—1 to 1½ inches.

Pressures.—Normal pressure at hydrant, 97 pounds; with 12 streams flowing, between 1.55 and 2.15 p.m., reduced to 85 pounds.

FIRE-FIGHTING FACILITIES. (WATER SUPPLY.)

CHART "D"

From automatic pressure recording gauge attached to hydrant at corner of St. John Street and Palace Hill, U. S. B. Plan S. 11, Blk. 84, September 24th, 1920; elevation of hydrant outlet, 107.



Hose lines laid.—6.

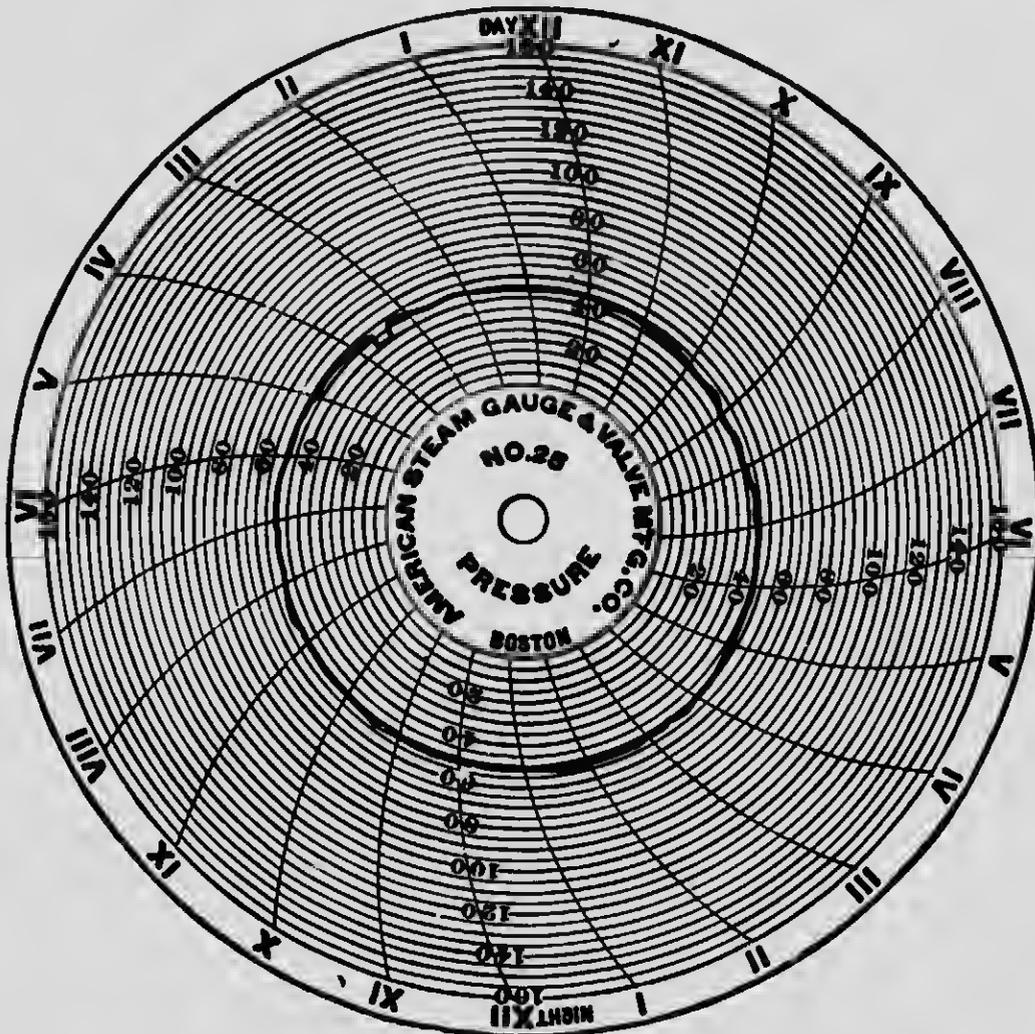
Length, each line.—250 feet.

Diameter of nozzles.— $1\frac{1}{4}$ inches.

Pressures.—Normal pressure at hydrant, 57 pounds, with 6 streams flowing, between 1.45 and 2.10 p.m.; reduced to 47 pounds.

CHART "E"

From automatic pressure recording gauge attached to hydrant at corner of Grande Allee and Scott Street, U. S. B., Plan S. 31, Blk. 372, September 17th, 1920; elevation of hydrant outlet, 324.



Hose lines laid.—5.

Length, each line.—250 feet.

Diameter of nozzles.—1 to 1½ inches.

Pressures.—Normal pressure at hydrant, 48 pounds, with 5 streams flowing, between 3.10 and 3.30 p.m.; reduced to 42 pounds.

FIRE-FIGHTING FACILITIES. (WATER SUPPLY.)

Hydrant Tests.—In order to test the general locations, the following tests were made with condition of hydrants in various parts of the city, water running through a 1/2-inch testing nozzle and to ascertain available pressures in different attached directly to a 2 1/2-inch hydrant outlet.

TABLE No. 4

LOCATION.	U.S.B. PLAN.			Diameter of Mains in Inches.	HYDRANT PRESSURE IN POUNDS PER SQUARE INCH.		Approximate Discharge in Gallons per minute.
	S.	B.	N.		Normal.	Running.	
UPPER TOWN.							
1. Grand Allee and Lachevrotiers Street	30	369	250	18	54	45	258
2. Grand Allee and De Salaberry Street.	55	419	358	18	60	50	272
3. Artillery and St. Augustin Streets.	29	346	50	8	75	60	298
4. St. Patrick and Berthelot Streets.	28	336	135	4	75	50	272
5. St. John and Augustin Streets.	27	823	270	14	42	35	228
6. D'Aiguillon and Deligny Streets.	24	275	214	4	55	32	218
7. St. Eustache and St. Olivier Streets.	27	814	18	4	70	42	250
8. St. Ursule and Angele Streets.	8	56	127	4	75	50	272
9. Desjardins and St. Anas Streets.	9	58	23	4	85	55	285
10. Buade and Du Fort Streets.	12	93	14	8	95	85	310
11. Grand Allee and Scott Street.	31	372	174	4	46	35	228
12. St. Louis and Ursule Streets.	8	55	55	4	60	35	228
13. St. John and Collins Streets.	11	84a	50	12	55	45	258
14. Couillard and Hamel Streets.	11	87	20	4	55	40	244
15. McMahon and St. Angele Streets.	10	71	1	4	50	30	211
16. St. Famile and Garneau Streets.	12	91	41	4	42	18	154
17. Des Carrieres and St. Genevieve Streets.	9	65	44	6	78	35	228
18. St. Denis and Breboeul Streets.	9	63	20	4	45	15	150
19. St. Louis, opposite Chateau Frontenac.	8	66	..	4	67	40	244
20. Des Crison and St. Genevieve Streets.	9	60	15	8	50	30	211
21. Chauveau and Cook Streets.	10	83a	2	4	85	35	228
22. Palace Hill and Arsenal Street.	14	68	23	4	70	45	258
23. St. Amable at No. 9 Fire Station.	30	270	61	8	57	40	244
24. Ross Rifle Factory, East End.	56	427	15	6	52	37	235
25. St. Cyrille, opposite Jeffry Hale Hospital.	50	430b	65	8	55	45	258
26. Lockwell and Turnbull Streets.	51	279	6	..	70	40	244
27. Marchand and Latourelle Streets.	51	774	211	..	55	40	244
28. Richelieu, opposite B. Houde Tobacco Factory.	25	288	209	..	55	45	258
29. St. Madeline and St. Genevieve Streets.	28	298	28	..	75	50	272
30. Cote Abraham and St. Olivier Streets.	27	812	54	..	56	25	192
31. St. Famille and Rampart Streets.	13	105	1	..	54	32	218
32. Laval University Grounds.	12	91	..	..	25	15	150
LOWER TOWN.							
33. Colomb and St. Sauveur Streets	43	781	408	..	95	65	310
34. Champlain Street and Cap Blanc.	7	44	788	4	51	24	189
35. Champlain Street, at No. 8 Fire Station.	6	40	51	8	40	21	189
36. Champlain Street, opposite No. 308.	5	39	308	8	41	25	192
37. Champlain Market and La Place.	4	24	40	8	50	17	159
38. Dalhousie and St. Paul Streets.	3	7b	105	8	55	45	258
39. Dalhousie and St. Andre Streets.	3	2c	25	8	55	45	258
40. St. Andre and St. Thomas Streets.	15	123	74	8	60	30	211
41. Nelson and Colombe Streets.	30	383	21	8	77	55	285
42. Des Fosses and Dupont Streets.	23	248	132	8	75	60	298
43. St. Roch, between Des Prairies and St. Marguerite.	23	256	33	8	75	37	235
44. Queen and St. Dominique Streets.	19	181	36	8	77	58	292
45. Prince Edward and Grant Streets.	19	181	180	8	60	55	255
46. Crown and Smith Streets.	17	149	1	8	80	60	298
47. Jacques Cartier, N.W. Corner of Faquette's Factory.	48	707	22	8	85	60	298
48. Prince Edward and Caron Streets.	18	133	9	8	77	58	292
49. Langelier and Richardson Streets.	47	136	186	8	80	60	298
50. Richardson and Caron Streets.	18	139	336	8	73	55	265

FIRE-FIGHTING FACILITIES. (WATER SUPPLY.)

QUEBEC, P.Q.

TABLE No. 4—Continued.

LOCATION.	U.S.B. PLAN.			Diameter of Mains in Inches	HYDRANT PRESSURE, IN POUNDS PER SQUARE INCH.		Approximate Discharge in Gallons per Minute.
	S.	B.	N.		Normal.	Running.	
LOWER TOWN—Continued.							
51. Langelier at General Hospital.....	47	132	24	4	88	28	204
52. Langelier and Francois Streets.....	37	615	155	6	85	63	304
53. St. Valier and Rameau Streets.....	34	306a	2	6	87	5	310
54. Bonaventure and St. Sauveur Streets..	32	505b	28	6	100	75	332
55. Hotel Dieu, Sacre Coeur, South Front..	44	525	32	6	100	73	320
56. Napoleon and L'Aqueduct Streets.....	42	737	95	6	96	60	298
57. Bayard, between Kirouac and Her- moine Streets.....	38	625	13	6	85	68	318
58. Napoleon, in rear of No. 7 Fire Station	46	600	68	4	90	56	288
59. St. Valier, 250 ft. W. of Marie de l'Incarnation.....	45	673	1206	8	102	75	332
60. Notre Dame des Anges and Dorchester Streets.....	21	209	74	8	85	57	290
61. Louise Embankment, West front of Immigration Building.....	40	700	96	6	68	20	172
62. Girouard and Lapeltrie Streets.....	..	..	..	..	117	85	354
63. F. C. Marquis Glue Factory.....	44	541	5	..	95	45	258
64. N.E. Corner of St. Malo Rly. Shops...	..	..	..	..	95	45	258
65. St. Valier and St. Nicholas Streets....	14	113	..	..	70	25	192
66. Barrone and Grant Streets.....	23	258	16	..	70	35	228
67. Bigaouette and St. Mathias Streets...	49	580	..	..	95	75	332
68. King East of Caron Street.....	16	146	Opp.	358	88	70	322
69. St. Dominique and St. Joseph Streets..	23	249	81	..	76	62	302
70. St. Joseph and Lalibertie Streets.....	22	224	140	..	77	65	310
71. St. Joseph and Dorchester Streets.....	21	208	272	..	82	55	285
72. Louise Embankment, North end of Shed No. 27.....	40	700	..	6	No water.	..	..
73. Louise Embankment at Grain Elevator No. 2, West End.....	400	700	1	6	66	27	201
74. Ramsay Street and Orleans Place.....	15	118	1	6	75	50	272
75. Crown and St. Valier Streets.....	21	221	411	6	66	58	292
76. St. Anslene and St. Valier Streets.....	20	201	580	12	78	65	310
77. Langelier and Arago Streets.....	30	249	152	4	75	50	272
78. Sauvageau and St. Colomb Streets....	39	652	130	8	82	65	310
79. Parent and Amhroise Streets.....	31	563	76	14	98	75	332
80. St. Malo and Renaud Streets.....	34	540	44	8	95	72	326
81. St. Therese and Marie de l'Incarnation Streets.....	58	749	156	8	100	77	337
82. St. Valier and Le Boutiller Streets....	46	685	234	8	97	70	322
83. Gamelin Street (formerly St. Charles, South of St. Valier Street).....	59	693	318	6	97	65	310
BELVEDERE WARD.							
(Formerly Montcalmville.)							
84. Des Erables and Grand Allee.....	54	390	38	8	50	30	211
85. De l'Alverne and St. Foye Streets.....	52	378	67	..	73	48	267
86. St. Foye Road, opposite Jesuits' Church	52	393	60	8	70	55	285
87. Brown Avenue and St. Foye Road.....	51	818	93	8	70	50	272
88. Des Franciscans and L'Alverne Streets	50	398	36	6	60	50	272
89. Des Erables and Marquette Streets....	52	379	15	4	50	35	228
90. St. Foye and Belvedere Road.....	60	810	..	8	84	55	285
91. Aberdeen and Bourlamaque Streets....	54	386	60	4	50	37	235
92. St. Louis and Belvedere Streets.....	..	..	..	6	65	37	235
93. Brown Avenue and St. Louis Road.....	63	400	..	8	53	33	272
94. Holland and St. Foye Road.....	..	..	..	12	85	60	298
95. Cremanzie and Bourlamaque Streets....	52	382	69	6	55	35	228
96. Fraser, near Cartier Street.....	55	413	25	..	60	60	272
97. Cremanzie, near Cartier Street.....	53	789	22	..	60	17	159
98. St. John and Cartier Streets.....	..	..	..	..	85	60	345

FIRE-FIGHTING FACILITIES. (WATER SUPPLY.)

TABLE No. 4—Continued.

