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INDUSTRIAL WATERS IN CANADA

Interim Report No. 5

by
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INDUSTRIAL WATERS OF CANADA

Interim Report No. 5.

The investigation of the quality of Canadian waters used or available for industry and for civic supply was begun in 1934. The investigation consists of, 1, sampling of the surface waters at key stations where the waters are of industrial importance and complete analyses are made, 2, sampling and partial analyses of civic water supplies and 3, obtaining information from manufacturers who are large consumers of water, concerning problems arising from the quality of the water used in their processes.

In carrying out this work a portable laboratory outfit is used and analyses and tests are made in the field, at the time of sampling, of such constituents and characteristics of the waters that could disappear or change on standing.

At the time of writing, 714 samples of water have been collected and analysed. About 200 of these are surface waters from lakes and rivers of industrial importance and the rest, over 500 samples, are from civic water supplies in cities or towns having a population of 3000 inhabitants and over from Eastern Canada, and 2000 and over for the rest of the Dominion west of Sault Ste. Marie. The latter limit was chosen owing to the sparseness of the population in the West. The investigation so far covers the whole of Canada except northern British Columbia, the Yukon and North West Territories, and in the absence of a sufficient number of analyses of samples taken at set intervals and of detailed investigatory work, it may be regarded

a preliminary investigation of the more important industrial waters of Canada. The work accomplished has been published in four interim reports containing tabulations of the analyses of surface waters of which complete analysis has been made, and of civic water supplies analysed for total hardness, calcium and magnesium hardness and alkalinity. Frequent requests for more complete analysis of these has led to the adoption since 1938 of the following extra determinations, colour, total dissolved solids dried at 110°C., silica, iron, bicarbonate, sulphate, chloride and nitrate. This information besides being tabulated has been plotted on a hardness map for eastern Canada published in Interim Report No. 2.

The first interim report included the work compiled during the years 1934 and 1935, embracing the quality of the natural and treated waters of the province of Ontario south of Georgian Bay and Ottawa River and the province of Quebec as far east as Riviere du Loup. The second covered the work of 1936, when the whole of Eastern Canada was completed except for the mining and industrial areas north of Ottawa River and Lake Huron. Interim Report No. 3 extended the investigation the following year as far west as the Columbia River, British Columbia, the northern mining areas in Quebec and Ontario and the industrial area on the Abitibi and Mattagami Rivers and tributaries as far north as Smoky Falls. No. 4 interim report for 1938 dealt with the province of British Columbia, except the northern parts, and a check of the waters in western Ontario, Manitoba, Saskatchewan and Alberta.

These four reports besides giving tabulated analyses of natural and untreated waters discussed the general character of waters, outlined

the methods of chemical analysis used in this investigation, furnished tabulations and diagrams compiled from data of public water supplies, and correlated the results with the requirement of purity of waters used in certain industries, and also dealt with the deleterious effect of impurities in some Canadian waters on certain manufacturing processes.

The present report is a continuation of this work, which becomes more valuable as the number of analyses increases, thanks to the determination of the seasonal and periodical variations in the composition of the waters. It deals with the surface and civic water supplies in the northern mining and industrial areas in the provinces of Ontario and Quebec, the samples collected to represent the quality of the waters at the freshet, the waters of the Maritime provinces, St. Maurice and St. Charles Rivers and the Lake St. John district as well as other places in the province of Quebec in direct line of travelling east and west.

Three special investigations were made:-

The Iroquois Lake at St. Remi d'Amherst, Quebec, the Moser River water-shed in the northern part of Halifax county, Nova Scotia, and the sea water at the Bay of Fundy, St. Mary's Bay, Lunenburg and Northumberland Strait off the Nova Scotia coast. Complete analyses were made of the waters from the first two localities and the sea waters were analysed for bromine and iodine only.