LOCATION.	U.S.H. PLAN.			Diameter of Mains, in Inches.	HYDRANT PRESSURE, IN POUNDS PER SQUARE INCH.		Approximate Discharge in Gallons per Minute.
	S.	B.	N.		Normal.	Running.	
LIMOILOU WARD.							
<i>(Formerly Stadacona and Hedleyville.)</i>							
99. 3rd Street, 175 feet East of 2nd Ave....	126	1300	opp 47	6	92	60	298
100. Papineau and Francois Premier.....	120	1353	27	6	83	60	298
101. Commissioners Road at Exhibition Grounds.....	122	2000	502	14	104	80	345
102. Exhibition Grounds, opposite Palais de l'Industrie.....	122	2000	515	4	98	63	304
103. 1st Avenue and Lamontagne Street....	123	1968	opp. 71 2	6	93	65	310
104. 1st Avenue and 10th Street.....	129	1418	..	8	83	55	285
105. 2nd Avenue and 5th Street.....	124	1386	..	6	77	50	272
106. 5th Street, opposite No. 10 Fire Station.	125	1401	658	8	80	48	287
107. 8th Avenue and 5th Street.....	128	1425	110	6	95	60	298
108. 10th Avenue, opposite Neabitt Sash & Door Factory.....	128	1425	20	6	95	55	285
109. 8th Avenue and Canadiere Road.....	125	1397	..	6 off 8	90	60	298
110. Bergemount Avenue and Canadiere Road.....	..	..	..	14	92	60	298
111. 6th Avenue and 2nd Street.....	121	1301	8	6	92	60	298
112. Canadiere Road, opposite Civic Hospital.....	Key	E. of 1719	..	12	90	60	298
113. 4th Avenue and 4th Street.....	127	1404	41	6	80	65	310
114. 3rd Street, 125 feet East of 2nd Avenue	126	1390	47	6	90	60	298
115. 2nd Street and 5th Avenue.....	127	1409	93	6	90	60	298
116. 3rd Street and 10th Avenue.....	129	1414a	213	6	95	60	298
117. 7th Street and 8th Avenue.....	128	1442	555	6	90	60	298
118. Cattle Market.....	Key	W. of 1769	..	6	92	60	272
119. Exhibition Grounds, opposite Cattle Pens.....	122	2000	..	6	100	55	285
120. 8th Street and 2nd Avenue, opposite No. 11 Fire Station.....	121	1361	8	6	95	20	172
121. 6th Avenue and 5th Street.....	127	1404	130	6	95	60	298
122. 1st Street and 10th Avenue.....	120	1416	A. 7	..	93	60	272
123. Bergemount Ave., 600 ft. South of Canada Box Works.....	..	..	..	..	80	52	278
124. L. Borne Tannery (Beauporte).....	..	..	..	2	37	5	87

Concentration.—Fire flow tests tabulated in this report were conducted under normal conditions of supply. When additional pressure is required the concentration of supplies is resorted to. (See "Closing of Valves," page 8.) On September 25th, 1920, a test was made by attaching a pressure gauge to a hydrant at the corner of Palace Hill and St. John Street, with the object of ascertaining the time required and to what extent pressures in the principal mercantile section of "Upper Town" would be increased. The results noted are as follows:—Normal pressure at hydrant at 2.50 p.m., 45 pounds. Assistant Fire Chief telephoned to waterworks guardian at De Salaberry Street for increased pressure at 2.55 p.m. At 3.12 p.m. there being no increase, the Chief ordered an 8-inch valve closed at top of Mountain Hill; pressure began to increase at 3.16 p.m., reaching a maximum of 82 pounds at 3.20 p.m.

A further test was made on the same date above referred to, by attaching a pressure gauge to a hydrant at the corner of St. Andre and Dalhousie Streets in "Lower Town." The normal pressure noted at 3.50 p.m. was 52 pounds, at which time Assistant Fire Chief telephoned to waterworks guardian at No. 8 fire station, Massue Street, for increased pressure. At 3.59 p.m. pressure began to increase; at 4.02 p.m. gauge registered 59 pounds, and at 4.10 p.m. a maximum of 63 pounds was reached.

Recent and Contemplated Improvements.—During the past 6 years 2,200 feet of 12-inch pipe have been laid along St. Joseph from Crown to St. Roch Street (replacing former 4-inch), 841 feet of 12-inch along Napoleon Street West to Montmagny Street; 428 feet of 8-inch along Chauveau Avenue in rear of City Hall; 1,000 feet of 8-inch

along Ramsay Street, North of St. Paul Street, and 1,146 feet of 8-inch along Champlain Street West to connect with 8-inch extending down from "Upper Town" via the Cliff (St. Louis Road).

In Belvedere Ward the system has been extended by laying 3,500 feet of 14-inch pipe along St. Foye Road from Maple Avenue West, 1,500 feet of 12-inch along St. Foye Road from Quebec Park East, 550 feet of 12-inch along Saunders Street from Cartier Avenue to connect with Grand Allee West, 200 feet of 12-inch along Bourlamaque South of Saunders Street to Grand Allee, 2,175 feet of 8-inch along St. Foye Road West of Levis Avenue; 450 feet of 8-inch along Grand Allee, West of Bourlamaque Street; 3,000 feet of 8-inch along St. Louis Road West of Maple Avenue.

Forty-two additional hydrants have been set. No extensive improvements are at present under consideration.

CONCLUSIONS.—Organization.—The works are under the supervision of a Business Manager, assisted by a Civil Engineer; both have been in the employ of the city and connected with the waterworks department for a number of years. Responsible employees enjoy long tenure of office, and according to a civic by-law cannot be dismissed without cause. A civic pension fund has been established from which an official can draw a pension after 35 years of service, or after having reached the age of 65 years.

Records.—Plans are fairly complete, and during the past three or four years have been put in proper form, but much statistical data is lacking, particularly that pertaining to consumption, which is of primary importance on any waterworks system.

Supply.—Lake St. Charles furnishes an ample and reliable supply and provides for a considerable growth of the city. The head works are well arranged and of permanent construction.

Supply Lines.—The supply lines from the source of supply at Lorette consist of an 18-inch, a 30-inch and a 40-inch diameter cast iron pipe. The capacity of the 18-inch is estimated at 5,400,000 the 30-inch 21,600,000, and the 40-inch 54,000,000 gallons per day, the total quantity being greatly in excess of the maximum consumption rate. For six consecutive weeks during the year 1915 the 40-inch main, under test by the waterworks department, alone supplied the entire city. The system, however, cannot be regarded as other than a single style system, the 18 and 30-inch pipes, jointly, under present conditions of consumption being incapable of adequately supplying the city. Moreover, the hazard due to lack of proper duplication is further increased by conditions which cause frequent breakage to the 30 and 40-inch mains and also to the fact that the pipes are laid so close together that the failure of one would endanger the other. Under existing conditions almost a complete interruption of supply is quite possible.

Consumption.—The lack of consumption records is to be deplored, as definite knowledge of this subject is essential to good operation and effective extension of the waterworks system. The consumption rate is liable to become, or is usually excessive where there are no definite records; high rates of domestic consumption reduce the margin available in the street mains for fire purposes, and necessitate the construction of supply works of greater capacity than would be otherwise needed. A few meters only have been installed during the past two or three years; a continuance of this policy cannot fail to greatly reduce the waste which is bound to exist in all unmetered works.

Pressures.—In the "Lower Town" area, which largely includes the congested value district and manufacturing sections, pressures range from light to heavy. In the north-eastern parts of the district, pressures are poorly maintained, due to insufficient carrying capacity of arterial feeders; in the principal manufacturing sections pressures, generally, are good.

Pressures at the lower levels of the "Upper Town" service are moderate, but at the higher levels light and insufficient for effective direct hydrant streams.

Protection for the Congested Value Districts and Other Sections.—Reasonable protection for the principal mercantile districts requires a fire flow, above maximum consumption of 5,500 gallons per minute, maintained under a pressure of 80 pounds. In residential sections a flow of 3,000 gallons is necessary. In the principal manufacturing sections these quantities and pressures are available, but elsewhere conditions are such as to require the assistance of fire engines.

Mains.—The carrying capacity of the main arteries from the supply mains into the principal mercantile and congested value districts is somewhat deficient. This is particularly marked in the North-Eastern portion of "Lower Town." Grid-ironing is fairly good and dead ends are few. Mains in the greater part of the principal mercantile districts are of fair size. Throughout the entire system about 54 per cent. of the mains consist of 6-inch and smaller pipe. It is estimated that about 15 per cent. of the mains have been in service over 50 years, and the carrying capacity appears to be materially reduced. It is said that no damage has resulted from electrolytic action, due in a measure to the ledge formation on which the city is built.

Gate Valves.—The system is generally well equipped with gate valves, but there are some sections in important districts which should be subdivided by setting additional valves. The practice of closing valves to maintain pressures at the higher levels is resorted to and which reduces

FIRE-FIGHTING FACILITIES. (FIRE DEPARTMENT.)

the quantity of water available at the lower elevations. Responsible employees appear to be familiar with gate locations, but no regular inspections are made.

Hydrants.—Hydrant spacing is generally good in and around the high value districts. One exception noted in particular, however, being in the vicinity of the Seminary of Quebec on Port

Dauphin Street, where additional should be installed. All hydrants are of the post type; about 96 per cent. have two 2½-inch outlets only, and 4½-inch barrels, which are too small; connections to the mains range from small to moderate in size; practically all are equipped with gates. Although hydrants are used indiscriminately by the several municipal departments, they were found in good condition, showing the efficiency of the inspection.

FIRE DEPARTMENT

ORGANIZATION.—Supervision.—The fire department, which has been on a full paid basis since 1864, is under the supervision of a committee formed from members of the City Council. This committee, known as the Fire Committee, is at present composed of Chairman P. Bertrand, J. A. Bouchard, C. Delagrave, A. Lebrecque, Dr. A. A. Lantier and J. Mercier.

A committee composed of the Mayor, Chairman of the Fire Committee and Chief of the Fire Department controls the promotion and retirement of members.

The enforcement of discipline and the expenditure of appropriations is vested in the Chairman of the Fire Committee and the Chief of the Fire Department.

The selection of candidates for appointment is made on recommendations of district chiefs and fire captains.

The Chief is the executive officer of the fire force, has full control at fires, and is responsible to the Fire Committee for the efficiency and operation of the force. He is appointed by the City Council for an indefinite term.

Expenses.—The expenses of the fire department for the last five fiscal years ending April 30th, 1920, not including those of the fire alarm system, are shown below:

Enlistment and Promotion.—Proper age limits are prescribed, ranging from 21 to 30 years; the minimum height is 5 feet 7 inches, and weight 140 pounds. Candidates are required to read and write, and are also required to pass a physical examination before the city medical officer. All appointments are probationary for 90 days, and at least 12 months' service is required before promotion can be made. Promotions are made on merit and length of service; an efficiency record is kept of each member.

Engineers are required to hold a portable engineer's license from the Provincial Board of Examiners.

Retirement and Pensions.—There is no pension fund; members simply receive, in case of disability at fires or in the event of illness, full pay during the term of incapacity. In the event of death his immediate dependents receive one month's salary.

No age limit has been set for retirement. Only a few men are over 60 years of age, and these are mostly officers.

If killed in service, his family or legal heirs receive \$1,000.00 from the city. A mutual relief association, composed exclusively of members of the department, pays a death benefit of \$500.00, \$50.00 for funeral expenses and nothing thereafter.

EXPENSES.

Year.	Salaries and Wages.	General Expenses.	Maintenance.	New Apparatus and Stations.
1915-16.	\$120,652.00	\$ 36,700.00	\$157,352.00	\$ 8,974.51
1916-17.	119,700.00	37,000.00	156,700.00	9,601.86
1917-18.	144,900.00	39,100.00	184,000.00	10,811.15
1918-19.	148,000.00	40,000.00	188,000.00	13,790.80
1919-20.	201,132.00	52,800.00	263,452.00	15,840.21
TOTAL.	\$734,284.00	\$205,600.00	\$949,504.00	\$59,018.53

FIRE-FIGHTING FACILITIES. (FIRE DEPARTMENT.)

QUEBEC, P.Q.

FIRE FORCE.—Numerical Strength.—Total membership August 31st, 1920, was 169 officers and men, divided as shown in Table No. 5. In addition the pay-roll of the department includes a Secretary-Treasurer, members of the fire alarm telegraph bureau, and members of the fire prevention bureau.

The fire prevention bureau is under the supervision of the Chief of the fire department and the Fire Marshal.

Permanent Details.—Details to work, other than fire duty, include four men at headquarters, one of whom is assigned to clerical work, one as storekeeper, and two to the repairing of hose and

harness. The latter two also attend general alarm fires, giving special attention to any defects which might arise in hose lines being used. Eight are also employed as chauffeurs for the Chief and District Chiefs. When a District Chief is on day-off or vacation, one District Chief is required to cover two districts; the Chief also acts as a relief.

Districts.—For fire purposes the city is divided into three districts, one of which is covered by the Assistant Chief, and the other two by District Chiefs. The lower levels of the city are about equally divided into two districts, and the upper levels constitute the other district.

TABLE No. 5—MEMBERSHIP

Total, 204; Fire Force, 169.

FIRE FORCE.	JULY, 1914.	SEPTEMBER, 1920.
Chief.....	1	1
Assistant Chief.....	none	1
District Chiefs.....	2	2
Captains.....	12	12
Lieutenants.....	12	12
Engineers.....	3	3
Assistant Engineers.....	3	3
Hosemen and Laddermen.....	85	107
Chief's Drivers.....	6	8
Valve Manipulators (for concentration of supplies when necessary).....	18	20
TOTAL.....	142	169
Staff and Office.....	1	2
Chief, Fire Prevention Bureau.....	none	1
Fire Prevention Inspectors.....	none	8
Veterinary Surgeons.....	1	1
Repair Shop.....	none	9
Fire Alarm Force.....	8	11
Hose and Harness Repairers.....	2	3

Officers.—Age, years in service and date of appointment to present position of the officers of the fire department are given in Table No. 6.

TABLE No. 6—CHIEF OFFICERS

TITLE.	NAME.	AGE.	When Appointed to Present Position.	Years in Service.
*Chief.....	Louis Talbot.....	64	1917	39
Assistant Chief.....	Lawrence Donnelly.....	49	1917	25
District Chief.....	Denis McManus.....	63	1911	38
".....	Omer Belanger.....	45	1914	17
Superintendent Fire Alarm.....	Pierre Duval.....	60	1915	40

* On October 15th, 1920, and while this report was being prepared, Lawrence Donnelly succeeded Louis Talbot as Chief of the Fire Department.

FIRE-FIGHTING FACILITIES. (FIRE DEPARTMENT.)

In Table No. 7 is shown the number of men assigned to each fire station and how divided between the various pieces of apparatus. The total number of 169 is about equally divided into two platoons, which alternate for duty every 24 hours. The two-platoon system became effective in May, 1919.

In case of urgent need, the Chief, or in his absence the Assistant Chief, has full authority to keep on duty any or all members of the department.

Members are required to report for duty on time, and one platoon is not permitted to go off duty before the arrival of the relieving platoon.

Roll call is made at 8 a.m., by the captain of each station. Proper entry is made in the Station Book.

In case of a fire occurring at the changing hour there are no precise rules by the department as to who shall man apparatus, but it is said that under these conditions the majority of members of both platoons respond.

Chief and District Chiefs are each provided with an automobile.

Distribution.—Two engines, 2 aerial trucks, 4 city trucks and 1 fuel wagon are stationed in the congested value district, with no point over 900 feet from a fire station. In outlying districts there is usually a company within $\frac{1}{2}$ of a mile of closely built sections, but parts of Limoilou and St. Valier Ward are more remote.

Apparatus of the automobile type is installed in two stations in "Lower Town" and in one station in "Upper Town."

Maintenance.—Members of each platoon are required to take their meals while on duty in the stations, proper facilities being provided for this purpose. Officers and men alike are granted an annual vacation only, for a period of 12 days. Leave of absence on account of sickness of any member, or of his immediate family, is granted without loss of pay, and other leaves involving loss of pay may be granted at the discretion of the City Council. Eight substitutes are employed

**TABLE No. 7—TWO-PLATOON SYSTEM
OFFICERS AND MEN ASSIGNED TO APPARATUS AT EACH STATION**

Station.	Hose Wagons.	Ladder Trucks.	Engines.	Fuel Wagons.	Chief and District Chief's Drivers.	TOTAL.
1	8	8	..	..	4	20
2	9	..	..	..	..	9
3	8	6	4	..	..	18
4	8	..	..	..	..	8
5	8	5	3	1	2	19
6	6	2	..	..	..	8
7	12	4	..	..	..	16
8	8	6	..	..	2	16
9	8	7	2	1	..	18
10	7	6	..	..	..	13
11	6	2	..	..	..	8
12	8	4	..	..	..	12
	96	50	9	2	8	165
Superior Officers.....						4
TOTAL.....						169

COMPANIES.—Organization.—In service are 12 plain hose wagons, 3 engines, 2 combination automobile chemical engines and hose wagons, 2 horse-drawn chemical engines, 2 aerial trucks, 7 city hook and ladder trucks and one fuel wagon. (See Table No. 8.)

Each hose company has from 3 to 5 men. Four men are assigned to engine No. 3, three men to Engine No. 5 and two men to Engine No. 9. Chemical engine apparatus, a lieutenant and one man; aerial truck companies, a lieutenant and 2 men; city truck companies, from 2 to 4 men. Fuel wagon carries a driver only. Chief, Assistant

to take the places of men on sick and vacation leave. In hose wagon companies the least number of men responding ranged from 3 to 4, engine companies 2 and ladder companies 2.

For satisfactory service the number of men assigned to hose wagon companies and responding to each alarm should not be less than 5; engine companies 3 and ladder companies 6.

Watch is maintained at all times on the apparatus floor of each fire station.

At large fires, horses during the winter time are quartered at the nearest fire station and drivers report back for fire duty.

TABLE No. 8—FIRE STATIONS—LOCATION AND EQUIPMENT

Number	LOCATION	U.S.B. PLAN.		Men	Horses	Salvage Covers	CHEMICALS		HOSE CARRIAGES		Feet of 2 1/2" Hose at Each Station.	Aerial Trucks.	Hook and Ladder Trucks.	No. of Feet on Each Truck.	STEAM FIRE ENGINES		Fuel Wagons.	Gauge in Fire Station.	Playpipes.	Cut-offs.	Hose Towers.	Motor Cars for Chiefs.	Smoke Helmets.	
		S.	N.				Engines.	H. Extinguishers.	Number.	Capacity.					No. in Service.	Gallons Capacity.								
1	City Hall.....	3	83b	20	1	23	1	8	1	1500	4400	1	.....	.....	253	.....	.....	1	2	2	1	2	1	1
2	Richelieu Street.....	25	287	9	3	2	.....	4	1	1000	600	.....	1	.....	147	.....	.....	1	2	2	.....	.....	.....	1
3	Dorchester Street.....	21	209	18	1	22	1	6	1	1500	1000	1	.....	.....	255	1	800	1	6	2	.....	.....	.....	1
4	St. Paul Street.....	14	11	388	8	.....	.....	2	1	1000	1000	.....	.....	.....	255	1	400	1	2	2	.....	.....	.....	1
5	Dalhousie Street.....	3	7b	99	6	5	1	6	1	1000	1000	1	.....	.....	147	.....	.....	.....	7	2	1	1	1	1
6	Champlain Street.....	6	40	51	3	5	.....	4	1	600	600	.....	1	.....	.....	.....	.....	2	2	2	1	.....	.....	1
7	Boisseau Street.....	36	600	67	4	.....	.....	6	2	1000	1000	.....	.....	.....	75	.....	.....	2	2	2	.....	.....	.....	1
8	Massue Street.....	42	726	16	6	5	.....	6	1	1000	1000	.....	.....	.....	182	.....	.....	2	2	2	1	1	1	1
9	St. Amable Street.....	20	370	18	7	6	.....	4	1	500	500	.....	.....	.....	182	1	400	1	2	2	.....	.....	.....	1
10	5th Street (Limouiy).....	125	1401	658	4	5	.....	4	1	1000	1000	.....	.....	.....	188	.....	.....	2	2	2	.....	.....	.....	1
11	6th Street and 2nd Avenue (Stadacona)	124	1383	.....	3	.....	.....	5	1	500	500	.....	.....	.....	77	.....	.....	2	2	2	.....	.....	.....	1
12	Cremazie Street.....	52	382	371	5	6	.....	6	2	1500	900	.....	.....	.....	214	.....	.....	2	2	2	1	.....	.....	1
	TOTAL.....			165	45	79	3	61	14	12100	13500	3	8	1875	3	1600	2	12	33	24	5	4	12	

Superior Officers, 4; Total 169.

QUEBEC, P.Q.

FIRE-FIGHTING FACILITIES. (FIRE DEPARTMENT.)

EQUIPMENT.—Summary of Apparatus.—In Table No. 9 following, the amount of apparatus in the department in July, 1914, and September, 1920, is given; showing the changes since the former date.

Engine Tests.—The engines were tested on September 18th, 1920 (by C. F. U. A. Engineer) to ascertain their condition and the ability of the operating crews. All were tested at draft from the St. Lawrence River, with 9 to 10 feet lift through 20

TABLE No. 9—EQUIPMENT—SUMMARY OF APPARATUS

	1914.		1920.	
	In Service.	In Reserve.	In Service.	In Reserve.
Engines, rated capacity:				
800 gallons.....	1	none	1	none
400 gallons.....	2	"	2	"
TOTAL ENGINES.....	3	....	3	....
Auto. Combination Hose Wagon and Chemical Engines.....	2	none	2	none
Hose Wagons, plain.....	10	2	10	2
TOTAL HOSE WAGONS.....	12	2	12	2
Ladder Trucks, aerial.....	3	none	3	none
city.....	8	2	8	2
TOTAL LADDER TRUCKS.....	11	2	11	2
Chemical Engines.....	1	1	2	1
Officers' Autos and Buggies.....	6	none	9	none
Wagons, Fuel.....	1	1	1	1
Horses.....	45	4	38	7
Hose, 2½-inch.....	17,550	3,300	21,800	3,800
Hose—1½-inch for Chemicals.....	450	150	600	600
Ladders, total length.....	1,941	none	1,975	none
Portable extinguishers.....	50	12	61	10
Deluge Sets.....	none	none	2	1
Turret Nozzles.....	"	"	2	none
Siamese Connections.....	24	"	24	"
Cellar Pipes.....	4	"	5	"
Salvage Covers.....	30	30	39	40

EQUIPMENT.—Steam Fire Engines.—In service, 3; in reserve, none. (See Tables Nos. 8 and 9.) One engine is of the double-piston pump type and is practically new, one single double-acting is 45 years old, and one triple single-acting is 48 years old. All are in a fair condition of repair, but the two latter are of obsolete type and inadequate capacity. All are provided with hand relief valves and ordinary gauges; two are provided with rubber tires. They are uniformly equipped, each carrying an Eastman deluge set, with 1-inch to 2-inch nozzles, a total of 31 ft. 6-in. hard suction hose, with 4½-inch couplings; also 3 lengths of 2½-inch soft suction hose, with reducer and Y. No heaters are provided in fire stations.

Two-horse teams are provided for two engines; one is self-propelling.

feet of stiff suction. The regular crews were assigned to run the engines.

The "Waterous" Engine delivered 584 gallons per minute—about 73 per cent. of its rated capacity; the average net pump pressure was 85 pounds and the average steam pressure 70 pounds.

The "Shand & Mason" Engine delivered 309 gallons per minute—about 77 per cent. of its rated capacity; the average net pump pressure was 62 pounds and the average steam pressure 70 pounds.

The "Clapp & Jones" Engine delivered 202 gallons per minute—about 73 per cent. of its rated capacity; the average net pump pressure was 55 pounds and the average steam pressure 80 pounds.

FIRE-FIGHTING FACILITIES. (FIRE DEPARTMENT.)

QUEBEC, P.Q.

In general, the crews could not be classed as skilful; engineer in charge of "Waterous" engine was careless with feed water and stokers showed inexperience in firing for heavy work.

Hose Wagons.—(See Table No. 9.) In service, 2 combination and 10 plain wagons; in reserve, 3 plain hose wagons. The majority of these wagons were built in the shops of the Quebec fire department, the auto. apparatus being built by the Seagrave Co.; none are equipped with turret pipes. Eight are provided with dividing boards which permit of two lines being laid simultaneously. Each carries from 500 to 1,000 feet of 2½-inch rubber-lined hose, two 3-gallon chemical fire extinguishers, shut off nozzles and full supply of minor equipment and tools. Two are motor-propelled and are equipped with rubber tires. Six are drawn by two horses and five by one horse; these wagons equipped with steel tires. All appear to be in good condition.

Ladder Trucks.—(See Table No. 9.) In service, 3 aerial and 8 ordinary; in reserve, 2. The three aerial trucks are self-propelling; two ordinary trucks in service are drawn by 3 horses, five by 2 horses and one by 1 horse. Aerial trucks Nos. 1, 3 and 5, each carry 75 feet extension ladders, also hand extensions from 40 to 50 feet and wall ladders ranging from 15 to 30 feet. The aerial trucks are equipped with roller bearings and rubber tires. City trucks of "Seagrave" and local make are equipped with hand extensions varying from 40 to 50 feet and wall ladders ranging from 15 to 30 feet. They are all provided with steel tires and hub brakes; two are provided with tiller wheels to enable them to turn into narrow streets. All of these trucks carry a full assortment of minor equipment and usual tools. They are in fair to good condition.

Chemical Apparatus.—(See Table No. 9.) In service, 2; in reserve, 1. All are of the "Seagrave" type; one is drawn by two horses and two by one horse. They are comparatively new, having been built in 1914. One carries two 35-gallon tanks and the other two are each equipped with a single 35-gallon tank; each carries 150 feet of 1½-inch chemical hose. These pieces of apparatus are in good condition and are frequently used.

Combination Hose Wagons and Chemical Engines.—(See Table No. 9.) In service, 2; one, located in No. 1 Station, made by "Seagrave," is propelled by a 6-cylinder, 80 H.P., air-cooled motor. This car is equipped with gas, electric lights and electric syren, and carries the following appliances: 1,000 feet of 2½-inch standard hose (dividing board in centre), two 35-gallon chemical tanks, 250 feet of 1½-inch chemical hose, 12 salvage covers (1,404 sq. feet), 3 playpipes with 1-inch controlling nozzles, two 3-gallon chemical fire extinguishers, one Pyrene fire extinguisher, two

extra charges for chemical tanks, two "Siamese," one life net, one foot roof ladder, one 20-foot splice ladder and minor equipment.

The other combination car, located in No. 3 Station, is of the same make and type as the one located in No. 1 Station, and carries practically the same equipment.

Salvage Wagons.—There is no standard salvage equipment; from 5 to 13 waterproof covers, 12 x 14 feet, are carried on hose wagons and ladder trucks.

Supply Wagons.—**FUEL.**—There is but one one-horse fuel wagon in regular service; 4 additional supply wagons, however, are available when necessary. About 2 tons of best quality steam coal is kept at Stations Nos. 5, 6 and 9 for fire engine purposes. Underground tanks of 350 gallons capacity each, equipped with approved pumps, are installed at Stations Nos. 1 and 3, and are the only means of gasoline supply for motor apparatus.

Officers' Automobiles and Buggies.—Chief, Assistant Chief, District Chiefs and Superintendent of Fire Alarm are each provided with an automobile. The Chief's car is a 7-passenger, 65 H.P. Studebaker; the others are of the two-seated, roadster type, 45 H.P. each and of Dodge and Abbott make. One of the latter is equipped with a 20-gallon chemical tank and 150 feet of 1½-inch chemical hose, and, with the exception of the Chief's car, all carry two 3-gallon chemical fire extinguishers. In the event of any of these cars becoming disabled, 4 one-horse buggies are available.

Horses.—In service, 38; in reserve, 7—suitably distributed throughout each district. They are not taken on approbation by the department, but simply purchased by the Chief and Assistant Chief of the department, if their physical condition is satisfactory to the department veterinary surgeon. All horses appear to be well selected and cared for; none are acceptable if over 5 years of age; horses are only inspected by the veterinary surgeon when called upon by the department officers to do so. Horses are in most cases shod at the nearest shop doing good work, and arrangements provide that preference must be given the department work; spare horses are used while others are being shod.

Harness.—Harness of the modern swinging type is in use, and is in good repair. Two harness makers are employed to make and keep harness in repair. Fourteen sets of double and single harness are kept in reserve in the department store room.

Fire Stations.—All are of solid brick or stone construction. Total 12. The stations are mainly well arranged, roomy, and in good condition. With exception of No. 4 Station, which is very old, all are exceptionally fine structures, with proper accommodation for men, horses and apparatus.

FIRE-FIGHTING FACILITIES. (FIRE DEPARTMENT.)

All stations are lighted by electricity and heated by hot water. Gas stoves are installed in a number of stations to provide a means for the men to cook their meals while on station duty. Stall trips and lighting switches are operated from the patrol desk. No heaters are provided for engines in service. Stable and sanitary arrangements in all of the stations are good.

Hose.—(See Tables Nos. 8 and 9.) All 2½-inch hose is double-jacketed cotton rubber-lined, and is purchased under suitable service guarantees. It is not tested at regular intervals but only when appearances warrant it. During 1919 about 1,000 feet was destroyed at fires and 1,000 feet condemned; the amount condemned indicates that the hose is properly cared for. Drying towers are provided at 6 stations, and hose on wagons if not used is shifted every 15 days. The amount of hose on hand, 25,600 feet, is in good condition. All companies are provided with complete extra shifts and the amount kept in stations permits 2,000 feet for apparatus contained in same. There is no 3-inch hose for general use in the department. A good quality of rubber hose is used for chemicals.