During 1939, 30 samples of surface waters were collected at the key stations of the larger lakes and rivers of industrial importance of which complete analyses were made. The civic water supplies are represented by 73 samples and were analysed for constituents as

4.

mentioned above. Of the surface waters those of northern Ontario and Quebec were collected at the time of the freshet at the following gaging stations: North Bay for Lake Nipissing, Haileybury for Lake Timiskaming, Iroquois Falls for the Abitibi River, Timmins, Smooth Rock Falls, Smoky Falls and Kapuskasing for the Mattagami River and its tributaries. The samples from the rivers were taken midstream and those from the lakes at a distance free from shore contamination and other disturbances. At the other places samples were collected at the pumping stations of the water works.

Compared with the analyses of the samples collected in the autumn of 1937, these are generally lower in concentration and in most of the constituents, which is what might be expected at the freshet, and they are somewhat higher in colour. The St. Maurice River samples from the key stations at Grande Mere and Three Rivers, give nearly identical analyses, except the former, which is characterized by the presence of silica, something unusual and not recorded by earlier analyses. Otherwise the composition of these waters shows no appreciable change when compared with the analyses of the samples collected in 1936. The St. Charles River, usually high in silica also shows the absence of the constituent in 1939. The concentration of this water is changeable, and for 1939 it was lower in most of the constituents than on previous occasions. The analyses of Lake St. John and the Abitibi River waters show in general only slight changes except for a higher content of magnesium, and consequently higher total hardness. The Francis River is of higher concentration than usual in most of the constituents and total hardness. Of the surface waters in the

Maritime provinces the St. John and Nipisiquit Rivers are appreciably higher in concentration and most constituents than any previous record shows. Of the other surface waters investigated, the two Miramichi rivers, Grand Lake and Moser River water-shed have been analysed for the first time and consequently there were no previous records for comparison.

Of the civic water supplies many of the treated and untreated surface waters show considerable variations in concentration and hardness. This in many cases is caused by the chemicals added in the purification process such as lime, ammonium sulphate, or alum, but also by changes in concentration of the raw waters. Deep wells and some springs as a rule show less variation in composition, seasonally and periodically than surface waters, thus for the supplies at Desaport, Montmagny, Cochrane, Summerside and Charlottetown, the analyses are identical with those of previous examinations. On the whole the civic waters of 1939 are of less total hardness than those of latest records of analyses except those investigated in the province of Quebec. Those of Nova Scotia have an average total hardness of the supplies examined of 26.9 p.p.m. as compared with 34.9 p.p.m., of New Brunswick 51.9 p.p.m. and 60.0 p.p.m., those of Prince Edward Island were identical, of Quebec 51.6 p.p.m. and 43.9 p.p.m. respectively and of Ontario 92.6 p.p.m. and 103.0 p.p.m.

Hardness map

The hardness map for western and northern Canada has been compiled on the same lines as that of eastern Canada, published in

terim Report No. 2, the difference being that the population served has been set at a minimum of 2000 inhabitants and over, instead of 100, because of the comparative sparseness of the population and the existence of fewer larger cities and towns. The ratio is not thereby increased appreciably, but it does give a better geographical distribution of the various industrial and civic waters. For the 80 supplies reported, only 4 places in Ontario, 1 in Manitoba, 4 in Saskatchewan, 1 in Alberta and 6 in British Columbia have less than 3000 inhabitants. The population figures are taken from the 1931 census with the exception of some larger cities and towns, which also serve adjacent suburbs, smaller towns and communities, for which calculations are based on the total number of persons served in accordance with data obtained from the Engineering and Contract Record, March 23rd, 1938, pp. 76 to 106. The 80 places of supply and key stations shown on the map represent a service of 1,329,140 inhabitants or 37.5 per cent of the total population. For details see table below:

Table I.

Comparison by provinces of the total population and of that part served by the waters that have been investigated.

Province	Number of places	Population	Population served	Percentage of population served
Northern Ontario and Quebec	24	328,000	203,505	53.3
Manitoba	7	711,000	316,162	44.5
Saskatchewan	14	931,000	165,035	17.7
Alberta	13	772,000	207,358	26.9
British Columbia	30	750,000	436,580	58.2
Total	88*	3,546,000	1,329,140	37.5

* Includes 8 places, suburbs and adjacent towns served by supplies from adjacent localities.