Couplings.—Hose couplings are of the usual screw type, and of the following dimensions:—

CONNECTION.	Nominal Size, Inches.	Outside Diameter, Male Thread, Inches.	Threads, per Inch.
Hose.....	2½	3 3/8	5
Hydrant and Suction Connections.....	4½	4 1/2	5
National Standard.....	{ 2½ 4½	{ 3 1/8 5 1/8	{ 7½ 4

Minor Equipment.—The minor equipment, carried on apparatus is fairly uniform. The three engines carry playpipes with 1-inch to 1½-inch smooth or ring tips. Engines carry a deluge set, with 1 to 2-inch tips on the hose wagon. Each hose wagon and ladder truck carries portable extinguishers, and extra charges are carried for the chemical engines. Each hose wagon carries fire axes, ladder truck branch holders, playpipes, shut-off nozzles, cut-offs, smoke helmets, 100 feet of rope, a number of "Siamese" connections, "Jimmy" bars, lock breakers, lamps, and full equipment of small tools.

Ladder trucks carry axes, life nets, crowbars, wire cutters, salvage covers, rubber gloves, rope, door openers, ball and chain for chimney fires, sledge hammers, plaster hooks, battering rams, roof cutters, revolving nozzles and burst hose jackets. Salvage equipment is carried on hose wagons and trucks.

Repair Shop and Repairs.—A repair shop, situated on Dorchester, near Jacques Cartier Street, is equipped with electric power, two drill-

ing machines, two blacksmith forges, band saw, wood planer, circular saw, woodworking lathe, electric welding machine, portable electric drill, hose expander and a supply of hard tools. With the exception of some machine work, which is entrusted to local shops, new apparatus such as hose wagons and ladder trucks, bench work, general overhauling and painting of apparatus is done in the department shop. A supply of the more important automobile parts, such as gears, driving chains, clutches, roller bearings, etc., is kept in stock. The shop is under the supervision of a foreman whose qualifications, however, do not include a thorough knowledge of machine tools.

The repairs for the year 1917-18 amounted to \$15,507.07, which includes \$6,864.42 for materials and \$8,642.65 for wages; in 1918-19 the amount was \$15,365.06, of which \$6,118.41 was for materials and \$9,246.65 for wages; and in 1919-20 the amount was \$21,267.25, of which \$7,801.15 was for materials and \$13,466.10 for wages. Total for three years \$52,139.38, of which 20,783.98 was for materials and \$31,355.40 for wages.

OPERATION.—Drills and Training.—Members of each platoon are drilled in their respective stations for one hour daily (Sunday excepted), under the supervision of a district Chief. In

engine companies the drill consists of working the engine, drafting, or from a hydrant and throwing water through short lines of hose for 20 or 30 minutes, about four times per annum. Hose on wagons is shifted at least every 15 days, and the use of tools and appliances explained to the men at time of daily drills.

In ladder companies of each platoon, aerial and extension ladders are raised daily and men instructed in the use of all appliances and equipment. Horses are hitched once daily and on all box alarms.

Discipline.—The department is governed by rules adopted by the Fire Committee and general orders issued by the Chief. Charges are preferred in writing and forwarded through the Chief to the Fire Committee; the Chief may suspend a member pending trial. The committee grants a hearing and may suspend, fine, curtail days off or dismiss. The privilege of appeal is not granted. The penalties imposed appear sufficiently severe, and discipline is good. Transfers are also made as a disciplinary measure.

FIRE-FIGHTING FACILITIES. (FIRE DEPARTMENT.)

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Response to Alarms.—The usual response to alarms is shown in Table No. 10, in which the numbers given for second and third alarms include apparatus which has previously responded.

Special signals are used after the first alarm to bring all apparatus responding on both second and third alarms, or to sound a general alarm; these signals are given by the first Chief arriving on the ground, and from the box "pulled," or nearest box to the scene of the fire. Any other method of transmitting an alarm is not recognized by the department.

The Chief or Assistant Chief, together with a District Chief, attends all first alarms in the congested value districts, and second alarms elsewhere.

Automatic alarms are received directly on gongs in three different stations only, in which case one hose wagon, one engine and a truck respond. Fire alarm headquarters are immediately appraised of such an alarm and all stations are notified accordingly. In response to a telephone alarm, apparatus from the nearest fire station is sent; the nearest box is "pulled" if additional assistance is required. On second and subsequent alarms, hose wagons and trucks move into vacant quarters nearest the fire, as directed in the assignment book.

water front; on second alarm engines immediately couple to hydrant; fires are lighted under boilers on leaving quarters. Hose is carried up stairways, ladders and fire escapes where attached to buildings. Roof lines are hoisted by means of a rope. The majority of wagons are designed to lay two lines simultaneously, and this is done when deluge sets are to be used immediately. Ladder companies are expected to ventilate a building on fire and this is usually accomplished promptly. There is no special salvage corps; this work is attended to by members of the fire department who proceed to cover in the first floor below the fire and work downwards. When no openings are already available, holes are cut in the flooring to allow surplus water to run to basement or ground floor. In cases where it is impossible to carry on salvage work, attention is directed to ventilating and laying covers in adjacent buildings.

After fires have been extinguished a number of men are detailed to remove all water, open drains, and, in general, clean up the premises.

Watch lines from hydrants are left at ruins so that companies may return to quarters more promptly. Hose is properly stowed in wagons before leaving and wet hose is shifted immediately on reaching quarters.

TABLE No. 10—USUAL RESPONSE TO ALARMS

DISTRICT.	Alarm.	Hose Wagons.	Ladder Trucks.	Engines.	Chemical Engines.	Fuel Wagon.	Chiefs.
Lower Town, congested value, wholesale storage, warehouse and water front...	1st	4	3	1	2		1
	2nd	8	6	3	3	1	3
	3rd	12	10	3	3	..	4
Upper Town, mercantile and closely built residential.....	1st	4	3	1	1	1	1
	2nd	8	6	2	2	..	3
	3rd	12	10	3	3	..	4
Outlying and sparsely built.....	1st	4	3	1	1	..	1

Fire Methods.—A full record is kept by the department of the manner in which each fire is extinguished. Chemicals are largely used, but a line of 2½-inch hose is always laid to support the chemical streams if required. Hose companies attach a line, with cut-off, to the nearest hydrant. Hand chemical extinguishers and single 2½-inch hose lines with 1-inch to 1½-inch shut-off nozzles are used at ordinary fires. The water pressure throughout "Lower Town" is generally satisfactory for direct hydrant streams, but for other than small fires throughout the greater part of "Upper Town" it is insufficient without the use of engines or the concentration of supplies. Engines on first alarm stand by hydrant on arriving, or if in "Lower Town" take a suitable location on the

The Quebec Public Service Corporation and the Quebec Light, Heat and Power Co. employees assist in removing electric light and power wires, or in cutting off current where necessary.

Communication is established with fire alarm headquarters by the first Chief's driver arriving at the scene of a fire; generally from the nearest fire station, he remaining at the station with the object of notifying the department already engaged as to the scene of other fires or alarms.

Inspection of Hydrants.—The fire department are solely entrusted with the inspection of hydrants; any serious defects are immediately reported to the water department. During cold weather the daily reports of fire department officers

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contain the location of hydrants used the day previous. The thawing of hydrants is accomplished by members of the fire department, one portable steam boiler being provided for the purpose. About 12 hydrants only were found frozen last winter.

The fire department is provided with a plan showing the location of hydrants and sizes of water mains; this plan, however, is of little value, not having been revised since 1909.

Building Inspection.—The building inspection bureau consists of the Chief of the fire department, Fire Marshal, Fire Marshal's secretary and 7 inspectors. All important buildings are inspected and a monthly report submitted to the Chief of the fire department. Records of buildings in general are kept by the Chief. Besides noting the individual features of buildings, the inspectors request occupants to remove rubbish and correct other hazardous conditions. Special attention is given to the enforcement of a by-law pertaining to the cleaning of chimneys, 8 men being employed exclusively for this work. If the owner or occupant of a building fails to comply with the request of an inspector, he is brought before the Recorder's Court and dealt with accordingly. Special attention is given to fire appliances in school houses. Theatres are inspected at regular intervals, but men are not detailed at performances, unless by special request.

Necessary repairs to fire escapes and the placing of new fire escapes are reported to the Chief of the fire department, who, in turn, makes a report on same to the City Engineer.

A special inspection where gasoline and other highly inflammable material is stored is also made.

Veterinary Hospital.—There is no veterinary hospital maintained by the department. All horses are under the general supervision of a veterinary surgeon employed by the city, but who attends to them only on request of the officers of the department. No horse ambulance is owned by the city; the S. P. C. A. ambulance is used when required.

Reports and Records.—Records are kept at each fire station of all events. Captains make daily reports of fires attended, members sick, off duty, or on leave of absence; also concerning horses, hose and feet of ladders in service. Weekly reports are furnished showing condition of engines, number of salvage covers in service and their condition. District Chiefs make a detailed report of every fire attended; suitable printed forms are provided for all routine reports.

Headquarters records include a fairly complete fire record, covering alarms, causes and mode of extinguishing fires, companies responding and insurance statistics, department accounts and full data concerning horses and appliances, and are kept

in good form. The Chief makes a monthly report to the City Council, in summarized and tabulated form, the organization and work performed by the department, statement of expenditures, fire stations, alarms and causes of fires and methods of extinguishing them and usually recommendations which he considers would better the service. Medical officers certify when a man is unfit for service, and again when he is in condition to resume his duties.

CONCLUSIONS.—Recent changes in the supervision of the fire department should materially enhance the efficiency of the force. The appointment and promotion of members, however, without examinations and suitable requirements, are unsatisfactory, and do not make for efficiency. The members of the brigade are affiliated with a local union, known as the "Union Nationale des Employes du Department du Feu." The existence of a union among firemen has been found detrimental to the service in other cities, although, with reference to the Quebec department, it might be stated that up-to-date discipline and the general spirit of the force is good.

The company officers appear capable and are experienced, and the majority of the men appointed are young and well qualified. The strength of companies as organized under the two-platoon system is fairly well maintained, but the average number of men responding on apparatus is inadequate; the permanent details are low in number. The distribution of companies is as good as could be expected with the present amount of apparatus.

Two of the three engines in service are very old; their capacities are deficient and recent and previous tests showed that neither could furnish much more than one good fire stream; all are in only fair condition. A fire boat is required for adequate protection along the waterfront. Other apparatus is mostly of good type and substantially built.

The appropriations for the past few years have been insufficient to provide a department adequate for the city, especially as the values are high and the structural conditions particularly weak in many sections. The manual strength of each platoon or men immediately available for fire duty is somewhat less than under the former single system of organization and does not meet the requirements which are considered necessary. It might be stated, however, that according to fire department regulations, which are posted in each fire station, all men composing the platoon off duty are required to respond to second alarm fires, the method of notification being by general alarm bells, which are located at three widely different points within the city. No man is allowed to reside outside of the city limits.

Hose, while not of approved make, is mainly of good quality, well cared for and properly tested. The supply of 2½-inch is ample, but 3-inch hose is

FIRE-FIGHTING FACILITIES. (FIRE ALARM SYSTEM.)

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not used; the latter size is especially desirable to obtain effective fire streams directly from hydrants and for use at large fires.

Repairs to apparatus and equipment are made at the department repair shop, but, owing to lack of machine tools, are limited to a certain class of work; much in the way of engine and other repairs could be accomplished in a well-appointed department repair shop.

Horses are of good stock and swinging harness is used. There is no department veterinary hospital; horses are cared for when necessary at a privately-owned hospital.

The fire stations are mainly well located, and, with one exception (No. 4), are modern and commodious structures.

The response to alarms is prompt, and, with the exception of too few men responding with apparatus, is well arranged. The amount of apparatus assigned to first and second alarm in the business districts

is as much as is usual in cities of this size, and, except for engines, protects the city fairly well.

Fire methods employed are modern and effective in most particulars.

Streets are generally in fair condition for fast running; grades, however, between "Upper" and "Lower Town," are excessive, and many streets in the business districts are narrow and congested with traffic during the day. Several bridges afford direct routes for companies going to or coming from the south side of the St. Charles River. There are a few railroad crossings at grade where delays may occur.

Inspections made by the Inspection Bureau are of value in reducing the fire hazard, as well as to inform the fire department officers of local conditions useful in fire fighting.

Fairly complete records are kept, but these are not summarized nor included in a published annual report.

FIRE ALARM SYSTEM

ORGANIZATION.—The fire alarm system is under the control of the City Council as a part of the fire department. A superintendent of fire alarm is directly in charge of the system. Pierre Duval was made superintendent in 1915, having been a member of the fire department and a fire alarm telegraph lineman for the previous 35 years. The force includes an assistant superintendent, one line foreman, three fire alarm operators and five linemen. None are appointed under civil service rules.

HEADQUARTERS.—On the upper floor of the city hall, a 4-story and basement, stone building of ordinary construction, occupied by municipal offices, police and fire headquarters, recorder's court, and as a fire station. The exposures are mild, but there is a large amount of interior woodwork. The fire alarm signalling system central office adjoins the battery and motive power rooms, the dividing partitions being of wood. One chemical fire extinguisher is provided for this office. There is a standpipe with hose attached on each floor.

EQUIPMENT.—**Apparatus at Headquarters.**—The original apparatus of "Gamewell" make was installed in 1868, and consists of five box circuits, one joker circuit and six gong circuits. With the exception of changing the box circuit batteries from the gravity type to the storage type, the system is practically the same as when originally installed. Each box circuit terminates in a line relay which controls the single joker circuit running through the city. The local contacts of all five line relays are wired in multiple, with the

coils of a relay which actuates the joker line. This makes all box circuits interfering one with the other in case two or more circuits are operated simultaneously. Each box circuit is provided with test key, tap bell, lightning arrester, and relay type of protector. Joker circuit is provided with one tap bell and lightning arrester. Gong circuits are provided with test key, tap bell and lightning arrester. The switchboard which was originally installed is still in service, although it could be dispensed with in view of the fact that a new storage battery controlling switchboard was installed in 1916. There is one six-circuit Northern Electric storage battery switchboard having capability of charging and discharging storage batteries used in connection with the box circuits.

There is no recording equipment provided to record alarms automatically, therefore, if a mixed alarm was received, the fact, at the discretion of the operator, could either be recorded in writing or kept in obscurity.

There is no standard protector provided, the fuses that are used being placed generally at the back of the operating table in a dangerous position. The system is operated on what is known as slow time, i.e., $1\frac{1}{2}$ seconds between blows which is too slow for a city the size of Quebec.

The gong circuits are controlled by a manual transmitter in duplicate which was purchased from the city of Montreal as a second-hand machine, it having been discarded by that city a number of years ago after having had many years of service. It is manual in operation and requires the constant attention of the operator while alarms are being sent out over the gong circuits.

FIRE-FIGHTING FACILITIES. (FIRE ALARM SYSTEM.)

Apparatus at Fire Stations.—At each fire station there is one 9-inch and one 18-inch gong. 9-inch gongs are connected directly on box circuits; 18-inch gongs are used for transmitting the alarm from fire alarm headquarters; at three fire stations there are sprinkler alarm bells. With reference to the wiring in stations a great variety of sizes have been installed—some carried on knobs and in tubes and some on wooden mouldings. Each station is provided with a telephone in connection with the Bell Telephone Company's system.

Street Alarm Signals.—Five electrically operated street signals are located at street intersections where steep grades are present to warn traffic of approaching fire apparatus. These consist of 10-inch gongs operated on 110 volt lighting circuits and controlled by a switch in Stations Nos. 3, 4 and 7. The switch is closed before the apparatus leaves the stations, and through automatic devices the bells are disconnected after ringing for about three minutes.

BOXES.—General.—Total number, 205. Of this number 55 are on private lines and inaccessible to the public; 190 are of "Gamewell" and 15 of "Lavoie" make—the latter a local manufacturer; the majority of boxes have keys attached under glass guard—15 only are equipped with brass handles instead of keys and in most cases are not protected by glass guards. With the exception of four boxes, which are spring actuated, all are of the interfering weight sector type of an antiquated design. Not only are they interfering one with the other on their respective circuits, but, due to the fact that the circuits are interfering, any two boxes, regardless of their location in the city, or to which circuits they are connected, when pulled simultaneously will interfere one with the other and the alarm will, therefore, be lost.

The original installation was made about 1868 and the majority of boxes installed at that time are still in use. They are said to be painted annually, but at time of inspection a number were inconspicuous. Boxes are tested and circuits examined at least once a month. Those inspected and tested at time of inspection were found to be clean and in good operative condition. They are mainly located at street intersections; a few are attached to buildings, but generally are supported on wooden telephone and lighting poles; no red lights are used to indicate locations. Each box is provided with a shunt, a Morse key and a lightning arrester. Outer cases are not properly grounded. No map showing locations of boxes is on file.

Distribution.—In and immediately around the congested value and manufacturing districts, box distribution is generally good. In closely built-up residential districts distribution is fair, and in outlying districts generally poor.

Circuits.—Five box, six gong and one joker circuit are in use. The box circuits are of the closed type, while the gong and joker circuits are of the open circuit type. The fire department depends upon receiving the first alarm over the joker circuit. This circuit is operated by dry cells and is normally open. After the alarm has been transmitted over the joker circuit, it is again struck at all fire stations over six gong circuits. Both the gong and the joker circuits are operated by the same open circuit battery, which means that in case the battery fails for any reason it would be impossible to send in any alarm whatever from the central office to the fire stations over the fire alarm system. All gong circuits are operated from a common battery and for this reason all gong circuits receive the same voltage, irrespective of their length or resistance. As neither the gong or joker circuits can be tested without actually operating them and striking a blow there is a very great possibility of these circuits being out of commission when an alarm is received.

The total length of circuits is about 183 miles; length of longest about 18 miles. Throughout the entire city wires are all overhead, of No. 8 weatherproof medium drawn copper wire; carried below other wires on telephone and electric light poles; about 5 per cent. are on high tension poles. Leads down poles are No. 14 rubber-covered copper wire in iron pipes for a distance of 5 feet above box. From 32 to 40 boxes are on one circuit. No map is on file showing the running of circuits.

Batteries.—Energy is supplied to the joker and gong circuits by means of a 75 volt dry cell battery. Energy is supplied to the five box circuits by means of storage batteries of the chloride accumulator type, there being a duplicate set of batteries for each box circuit. There are a total of 341 cells in use which were apparently in good condition at the time of inspection. The batteries are mounted on wooden racks with glass and porcelain insulation. They are charged every day by means of a 300 watt motor generator set. There is no spare motor generator set, which could be used as a "stand by" in case of emergency.

Telephone System.—There is only one telephone instrument in fire alarm headquarters, which is used for general routine business. There should be at least two trunk lines provided.

OPERATION.—Routine and Maintenance.—Operators on fire alarm signalling system are on duty in six-hour shifts. The hours of the Superintendent and Assistant Superintendent are the same as the operators, all being required to work a six-hour shift. The line foreman, under the direction of the Superintendent, has charge of all outside work, and, with the linemen, attends to trouble and inspection work. The Superintendent, Assistant Superintendent, two operators and Line

FIRE-FIGHTING FACILITIES. (FIRE DEPARTMENT AUXILIARIES.) QUEBEC, P.Q.

Foreman are provided with telephones in their dwellings. An automobile and horse-drawn repair wagon, the latter kept at No. 4 Fire Station, are available at all times.

Batteries and circuits are tested two or three times daily by the operators, or at any time when trouble develops. Boxes are tested and circuits examined at least once a month. Records of boxes are kept showing location, type, date of installation and dates of inspections. Records of alarms and of all trouble are kept by the operators. No plans or diagrams of circuits are kept on file.

Alarm Transmission.—Four rounds of box signals are automatically transmitted over the joker system to all fire stations, Chiefs' quarters and residences, the Guardian of the Mount Pleasant valves, the Chimney Inspector, and to fire alarm headquarters. From the latter place alarms are duplicated over the gong circuits by a manual transmitter to an 18-inch gong in each fire station, and also to three general alarm bells on the Church of St. John, St. Sauveur and on the City Hall. As previously stated, there is no automatic record of alarms transmitted except that hand-written by the operator on duty.

Telephone alarms are received at fire alarm headquarters, and the operator notifies the companies and chiefs by telephone, giving the alarm first to those companies which are to respond.

A company receiving a verbal alarm responds, notifying the nearest fire station and fire department headquarters by telephone. Alarms during 1919 included 483 box and 305 telephone and still; total 788, of which 76 were false.

IMPROVEMENTS AUTHORIZED.—None.

RECENT IMPROVEMENTS.—Since the inspection of 1914, 15 boxes have been added to the

system, storage battery equipment installed, outside circuits re-wired and interior wiring at headquarters overhauled.

CONCLUSIONS.—The fire alarm system as a whole is unreliable, inefficient and interfering, not only between boxes but between circuits as well. With the exception of the recently installed storage battery equipment, apparatus is of an antiquated type and inadequate for a city of this size. There is no protection provided against high tension and lightning. There are no records of alarms recorded automatically. The department relies upon either the joker circuit or the gong circuits for receiving alarms from headquarters, therefore, should any accident occur to the battery which operates both these circuits it would be impossible to transmit such alarms to any station. Boxes are all of the unsatisfactory interfering type. Those tested appeared to be in good condition, but a number are inconspicuous and no red lights are used to indicate locations; the general use of red for letter boxes detracts from the conspicuousness of fire alarm boxes.

Distribution of boxes in important districts is mainly good, elsewhere fair to poor. Wiring in fire stations is not properly installed. Batteries are of satisfactory type and are properly mounted. Box tests are made at proper intervals and records are kept of box tests and all troubles.

Overhead wiring is very objectionable, particularly in the thickly settled portions of the city.

The present method of transmitting alarms, while unsatisfactory, is as good as the inadequate equipment will permit.

Fire alarm headquarters is hazardously located in a building of ordinary construction, containing numerous fire hazards, and is without adequate protection.

FIRE DEPARTMENT AUXILIARIES

FIRE MARSHAL.—The Fire Marshal is appointed by the Provincial Government, the City of Quebec being responsible for the payment of his salary and expenses. The present Fire Marshal, Mr. Eug. Leclerc, was appointed in April 1917, and since May 1920 has been provided with an assistant. The Marshal is given proper powers to investigate all fires and direct prosecutions. During the past three years there have been 17 fires reported to be of incendiary origin, but no arrests.

POLICE DEPARTMENT.—Chief, Emil Trudel; total active membership, including 6 detectives, 128.

Equipment.—A patrol wagon is stationed at No. 2 Police Station, St. Patrick Street. No signalling system is maintained. Patrolmen report to sergeants on their beats, every two hours.

Fire Service.—Alarms are received on a tapper in Stations Nos. 2 and 3; the men assigned to No. 1 Station in the City Hall depend on the tower bell on that building. The men on adjoining beats respond to box alarms and establish fire lines if necessary; co-operation with the fire department is good. The police notify the Building Inspector of dangerous buildings and report on building operations.

BUILDING DEPARTMENT.

TELEPHONE SERVICE.—The Bell Telephone Company serves about 11,115 subscribers on 7,817 lines, through one exchange. The exchange is located on St. John Street in the principal mercantile district of "Upper Town," in a 5-story building; walls brick and stone, joisted, with auxiliary steel columns and beams covered with plaster on metal lath; vertical openings enclosed in plaster on metal lath with self-closing wooden doors. On the second floor and two sides of the third, horizontal openings are protected by wired glass in metal frames; the remainder are unprotected. The building, which is detached, is protected by a water curtain on three sides. Standpipe and hose is provided for each floor, and water pails, asbestos smothering cloths and fire axes are distributed throughout. A push-button alarm (in Board Room) on third floor is said to call 7 men who are constantly available. A weekly inspection of the building and fire appliances is made by the Superintendent. An auxiliary water supply for water curtains and standpipe is available from a storage tank of 17,000 gallons capacity, and is located on the roof; no pump. Municipal fire alarm box inside of building on the ground floor. Building occupied exclusively as telephone exchange with cafeteria for employees.

The main lines of the Bell Telephone Company, operating within Quebec City limits, are installed underground in tiled conduits. They consist of 230,293 feet of cable, each cable consisting of from 100 to 1,800 wires. The only pole lines in use are for distribution purposes, in sections where underground cable rise to junction boxes. In general, the construction is standard.

During 1919, 305 alarms, or about 38 per cent. of the total, were received by the telephone.

PRIVATE FIRE PROTECTION.—33 establishments, some of which include a group of several

buildings, are equipped with automatic sprinklers. 97 have inside standpipes with 50 to 300 feet of hose on each floor. These are supplied from the city water mains; a few have auxiliary tanks and 9 have private fire pumps; none have outside steamer connection. 70 per cent. of the most important and 10 per cent. of the minor institutions and industrial buildings have chemical extinguishers, or casks and pails. 20 large establishments employ night watchmen with stations and clocks.

PUBLIC SERVICE CORPORATIONS.—The Quebec Railway, Light, Heat and Power Company receives all box alarms on a gong in their power station, and with a patrol wagon attend all fires. The Gas Company have no patrol and do not attend fires unless called upon, in which case they send some men to turn off gas. The Quebec Public Service Corporation are not provided with a gong, but, it is said, attend all large fires and look after the company's interests.

AUXILIARY ALARM SERVICE.—From 20 sprinklered risks electric circuits are run to Fire Stations Nos. 1, 3 and 5. All circuits are of the open type; 11 are in connection with No. 3, 7 with No. 5, and 2 with No. 1 Station. Bells in service are of the ordinary iron box vibrating type, varying in size from 3 to 10 inches; rung automatically in the event of the sprinkler system becoming operative; energy is procured from a battery of dry cells.

OUTSIDE AID.—The City of Levis, across the St. Lawrence River, has a Patterson engine, which would respond on request, also some aid could be obtained in case of emergency in about 2 hours from the City of Three Rivers; hose couplings are not interchangeable, a few adapters, however, being provided.

STRUCTURAL CONDITIONS AND HAZARDS

BUILDING DEPARTMENT.

ORGANIZATION.—Supervision.—The City Charter creates the office of Building Inspector; appointment is made by the City Council on nomination of the Public Works Committee.

Jurisdiction.—It is a branch of the City Engineer's Department, and is controlled by that office.

Personnel.—The staff consists of a Chief Inspector, Mr. J. L. Pinsonneault, and one Assistant Inspector, Mr. A. D. Trudel; both are qualified Architects.

Quarters.—Inspector's office is in the City Hall; a building of ordinary stone-joisted construction. Records are stored in wooden filing cabinets.

Permits.—A permit must be obtained before the erection, alteration or addition to any building may be commenced. Applications for permits must be made on forms provided for the purpose, giving the nature, extent and particulars of construction of the buildings to be erected or modified. They must be signed by the owner or his representative and accompanied by plans and specifications. Deviation from the plans submitted cannot be made without permission of the Chief Inspector.

Inspections.—The Chief Inspector's time is devoted principally to the office, the Assistant Inspector to outside work. Buildings are inspected during construction or alteration as opportunity permits, there being no special time for "follow-up." The police report any work observed under construction. An allowance of \$7.50 per week is made for Inspector's transportation.

BUILDING LAWS.—The present building laws were adopted in January, 1918, and slight amendments made thereto in May, 1918. Construction is classified as follows:—

1ST CLASS.—Entirely of incombustible material, with exception of doors, windows and top flooring.

2ND CLASS.—With all walls of brick or stone, or other materials offering the same guarantee of solidity; this is interpreted to include cast concrete, solid and hollow concrete blocks, etc.

3RD CLASS.—With walls of 3-inch deals solidly bount together and veneered in not less than 4 inches of brick or 6 inches of stone, or clad in asbestos shingles, asbestos board, asbestos cement materials or cement plaster, providing the walls adjoining another property are covered with not less than 4 inches of brick, not over 3 stories or 37 feet above sidewalk level.

Sheds and Stables.—Fuel sheds and private stables may be light frame, clad in metal laid on asbestos paper, or clad in other materials as designated in Class 3. If they adjoin an inhabited building, the side adjoining must be covered in 4 inches of brick. Height is limited to 18 feet. This class of construction is also permitted for storage sheds built on the wharves.

Warehouses, Garages, etc.—Warehouses, garages, manufactories, workshops, if over 1,500 feet ground area, must not be inferior to 2nd Class. Heating is confined to steam or hot water; boilers to be in brick room, ceiling of which is to be of cement plaster. If less than 1,500 feet ground area they may be built of wood, covered in incombustible materials and without heating restrictions. Incombustible material is interpreted to include all wall coverings named in Class 3, but not to include metal cladings.

Private Garages may be metal or steel skeleton.

Frame Buildings.—All to be clad as mentioned in foregoing paragraphs. Metal wall covering is not permitted on a street front, nor on any building inside the old city walls in "Upper Town," or between St. Roch Street and Champlain Market Place in "Lower Town." Asbestos or cement cladding as mentioned in Class 3 is allowed.

Floor Areas.—No restriction, except as mentioned for warehouses, etc.

Height.—No restriction, except as mentioned in Class 3, and for sheds.

Wall Thickness.—Minimum thickness of brick walls is 8 inches, and that for the upper storey in 2 and 3 story buildings only; for buildings exceeding 3 stories in height the minimum required is 12 inches. The by-law gives a scale for cement blocks, solid or hollow, by which 10-inch blocks are rated to equal 12 inches of brick and graduated to 24-inch blocks as equal to 32 inches of brick. Hollow blocks in party walls must be filled with cement.

Roofs.—Roofs must be covered with metal, asbestos cement shingles, composition and gravel, or any other material approved by the Underwriters' Association.

Cornices.—Must be of incombustible material, and brick walls behind must extend up to roof boards.

Parapets.—All party walls must extend 12 inches above roof.