Many scales for reporting the hardness of waters are found in the technical literature; that adopted by the United States Geological Survey has been chosen for the industrial waters investigation, because many of the waters investigated are international, the same rivers flowing through both countries. It is as follows:

Table II

Total hardness in parts per million expressed as calcium carbonate (CaCO_3).

1 to 60 p.p.m.	soft water
61 to 120 " " "	medium hard water
121 to 180 " " "	hard water
181+	very hard water

Subdivision of these may be made as the hardness approaches the upper or lower limit set, for example less than 30 p.p.m. hardness may be termed very soft water, 65 p.p.m. medium hard to soft, 125 p.p.m. hard to medium hard, or 175 hard to very hard.

In preparation of the hardness map the writer has departed from the usual method of employing shadings ranging from white for soft waters to black for very hard waters and showing these as extending to political boundaries of provinces or states as the case may be, because of the false inference implied that by stepping across a borderline into another province the water suddenly changes in hardness, such as would be the case in passing from British Columbia to Alberta or from Western Ontario to Manitoba. A better way would be to shade the districts in conformity with the distribution of the waters of the various hardnesses, irrespective of political division,

At in this investigation insufficient data are yet available, the waters investigated serving only an average of 37.5 per cent of the population, and this again might lead to false deductions from the map.

The water supplies have consequently been plotted on the map by means of symbols indicating the hardness of the water for each particular place. The reader can perceive at a glance the geographical distribution of the hardness of the various water supplies in western Canada.

Distribution of hard waters

Civic water supplies of western and northern Ontario are very soft, and soft, only 3 supplies being hard and 3 very hard. The three very hard are fed from wells and all the others from lakes and rivers. Manitoba waters are represented by 7 supplies of which 6 are very hard and 1, that of Winnipeg and suburbs, medium hard, but this is drawn from Shoal Lake in western Ontario. Saskatchewan has also predominantly very hard waters only two supplies, from the two Saskatchewan rivers, yielding hard to medium hard waters. In Alberta the general trend is towards softer waters than in the Prairie Provinces, many supplies being drawn from the large rivers, mountain lakes and streams of moderate hardness; only two, supplied by wells, were very hard. British Columbia has predominantly soft to very soft waters, mostly from mountain lakes and streams, only one supply had hard to medium hard water, the average hardness for the province being slightly below 60 p.p.m. The above supplies were examined in 1939.

The following tables give detailed analyses of the samples of surface and civic waters collected in 1939, and analysed by the writer, assisted by H. Mercier.

Sample No.	606	607	608	609	631
Date of sampling	May 7	May 10	May 12	May 15	May 30
Source	Abitibi River	Mattagami River	Kapuskasing River	Mattagami River	Mattagami River
Locality	Iroquois Falls, Ont.	Smooth Rock Falls, Ont.	Kapuskasing, Ont.	Timmins, Ont.	Smoky Falls, Ont.
Sample collected	Intake pipe pulp mill	Intake pipe pulp mill	Power dam	Midstream at water works	Dam at power house depth sample
Gauge	high	high	high	high	high
Temperature	5°C.	5°C.	4°C.	5°C.	5°C.
pH	7.0	7.0	6.9	6.9	6.5
Dissolved oxygen cc. per litre	8.5	9.5	9.5	7.8	9.5
Free carbonic acid (CO ₂)	p.p.m. 2.5	1.5	2.0	2.0	3.0
Turbidity	" " " 10.0	10.5	20.0	none	2.5
Colour	" " " 130.0	130.0	135.0	90.0	120.0
Alkalinity	" " " 33.5	19.5	26.5	20.0	21.5
Suspended matter	" " " 18.5	18.3	24.6	1.6	5.5
Total dissolved solids dried at 180°C.	" " " 84.4	61.1	78.3	61.9	75.8
Silica (SiO ₂)	" " " 7.1	3.4	3.3	3.7	1.4
Iron (Fe)	" " " 0.22	0.23	0.20	0.15	0.15
Calcium (Ca)	" " " 13.4	10.5	10.7	10.4	11.6
Magnesium (Mg)	" " " 4.5	3.1	3.1	4.3	4.6
Alkalies as sodium (Na)	" " " 2.1	5.2	2.5	2.3	2.3
Hydrocarbonate (HCO ₃)	" " " 40.9	22.6	32.3	24.4	26.2
Sulphate (SO ₄)	" " " 7.4	5.2	6.0	5.4	5.9
Chloride (Cl)	" " " 1.5	0.5	0.5	0.9	0.5
Nitrate (NO ₃)	" " " 0.44	0.44	0.44	0.62	0.27
Hardness as CaCO ₃ calculated					
Total hardness	" " " 52.0	39.0	39.5	43.6	47.9
Carbonate hardness	" " " 33.5	18.5	26.5	20.0	21.5
Noncarbonate hardness	" " " 18.5	20.5	13.0	23.6	26.4
Calcium hardness	" " " 32.5	26.3	26.8	26.0	29.0
Magnesium hardness	" " " 18.5	12.7	12.7	17.6	18.9