Wall and Floor Openings.—There are no specified requirements for the protection of windows, horizontal or vertical openings in any class of construction.

Chimneys.—By-law permits brick, stone or other incombustible materials and is interpreted to include cement blocks, concrete, etc.; stone chimneys must be well lined; flue dimensions and heights are mentioned. Chimneys must not be built on wooden supports.

Fire Walls.—If two or more buildings are constructed in a row and occupied as lodgings, 3rd Class construction, a brick or concrete wall of at least 8 inches in thickness is required between lodgings, and this wall must extend 12 inches above the roof to form a parapet.

Deadening.—It is prohibited to use sawdust or wood refuse between floors or in roof spaces.

Fire Resistive Buildings.—Theatres and moving picture houses must be of 1st Class construction.

2nd Class Buildings.—Assembly or concert halls, schools with accommodation for over 75 pupils, convents and boarding schools are required to be of the 1st or 2nd Class.

Private Protection.—All public buildings are required to provide, on each floor above the basement, water pails, portable extinguishers or stand-pipes, subject to the approval of the Building Inspector.

Fire Escapes.—By-law provides that every inhabited building more than one story high, shall have on the side fronting on the yard, exits and stairs (not circular stairs), starting from the uppermost story leading to the ground. Where it is impossible to build such exits and stairs at the back of the building, they shall be built on the street front and in this case must be of iron.

EXPLOSIVES AND INFLAMMABLES.

Fire Limits.—There is no particular section of the city in which construction is restricted in the sense of a fire limit, but it is restricted to 1st and 2nd Class, when buildings front on the following named main thoroughfares: Port Dauphine, Buade, Fabrique, St. John up to De Salaberry, St. Louis, Grand Allee up to De Salaberry, Dalhousie, St. Peter, St. Paul, St. Joseph, St. Valier up to Scotts Bridge Road, Bridge, Crown, Henderson, St.

Nicholas, St. Roch, Mountain Hill and the South of St. Andrew Street. It is prohibited to increase the height of 3rd Class buildings now standing on these streets.

Penalties.—Suitable penalties are provided for violation of the law.

Enforcement.—Fair.

EXPLOSIVES AND INFLAMMABLES

ORGANIZATION.—Supervision.—Ordinances concerning explosives and inflammables are included in the building by-laws.

Permits.—The City Engineer and Building Inspector control the issue of permits.

Inspections.—The Building Inspectors visit all premises for which permits are requested. Officers of the fire department are authorized to inspect and report infractions to the Recorder's Court.

LAWS AND REGULATIONS.—Buildings used for the storage or sale of straw, hay, flax, inflammable liquids or other highly combustible substances, must not be occupied in any part as a dwelling. Automobile warehouses or workshops in which gasoline is kept must not be occupied in their upper stories by lodgings or public halls; chauffeurs' rooms are permitted.

The storage of gasoline or kindred fluids is permitted only in underground tanks as approved by the City Engineer, and must be handled by pumps of an approved model. When automobile tanks are to be filled or emptied it is prohibited to use cans exceeding 5 gallons capacity, or open vessels; lights on cars must be extinguished and no open fire within 50 feet; permits for the storage or sale of gasoline must be renewed yearly.

A permit must be obtained from the City Engineer for the storage of coal oil or petroleum in excess of 5 barrels.

A permit is required for the storage, sale or manufacture of fireworks, or the setting off of same in a public place; they may be set off on a private property, hut not within 40 feet of any building.

Woodworking establishments are required to remove refuse every two days. Stoves in such establishments must be encircled in fireproof materials. It is prohibited to place ashes on a wooden floor or in proximity to any woodwork, or in a wooden receptacle.

LOCAL CONDITIONS.—A laboratory for explosives is maintained by the Federal Government. It is situated within the city limits in an open field about 300 yards distant from buildings on one side, the three other sides being clear.

The manufacture of small arm ammunition is conducted in a large government plant and which is located in a built-up section of the city.

Sporting goods stores keep gunpowder in small quantities and fixed ammunition in fairly large quantities. Calcium carbide in sealed containers is kept in the outbuildings of two concerns. Five wholesale or manufacturing drug houses keep alcohol in quantities—usually in steel containers, also quantities of various volatile and combustible liquids, acids and salts. There are four fairly large dry cleaning plants using considerable quantities of gasoline and several using small quantities. Printers and tailors keep small quantities of gasoline, usually in safety cans. Plumbing shops also keep from 1 to 5 gallons of gasoline. Hardware stores generally keep oils in quantities up to 600 gallons; some provided with stone vaults or approved tanks, others with ordinary barrels on the surface without precaution against leakage. Varnish is usually kept in sealed tins.

There are two large oil and gasoline distributing firms with tanks and warehouses. A row of frame buildings is exposed by one of these establishments at a distance of 50 feet, and one is but 125 feet distant from a series of large heavily stocked frame warehouses. Grocers keep from 1 to 5 barrels of kerosene. Of the many garages and auto repair shops, one only is of fire resistive construction; many are of poor frame construction and in built-up districts. Underground storage tanks are general; the majority have pumps and filling pipe inside the building, outside pumps not being permitted by the city authorities. Heating plants are cut off in a few only; many are heated by stoves. Boot and shoe factories and tire vulcanizing shops use rubber cement, which, in some cases, is kept in standard containers; others keep and use it from ordinary tins and in close proximity to open flame. Tanneries keep from 5 to 50 gallons of acids in carboys. There are no film exchanges in the city. Of the 8 moving picture theatres, 5 have approved booths; the condition of the other three is unknown, the management having refused to permit an inspection of same; seven are in brick-joisted buildings and one brick-veneered. Wholesale grocers stock matches in carload lots. Among the hay and straw warehouses several are heated by

stoves. Planing mills burning wood refuse are found with wood-shaving bins near boilers and not protected by steam jets. Smoke stacks on several are not provided with spark arresters. Many small woodworking and joiners' shops are heated by stoves which are unprotected, and large accumulations of shavings are the rule. Accumulations of ashes and garbage in cellars are frequent, particularly in dwellings, as there is no scavenging service; the practice is to clean out cellars in the spring of the year. Dynamite is used frequently

for blasting, the ground, particularly in "Upper Town," being of rock formation.

CONCLUSIONS.—The regulations affecting hazardous materials are few and fail to cover the subject. Occasional inspections made by the officers of the fire department have some value in disclosing the location of hazardous materials, but do not accomplish the results obtainable by a systematic method of inspection accompanied by suitable laws.

ELECTRICITY

ORGANIZATION AND CONTROL.—The city of Quebec does not maintain a bureau for the inspection of electric wiring. About three years ago a law was passed in Parliament requiring all those undertaking the installation of electrical work to be examined and to procure a certificate as to their ability. This law will come into force in May, 1921. The inspection of electric wiring and equipment is taken care of by the Canadian Underwriters' Electrical Inspection Bureau, Limited, the different lighting companies having an agreement between themselves and the Bureau not to make connections until the work has been passed by the said Bureau.

REGULATIONS.—The regulations of the National Electric Code are enforced, with a few changes to meet local conditions, such as requiring service entrance to be in rigid iron conduit and wiring for motors operating at a potential between 400 and 600 volts to be in iron conduit.

INSIDE WORK.—The general voltage used for lighting is 110, and for power 550 volts, 2 and 3 phase. Elevator motors in large buildings usually are operated at 220 D.C.

LIGHTING COMPANIES.—There are two companies supplying current, viz., the Quebec Railway, Light and Power Company and the Quebec Public Service Corporation.

OUTSIDE WORK.—The outside wiring in city and district is on pole lines of standard construction. The high voltage lines from outlying plants are carried to the city on steel towers. The outside wiring was in a hazardous condition some few years ago. The Electrical Inspection Bureau took the matter up with the Public Utility Commission, the latter summoning both the Quebec Railway, Light and Power Company and the Dorchester Company (now the Public Service Corporation) before them. A large number of photographs showing the locations where defective outside wiring existed were exhibited. The Public Utilities Commission issued an order to both lighting companies, compelling them to put their

lines in order. These defects were rectified and conditions are good at the present time.

During the year 1912 and previous years a number of electric fires were caused by defective outside wiring, which was the chief reason for calling the lighting companies before the Public Utilities Commission. One fire in particular occurred in December, 1912, during a heavy rain and sleet storm; the primary wires of the Quebec Railway, Light and Power Company bore down on the secondary wires of the same company, which was presumed to have been caused by branches falling on primary wires, as lines passed through trees at this location. The interested insurance companies took action against the lighting company to recover losses. The case was appealed, and was finally brought before the Privy Council, when judgment was rendered in favor of the insurance companies, the lighting companies being obliged to pay all the losses.

STREET LIGHTING.—The city street lighting consists of 621 series arc lamps, 211, 50 c.p. incandescence series lamps on same circuit as arc lamp. These lamps remain burning all night. The wiring for same is carried on pole lines. The lighting of the main streets consists of 664 ornamental poles of 5 lights each, having one 80 watt and four 40 watt lamps. The 5 lights are left burning until midnight, and after that hour the four 40 watt lamps are switched off.

ELECTROLYSIS.—From information gathered from the lighting companies and city waterworks department, it is stated that no trouble from electrolytic action has ever been brought to their attention.

CONCLUSIONS.—Inside electric wiring and equipment (new work) are well installed and taken care of. Defect inspections are now being made in dwellings, many of which are found to be wired with flexible cord. In many cases the proprietors, as soon as defects are brought to their attention, have them rectified. Outside line work is, in general, in good condition.

LOCAL CONDITIONS AND CONFLAGRATION HAZARDS

Construction encompassed by the old city walls in "Upper Town" is almost exclusively stone or brick. Heights range from $1\frac{1}{2}$ to 5 stories, the greater number being $3\frac{1}{2}$. There are four fireproof and two sprinklered buildings, one fireproof section of an hotel being 1 to 2 stories in height. Some of the sheds and outbuildings are of frame construction.

Outside the city walls in "Upper Town," about 50 per cent. of the total construction is stone or brick-joisted, the remainder being about equally divided between brick-veneered and frame; there are three fireproof and one sprinklered building. Heights range from $1\frac{1}{2}$ to 5 stories, with a few only up to 6, the greater number being $2\frac{1}{2}$ to 3. About 80 per cent. of all buildings in "Upper Town" are residential. The main street in this section runs East and West through the centre and is principally occupied by retail stores. There are a number of religious, scholastic, government and municipal buildings. Surrounding the district just referred to, also along the cliff above the St. Lawrence River and in Belvedere Ward to the West, construction is mostly detached, otherwise it is closely built up. North of the main street (St. John) to the cliff overlooking "Lower Town," the construction is, generally, inferior. The greater part of the frame and veneered buildings are in this section, among which are to be found several manufactories and wood planing mills. In the principal office and wholesale district situated in "Lower Town" on the St. Lawrence River front, and extending West to St. Roch Street on the St. Charles River front, construction is principally stone or brick-joisted, with the exception of the East side of Dalhousie Street, the North side of St. Andrew Street, and on the wharves, where it is principally frame; heights range from 3 to 5 stories. There are 12 fireproof and 4 sprinklered buildings; fireproof buildings are from 4 to 9 stories in height; this section is closely built upon. West of St. Roch Street, bounded North by the cliff, South by the St. Charles River and West by Boulevard Langelier, is situated the principal manufacturing and retail district. This is also the marked congested and conflagration area. The large stores and factories are principally brick-joisted; the total construction in this section consists of about 40 per cent. brick or stone and 60 per cent. frame. Heights range from $1\frac{1}{2}$ to 6 stories; 15 to 20 buildings are sprinklered and there are 3 fireproof buildings. Large planing mills, lumber yards and several large garages are situated in this section. From Boulevard Langelier West to the city limits the construction is almost entirely frame, with some few brick-joisted or veneered buildings scattered throughout. It is closely built up, except on the outskirts and is mostly residential. There are a number of retail stores,

particularly on St. Valier Street, a few important mercantile buildings, heavily stocked warehouses and several manufactories near the western limits along the railway tracks. There are two oil distributing firms with tanks and warehouses, one of which is within 50 feet of a row of frame dwellings, and one less than 200 feet distant from large frame warehouses. Large steel working and railway shops are situated at the western limits. Two manufactories are sprinklered and there are two fireproof buildings 2 and 3 stories in height; in general, heights range from $1\frac{1}{2}$ to 3 stories, the greater number of buildings not exceeding 2 stories.

North of the St. Charles River (former municipalities of Hedleyville and Stadacona) the construction is largely frame, with some brick or brick-veneered buildings. A number of blocks are closely built up, but construction in general is spread over a considerable area, also, with Hedleyville and Stadacona separated by some distance. There are a number of small retail stores situated principally in one block on Canadiere Road, also a few manufactories, lumber yards, planing mills and railway shops. The exhibition grounds are situated at the Northern limits and are used during the summer months as an amusement park. There are two fireproof buildings in this section, one of which is situated on the exhibition grounds; heights range from $1\frac{1}{2}$ to 3 stories.

Throughout the city fireproof buildings are of reinforced concrete or protected steel frame construction. Interior wood trim and exterior wood roofs communicating with the interior are weakening features in nearly all. Seven are office buildings; included among the others is a grain elevator, hotel, apartment house, 2 churches, 2 educational institutions, 1 cold storage plant, 1 four-story garage, 1 public power plant, 1 wholesale hardware house, a railway station and sheds and several government buildings; heights range from 2 to 12 stories. The area of one building exceeds 50,000 square feet and two exceed 20,000 square feet, others range from 1,200 to 12,000 square feet.

Protection to vertical openings is mainly lacking, protection to horizontal openings between sections is generally poor, also windows and doors in exterior walls are mostly unprotected; most of the buildings are equipped with either standpipe and hose or chemical extinguishers, or both.

There are 33 sprinklered properties in the city, also two partial equipments and two equipments out of service. These sprinklered properties are mainly located in "Lower Town," and for the most part are scattered.

An additional weakness is that less than 40 per cent. have a secondary water supply in the shape of a tank or fire pump, so that any breakdown in the city pressure, as reported elsewhere, effects the reliability of the equipment. The

alarm service in a great percentage is also poor, being simply connections to fire stations and without proper devices to indicate the building from which the alarm is received.

The only close groupings of the sprinklered properties are in the district bounded by Charest, Dorchester, Arago, Belleau, St. Colomb, Turgeon, and St. Crepin Streets, Sheet 20 and 21, Block 201-203-213-215-217-219 U. S. B. plan, where there are 10 sprinklered properties covering 35 to 40 per cent. of the total area of these blocks. Only 5 of them have a secondary water supply. Also in the block St. Joseph, Church, Des Fosses and La Libertie Streets, Sheet 22, Block 226 227, about 75 per cent. is protected by automatic sprinklers due to a large departmental store and two other sprinklered premises. The equipment in the departmental store has a secondary supply, but the system is not a modern one.

There are approximately 4,300 buildings of brick or stone-joisted construction. Areas, generally, are small to moderate, 135 exceed 5,000 square feet of which 32 exceed 10,000 square feet. Frame buildings number from between 8,000 to 9,000; the majority are small in area, but 25 exceed 5,000 square feet and 11 exceed 10,000 square feet, 5 exceed 15,000 square feet, 3 exceed 20,000 square feet and one on the Exhibition Grounds exceeds 60,000 square feet. These areas are exclusive of large railway freight sheds and the landing sheds on the wharves. Heights are mostly 1 to 2 stories, some are 3 and a few up to 5 and 6 stories.

In all classes of construction roof coverings are generally good; metal predominates; wooden shingles are found only on a few old buildings. Peak and mansard roofs with dormer windows are common throughout the city. Sawdust in roof spaces is found only in a comparatively few cases. There are many chimneys on wooden supports, and some constructed of cement blocks. Vertical openings are mainly unprotected, and in a few buildings only are well protected. About one third of all skylights are protected by wired glass or external screens; the remainder are, principally, ordinary glass in wooden frames. Window protection is practically unknown. Wall thicknesses in brick and stone buildings are generally good, but walls of hollow cement blocks are frequent in buildings constructed in recent years. Parapets are fairly frequent.

While the larger or most important buildings are heated by hot water systems, stove heat is general, and the Quebec heater (a sheet or cast iron cylinder stove without legs or grate) is extensively used.

There being no municipal scavenging system, accumulation of ashes and rubbish in cellars is common—particularly in dwellings; the general custom is to clean out cellars in the spring of the year after the snow has left the ground. The C. F. U. A. has now inaugurated in Quebec City a "Clean-up and Defects" Dept., similar to that in existence in Montreal for many years. (For report, see Annual Minutes.)

CONCLUSIONS.—The present municipal laws lack most of the essential features of a modern building code, fire limits are not established, and, while in certain sections, particularly within the old city walls where construction is almost exclusively stone or brick, inferior buildings are permitted and within recent years several have been erected and occupied as garages, planing mills, etc.

The fact that on certain principal streets construction is restricted to buildings of the 1st and 2nd Class is of little or no value as the remainder of the block and neighbouring blocks are generally of inferior construction. Heights, areas, floor openings or exposed windows are given little or no consideration. Inspectors appear to be capable, but are too few in number. While the laws are fairly well enforced, some construction was noted, which is either in contravention or due to a very broad interpretation of the law. For example: The erection of an additional story of wood to a large public building of brick-joisted construction was noticed under way, and this on one of the streets where construction is restricted to the 1st or 2nd Class, and addition to height of wooden buildings is prohibited. Due to narrow streets, congestion and unprotected wall openings, the conflagration hazard is marked in that part of "Lower Town," known as St. Roch, serious in St. Sauveur, and in the northern section of "Upper Town," outside of the city walls. In the office and wholesale district and within the city walls, construction is somewhat better, although, in this part, narrow streets, unprotected openings and congestion also prevail. The contour of the city and its high dividing cliff makes the likelihood of a general conflagration remote; nevertheless, at points where buildings are close under and over the cliff moderate winds would carry flying brands over this barrier.

RECOMMENDATIONS

WATER SUPPLY.

Records.

1. That a Venturi meter be installed in the 18-inch, 30-inch and 40-inch supply pipes at Chateau d'Eau, in order to determine the city's consumption of water and that accurate records of the flow in the supply pipes be kept.

2. That an automatic water pressure recording gauge be installed in each fire station, and records from same filed for future reference.

3. That an up-to-date plan of the distribution system be maintained in each fire station; this plan to show sizes of all mains and locations of all hydrants.

Supply Lines.

4. That the reliability of supply be assured by making a comprehensive study of conditions pertaining to the installation of the 30-inch and 40-inch supply mains; this to include, particularly, an examination of the foundations on which the mains are laid, also the number and location of air valves and their condition as to reliability of operation.

In the event of it having been determined that an unsatisfactory condition of the foundations is responsible for the frequent breaks just northwest of the St. Charles River, I would suggest for consideration that the work of paralleling the unreliable portion and making provision for the ultimate extension of at least the 40-inch line be commenced and completed at the earliest possible date.

5. That the number of gate valves on the 40-inch pipe line be increased by placing one additional at Aqueduct Hill, also that cross connections with suitable valves be placed on the supply mains at intervals of about $1\frac{1}{2}$ miles.

Pumping Station.

6. That the erection of a fireproof pumping station equipped with electrically driven centrifugal pumps to provide satisfactory pressures for effective direct hydrant streams at the higher levels of the city be included in studies of the water supply system.

Consumption.

7. That a leakage survey of the distribution system and a thorough inspection of plumbing fixtures be made immediately, and that every effort be made to reduce leakage and waste so that the consumption rate may be materially reduced.

8. That the city adopt the policy of metering all new services and ten per cent. annually of those now used, so that at the end of ten years all services will be metered.

Mains.

9. That the distribution system in the principal congested value and mercantile districts of "Lower Town" be strengthened by laying a 12-inch line along St. Peter and Du Fort Streets, connecting with the 12-inch on St. Andre and Little Champlain Streets, also by extending the 12-inch along St. Joseph Street to connect with the 12-inch on Boulevard Langelier.

10. That the reliability of the system be improved by testing all mains in the trench before back-filling to a hydrostatic pressure of 125 pounds.

11. That the following be adopted as the standard minimum size of mains used for hydrant supply:

(a) For residential districts 6 and 8-inch; the former to be used only where they complete a good gridiron, and the latter in locations where dead ends and an incomplete gridiron are likely to exist for some time, and in any case where blocks exceed 600 feet in length.

(b) For manufacturing and mercantile districts 8 and 12-inch, the former to be used only in sections where they complete the gridiron.

12. That 4-inch mains in the distribution system which furnish hydrant supply or form a part of the gridiron be replaced within 5 years.

13. That dead ends be eliminated wherever practicable and long, unsupported lines of pipe be cross-connected so that each of the hydrants about any block will furnish ample engine supply.

14. That an electrolytic survey be made and remedial measures in accordance with the best waterworks practice be adopted.

Note.—The Canadian Fire Underwriters' Association believes that it is essentially the business of each municipality to lay out its system of distributing mains, as it is best able to judge of present and future consumption in each district, and of other local conditions involving paving, topography, pressures, size and type of hydrants, etc.; but practical experience has shown that for good fire protection in districts such as are found in this city, a gridiron system of mains of the sizes recommended above is satisfactory only when cross-connected at all intersections, free from dead ends and with secondary cross-feeder mains at frequent intervals.

Gate Valves.

15. That additional gates be set so that no single case of accident, breakage or repairs to the pipe system in important mercantile and manufacturing districts will necessitate shutting from service a length of main greater than 500 feet, and in other districts lengths greater than 800 feet.

16. That all valves except those along service limits be kept open during the normal operation of the system.

17. That an inspection be made annually of all gate valves and that records be kept of operation and inspection.

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Hydrants.

18. That additional hydrants be set in the immediate vicinity of the Seminary of Quebec, also, that additional 3 and 4-way hydrants (replacing those with two 2½-inch outlets and 4½-inch barrels) be set in and about the congested value districts; the intervals between adjacent hydrants should not exceed 250 feet in the vicinity of important buildings, mercantile or manufacturing sections, nor 500 feet in residential sections.

19. That the use of hydrants be restricted to fire department purposes and the flushing of mains.

20. That the inspection of the hydrants be placed solely in charge of the water department, who shall assign a sufficient corps of employees to inspect hydrants at regular intervals, particular attention being given to their condition during winter months.

21. That the threads of outlets on hydrants conform to the Standard of the National Board of Fire Underwriters, which is as follows:—

Nominal Size of Connection, Inches.	Outside Diameter of Male Thread, Inches.	Threads, per Inch.
2½	3½	7½
4½	5½	4

FIRE DEPARTMENT.

Organization.

22. That the strength of the fire department be increased, by providing additional members for each platoon, so that the number of men assigned to the various pieces of apparatus will be as follows:—

(a) In the congested value, mercantile, manufacturing and warehouse districts, 5 men in each hose wagon company, 3 men in each engine company and 6 men in each ladder company.

(b) In outlying and sparsely built districts, 4 men in each hose wagon company and 5 men in each ladder company.

23. That all members be appointed for indefinite terms under civil service, with removal only for cause; the examinations for the different grades to be separate and in case of engineers and assistant engineers of steamers and chauffeurs to consist of a thorough examination of their ability in the maintenance and operation of their apparatus. The Chief to be the judge of efficiency during a reasonable probationary period; eligible candidates to be considered as substitutes subject to the call of the Chief.

Companies and Apparatus.

24. That more adequate protection be provided along the water front by installing a fire boat.

25. That a Salvage Corps consisting of at least five men on each platoon be organized and provided with a motor propelled wagon carrying 60—12 x 14 feet and 12—20 x 20 feet waterproof covers, 4—three gallon chemical fire extinguishers, brooms, buckets, sponges, smoke helmets, life guns and full minor equipment appertaining to salvage work. For reserve purposes a total of 150 covers should be provided including those carried on the wagon.

26. That the department repair shop be provided with machine tools and other appliances which would enable all department repair work and testing to be done; the shop to be in charge of a master mechanic skilled in engine and automobile work.

27. That at least one plain hose wagon, carrying 1,000 feet of 3-inch hose and equipped with a turret pipe, be stationed in the congested and principal manufacturing sections of "Lower Town."

28. That the Shand and Mason and Clapp and Jones engines, each of which are very old and of inadequate capacity, be replaced at an early date by two first size combination automobile pumping engines.

Note.—Specifications for automobile pumping engines to require pumps to deliver at least 700 gallons per minute at 120 pounds net water pressure, 50 per cent. of rated capacity at 200 pounds net pressure and 33 per cent. at 250 pounds pressure.

Automobile hose wagons to have divided hose body with a capacity of at least 1000 feet of hose when carrying equal amounts of 2½- and 3-inch hose. To be capable of attaining a speed of 30 miles an hour and of covering 20 miles in an hour over paved or macadamized streets having such grades as the apparatus is likely to encounter in service.

Hose Wagons and Hose.

29. That all one-horse hose wagons now in service be replaced by standard hose wagons, each drawn by two horses carrying about equal amounts of 2½ and 3-inch hose, with a total of at least 1,000 feet, and that all 2½ and 3-inch hose be fitted with 2½-inch couplings, sleeves on 3-inch couplings to be properly bevelled; all hose to be tested yearly with a static water pressure of 200 pounds per square inch.

Minor Equipment.

30. That at least one hose wagon in each district be equipped with a turret nozzle, and that all apparatus running on paved streets be equipped with rubber tires.

31. That portable searchlights of at least 1,500 candle power each be procured to enable firemen to work more advantageously at fires, also that oxy-acetylene equipment for cutting iron bars be provided.

Operation.

32. That a drill tower and school be established, where members of the department, especially probationers, shall be trained in the use of all

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appliances and tools, including "Pompier" ladders, quick handling of hose and in life saving, these drills to be in charge of a competent instructor, who shall be sent to one or more cities which maintain drill schools, to obtain experience in modern fire methods.

33. That engines be tested annually, and after any extensive repairs, following methods published by the National Board of Fire Underwriters; pumps showing more than 7 per cent. slip, or delivering less than 90 per cent. of their rated capacities should be overhauled or their crews drilled, or both. Attention is called to the fact that none of the engines in service meet these requirements.

34. That company officers inspect all manufacturing, mercantile and storage buildings in their running districts quarterly, to familiarize themselves with local conditions.

FIRE ALARM SYSTEM.

Headquarters.

35. That fire alarm headquarters be removed to a fireproof building, especially constructed to reduce as far as possible all liabilities to interruption of service. In the new location all apparatus to be placed on incombustible mountings, and no unnecessary combustibles to be permitted in the fire alarm rooms. Until this is done every effort should be made to safeguard the present quarters by placing an adequate number of chemical extinguishers throughout the building, providing an approved system of automatic sprinklers in that portion of the building occupied as a stable and storeroom and sand pails in the operating and battery rooms.

36. That apparatus be provided as follows:—

AT FIRE ALARM HEADQUARTERS:—

(a) Automatic recording apparatus to record alarms received over all box circuits and all alarms sent out over both joker and gong circuits.

(b) A universal recording set to record on same paper tape, incoming and outgoing alarms, this set to be provided with automatic time and date stamp.

(c) An automatic repeater of the proper capacity to prevent interference between circuits and arranged to automatically transmit alarms over the joker circuits without manual intervention or the use of relays.

(d) Additional storage battery controlling boards, storage batteries and racks, for the proposed additional box, joker and gong circuits; storage batteries for each circuit to be in duplicate, also a stand-by motor generator set.

(e) A modern manual transmitter to replace the machine now in service.

AT EACH FIRE STATION:—

(f) A punch register and take-up reel.

Circuits.

37. That reliability of service be increased—

(a) By placing circuits underground in the principal mercantile and congested value districts.

(b) By removing overhead circuits from buildings and from poles carrying high-tension wires.

(c) By providing additional circuits and limiting the number of boxes on each circuit to 20.

(d) By providing an additional gong and joker circuit, so that one joker circuit and one gong circuit will serve 6 fire stations and the other joker and gong circuit the remaining 6 stations.

(e) By remodelling wiring in all fire stations to conform to the Standard of the National Electrical Code.

Boxes.

38. That the future installations of boxes be of the positive non-interfering successive type, with platinum or hard silver contacts and proper protection against abnormal currents; outer doors to be provided with brass handles under glass guard and outer shells properly grounded.

39. That additional boxes be installed in residential and outlying districts. In general, it is considered from any building in the mercantile and manufacturing districts it should not be necessary to traverse over 400 feet in order to reach a box; in closely built-up residential districts this distance should not be over 800 feet, and in outlying residential districts this distance should not be over 1,200 feet.

40. That a conspicuous sign in the English and French languages, stating the manner in which alarms are to be transmitted, be attached to supporting pole immediately above each box, also that box locations be indicated by red lights; that all boxes and a portion of each supporting pole be painted red annually and that letter boxes be painted a different color from the fire alarm boxes.

Telephones.

41. That a private branch exchange be installed at fire alarm headquarters with direct circuits to all fire stations; provided with at least two trunk lines, one of which should be reserved solely for fire alarm purposes. It is also desirable that an arrangement be entered into, if possible, with the Bell Telephone Company to have an emergency call number for fire only, printed in the English and French languages on the outside of the telephone directory cover.

General Alarm Bell.

42. That an independent general alarm bell and striker in connection with the fire alarm telegraph system be installed in the City Hall tower; according to present arrangement this source of notification

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tion is unreliable owing to the probability of an alarm being sounded simultaneously with the tower clock indicating the hour on the same bell.

Operation.