Date of sampling	May 18	May 20	May 24	May 26	May 25
Source	Dufault Lake	Lac Blouin	Lake Temiskaming	Lake Nipissing	Gull Lake
Locality	Noranda, Que.	Bourlamaque, Que.	Haileybury, Ont.	North Bay, Ont.	Kirkland Lake, Ont.
Sample collected	Intake pipe at water works	Depth sample from lake	Depth sample 2 miles from shore	Depth sample 2 miles from shore	Depth sample from lake
Gauge	high	high	high	high	high
Temperature	5°C.	6°C.	14°C.	13°C.	14°C.
pH	6.1	6.2	6.9	7.2	7.2
Dissolved oxygen cc. per litre	7.5	7.2	7.6	7.6	7.6
Free carbonic acid (CO ₂)	p.p.m. 3.0	3.0	2.0	1.5	1.5
Turbidity	" " " none	none	12.0	none	none
Colour	" " " 70.0	180.0	50.0	40.0	25.0
Alkalinity	" " " 6.5	9.5	25.0	21.5	30.0
Suspended matter	" " " 4.2	3.6	15.0	1.4	none
Total dissolved solids dried at 180°C	" " " 68.4	70.0	85.0	65.9	85.0
Silica (SiO ₂)	" " " 2.6	2.1	13.2	3.0	0.5
Iron (Fe)	" " " 0.20	0.75	0.20	0.15	0.11
Calcium (Ca)	" " " 7.8	7.7	9.0	9.0	10.8
Magnesium (Mg)	" " " 3.2	2.8	3.0	3.6	4.5
Alkalies as sodium (Na)	" " " 3.0	2.0	5.0	3.8	9.3
Hydrocarbonate (HCO ₃)	" " " 7.9	11.6	30.5	26.2	36.6
Sulphate (SO ₄)	" " " 34.0	7.0	10.0	8.5	16.0
Chloride (Cl)	" " " 0.2	3.5	5.0	1.0	14.3
Nitrate (NO ₃)	" " " 1.06	2.00	1.06	1.33	0.7
Hardness as CaCO ₃ calculated					
Total hardness	" " " 22.6	30.0	37.7	37.3	42.0
Carbonate hardness	" " " 6.5	9.5	25.0	21.5	30.0
Noncarbonate hardness	" " " 16.1	20.5	12.7	15.8	12.0
Calcium hardness	" " " 19.3	19.5	22.5	22.5	24.6
Magnesium hardness	" " " 13.1	10.7	15.2	14.8	17.2