43. That a map showing the location of all boxes and circuits be provided.

FIRE DEPARTMENT AUXILIARIES.

44. That owners of extensive establishments be encouraged to equip their premises with auxiliary fire alarm boxes or with some approved automatic or manual fire alarm system, or both.

45. That all public service corporations install gongs in their offices, connected to the fire alarm system, and send men to fires in important districts who shall carry out the orders of the Chief of the fire department.

46. That the present unsatisfactory and unreliable arrangement of vibrating gongs in Stations Nos. 1, 3 and 5, and in connection with sprinklered risks be discarded.

An approved mechanical transmitter controlled by the closed circuit contact of the alarm valve of each sprinklered installation should be installed. These transmitters should be connected in series and run as a separate closed circuit to fire alarm headquarters, so that any alarm coming in over the circuit would be handled in exactly the same manner as a box alarm. Each building would be assigned a code number and the effect of the transmitter being operated by the opening of a sprinkler head would have the same results as pulling a fire alarm box.

The transmitters referred to must be arranged so that there is no local battery required between the transmitter and the alarm valve, the entire circuit being operated by one main storage battery in duplicate at fire alarm headquarters, this to be accomplished by equipping each transmitter with a tripping coil wired in series with the fire alarm circuit, but normally short-circuited by the closed contacts of the alarm valve.

BUILDING DEPARTMENT.

47. That the building laws be revised to conform fully to modern requirements for construction and fire prevention as given in the National Board Building Code, especially as to the limitations of areas and heights, and protection to openings in floors and external walls.

EXPLOSIVES AND INFLAMMABLES.

48. That a complete code of regulations governing the manufacture, sale, storage and transportation of explosives and inflammables be adopted by ordinance, the Chief of the fire department to be held solely responsible for its enforcement and the keeping of records. It is recommended that the suggested ordinances promulgated by the National Board of Fire Underwriters be used as a guide in framing new regulations.

ELECTRICITY.

49. That systematic tests be made for electrolysis, and if any dangerous conditions are determined these should be eliminated. It is desirable that the C. F. U. A. and other interested organizations be notified so that their representatives may witness and assist at any tests which might be made.

50. That all overhead wires in the streets, lanes and block interiors of the principal mercantile and closely built sections, except trolley wires, but including trolley feed wires be placed underground.

CONFLAGRATION HAZARD.

51. That owners of existing defectively constructed buildings which are so located as to form conflagration areas be required to suitably protect roof, floor, party wall and exposed openings.

52. That automatic sprinkler equipments, with outside "Siamese" connections and controlling valve near main in street, be required in all buildings, which, by reason of their size, construction or occupancy, singly or combined, might act as conflagration breeders.

GENERAL SUMMARY.

CITY IN GENERAL.

Population about 116,850. Large amount of manufacturing. Extensive waterfront and important summer seaport. City very hilly, except near tide water. Many grades very steep; some close to the congested value district practically impassable for fire apparatus. Streets generally narrow; mostly paved; generally in fair to good condition. High winds frequent; winter temperatures severe and heavy snowfall frequent. Loss per fire and per capita high; number of fires moderate.

FIRE-FIGHTING FACILITIES.

Water Supply.—Owned and operated by the municipality. Supervision of works under Business Manager, assisted by a Civil Engineer; both connected with the water department for a number of years. An ample supply is conveyed to the city by gravity from Lake St. Charles, through three adjacent pipe lines to the distribution system, which is in two services; supply lines moderately unreliable and not sufficiently in duplicate. Consumption high. Pressures in "Lower Town" range from moderate to heavy; in "Upper Town" from light to moderate. Main arteries to principal mercantile and congested value district inadequate; fire supply dependent upon the operation of valves separating services and other closed valves in the district, all subject to delay; elsewhere arterial system only fair and gridiron poor in some parts, with considerable amounts of small and old pipe, some of which has questionable joints. Valves fairly well spaced; not regularly inspected. Hydrants fairly well spaced; many too small; regularly inspected; in good condition.

Fire Department.—A full paid force; not under civil service regulations; officers experienced and Chief progressive. Financial support fair. No age limit for retirement. Companies sufficient in number and fairly well distributed, but, under the two-platoon system, undermanned. Discipline fair. Two of the three engines in service very old and of inadequate capacity; crews not sufficiently skilful. Some hose wagons light and too small. Chemical and ladder protection good. Heavy stream appliances inadequate. Hose supply adequate and in good condition; no 3-inch hose. Minor equipment good, but standard salvage and some modern appliances lacking. Special appliances for handling streams do not include turret pipes on hose wagons. Fire stations mainly satisfactory and a repair shop maintained. Horses satisfactory and used for fire purposes only; veterinary hospital lacking. Response to alarms good, but hills at times are a handicap. Fire methods good, except for lack of salvage work. Briefing inspections of value. Records good.

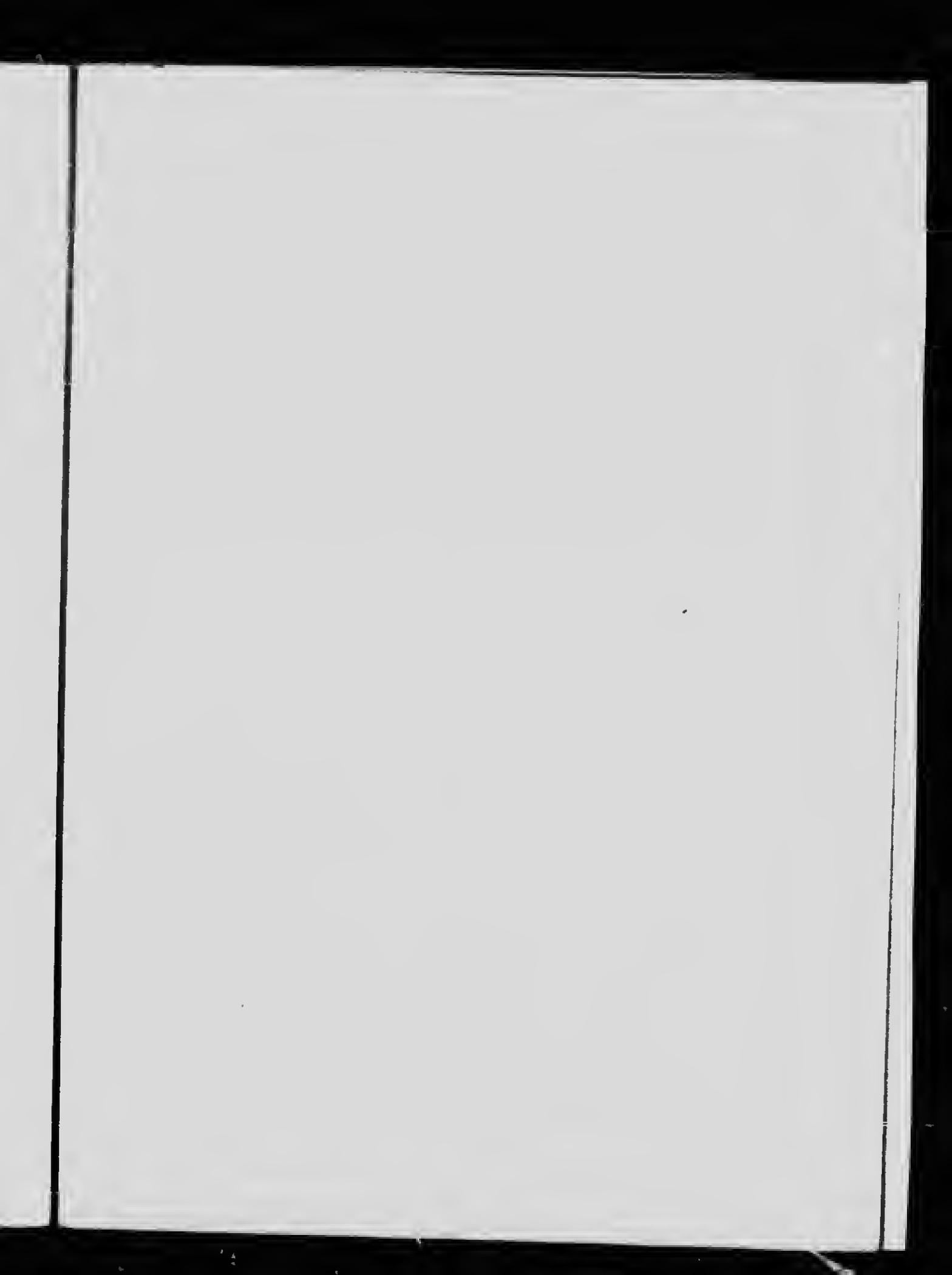
Fire Alarm System.—Combined automatic and manual system, fairly well maintained, but with apparatus largely of obsolete type and inadequate for the city. Headquarters in a non-fireproof building; operating room contains much woodwork. Department telephone facilities inadequate. Boxes of unsatisfactory type. Distribution generally good in important districts, elsewhere fair to poor. No red lights used to indicate locations and no signs (in English and French languages) giving instructions for proper method of transmitting alarm. Circuits all overhead; wiring fair; numerous grounds; box leads poorly installed; circuits to and apparatus at stations deficient; box circuits overloaded. Batteries of satisfactory type, in good condition and well mounted. System as a whole has many unreliable features.

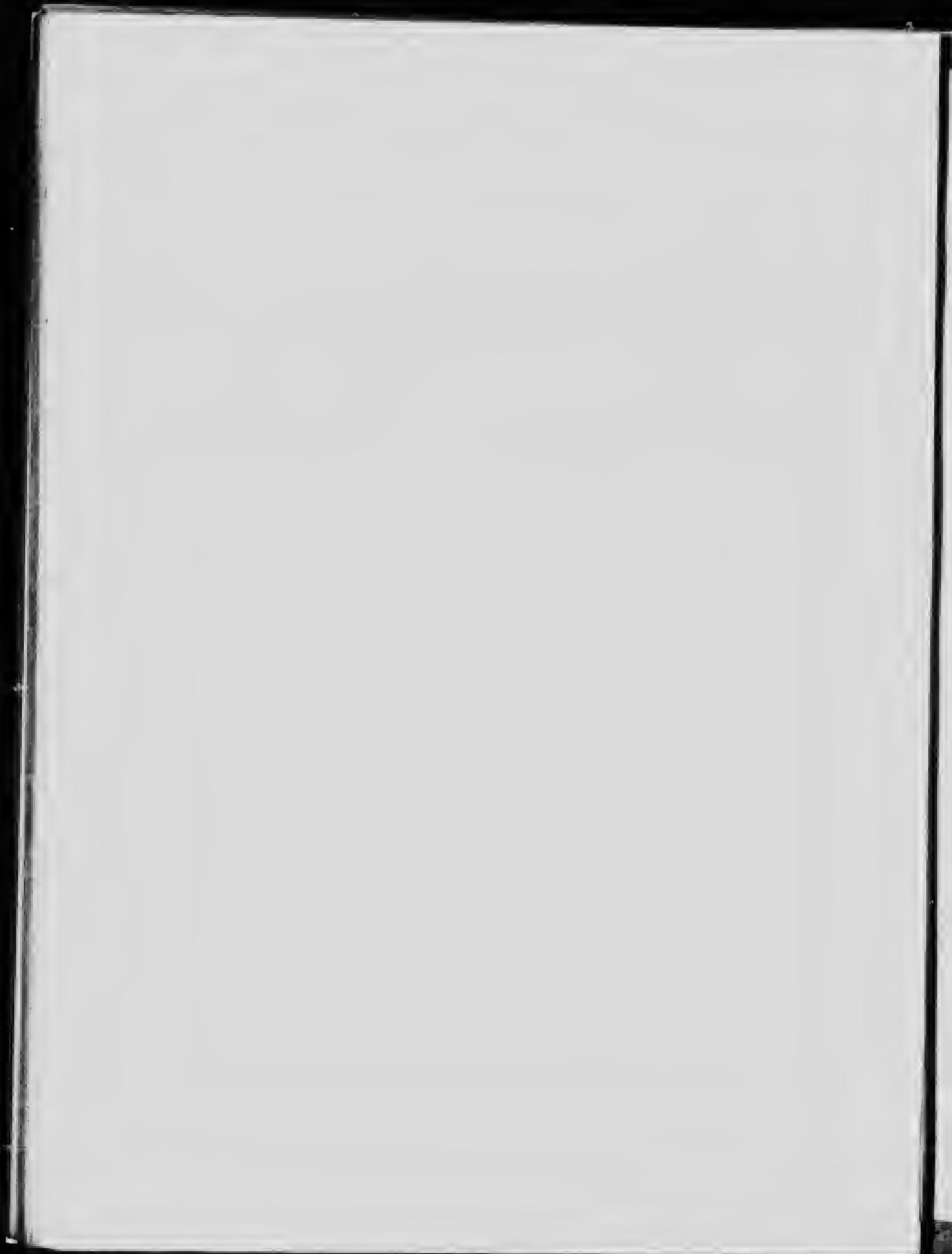
Fire Department Auxiliaries.—Police department efficient from a fire protection standpoint. The Quebec Railway, Light, Heat and Power Company render good assistance at fires; other public service corporations receive no alarms and render aid only when called upon. Telephone service widely distributed; frequently used for transmitting fire alarms. Sprinkler equipments and standpipes few and little private protection. Outside aid of little value.

Summary.—Water supply available generally in sufficient quantities, and in some parts of the system at pressures adequate for direct hydrant hose streams; somewhat unreliable as demonstrated by too frequent breakage to 40-inch and 30-inch supply mains. Fire department weak numerically, and engine capacity inadequate. Fire alarm system seriously unreliable, and should be superseded largely by a new system in fireproof headquarters.

JAMES LESLIE,

Engineer, C. F. U. A.







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Exhibition Grounds

GRAHAM

VICTORIA HARBOUR

C.N.R.

DE LA CANARDIERE COVES

NEW STAIRS
LOWER BARR

WATERWORKS

ST. JEROME

ST. JULIAN

ST. JAMES

ST. JOHN

ST. PETER

ST. PAUL

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ST. MICHAEL

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ST. LAWRENCE



LAWRENCE

RIVER

CITY OF LEVIS

BATTLEFIELDS

CITADEL

ALLAN LINE

CHAMPLAIN

LAURIER AVE.

LOUISE BACH

NEW RIVER

DE LA CANARDIERE COVES

VICTORIA PARK

CHAMPLAIN

ST. JEAN

ST. ANNE

ST. LOUIS

ST. CHARLES

ST. MARY

ST. JOSEPH

ST. MICHAEL

ST. ANTHONY

ST. MARTIN

ST. PIERRE

ST. JACQUES

ST. ISIDORE

ST. EUGENE

ST. FELIX

ST. GABRIEL

ST. RAYMOND

ST. ANNE

ST. JOSEPH

ST. MICHAEL