ANALYSIS OF SURFACE WATERS

Sample No.	615	616	649	632
Date of sampling	June 5	June 6	Oct. 5	July 19
Source	Iroquois Lake	Rideau River	Rideau River	St. Lawrence River
Locality	St. Remi d'Amherst, Que.	Smiths Falls, Ont.	Smiths Falls, Ont.	Montreal Que.
Sample collected	Midlake depth sample	Power canal depth sample	Depth sample 20' at canal at water works	Intake pipe water works
Gauge	high	high	low	mean
Temperature	16°C.	19°C.	15°C.	21°C.
pH	7.1	7.3	7.6	7.3
Dissolved oxygen cc. per litre	7.1	6.4	7.6	6.5
Free carbonic acid (CO ₂)	p.p.m. 1.0	3.0	none	none
Turbidity	" " " none	2.0	none	none
Colour	" " " 10.0	50.0	40.0	10.0
Alkalinity	" " " 6.0	73.5	66.0	71.5
Suspended matter	" " " 5.3	5.5	1.4	3.0
Total dissolved solids dried at 180°C.	" " " 48.7	130.2	112.4	172.9
Silica (SiO ₂)	" " " 1.4	0.5	1.2	1.6
Iron (Fe)	" " " 0.9	0.03	0.07	0.09
Calcium (Ca)	" " " 9.9	27.5	25.8	31.6
Magnesium (Mg)	" " " 4.2	7.3	9.3	3.8
Alkalies as sodium (Na)	" " " 10.9	2.5	5.0	8.5
Hydrocarbonate (HCO ₃)	" " " 7.3	92.1	60.5	87.2
Sulphate (SO ₄)	" " " 15.0	14.0	13.9	20.6
Chloride (Cl)	" " " 0.5	1.0	1.0	14.0
Nitrate (NO ₃)	" " " .44	.80	0.89	2.21
Hardness as CaCO ₃ calculated				
Total hardness	" " " 42.0	98.7	102.6	94.6
Carbonate hardness	" " " 6.0	73.5	35.0	71.5
Noncarbonate hardness	" " " 36.0	25.2	36.6	23.1
Calcium hardness	" " " 24.8	68.8	64.5	79.0
Magnesium hardness	" " " 17.2	29.9	38.1	15.6

Sample No.	633	635	634	636
Date of sampling	July 21	July 20	July 22	July 22
Source	St. Maurice River	St. Maurice River	St. Charles River	Lake St. John
Locality	Grande Mere, Que.	Three Rivers, Que.	Chateau d'Eau, Que.	2 miles from shore opposite Little Outlet, Que.
Sample collected	Intake pipe pulp mill	Intake pipe city water works	Dam at pumping station	Depth sample 25'
Gauge	mean	mean	mean	high
Temperature	19°C.	20°C.	21°C.	18°C.
pH	6.5	6.7	6.8	6.4
Dissolved oxygen cc. per litre	6.1	6.5	6.6	6.8
Free carbonic acid (CO ₂)	p.p.m. 3.1	2.5	2.0	4.2
Turbidity	" " " none	2.5	2.0	none
Colour	" " " 50.0	55.0	35.0	60.0
Alkalinity	" " " 5.0	4.5	7.0	1.0
Suspended matter	" " " 4.0	4.8	5.6	2.2
Total dissolved solids dried at 180°C.	" " " 39.0	34.2	40.0	31.7
Silica (SiO ₂)	" " " none	4.6	none	2.6
Iron (Fe)	" " " 0.07	0.14	0.20	0.07
Calcium (Ca)	" " " 3.7	4.7	4.3	3.7
Magnesium (Mg)	" " " 1.9	2.1	2.2	3.7
Alkalies as sodium (Na)	" " " 3.0	3.5	3.1	4.3
Hydrocarbonate (HCO ₃)	" " " 6.1	5.5	8.5	1.2
Sulphate (SO ₄)	" " " 4.5	5.2	2.5	4.3
Chloride (Cl)	" " " 0.5	1.0	1.5	1.0
Nitrate (NO ₃)	" " " 0.44	0.44	0.44	0.27
Hardness as CaCO ₃ calculated				
Total hardness	" " " 17.1	20.4	19.8	24.5
Carbonate hardness	" " " 5.0	4.5	7.0	1.0
Noncarbonate hardness	" " " 12.1	15.9	12.8	23.5
Calcium hardness	" " " 9.3	11.8	10.8	9.3
Magnesium hardness	" " " 7.8	6.6	9.0	14.2

ANALYSIS OF SURFACE WATERS

Sample No.	637	638	639	640
Date of sampling	July 24	July 28	July 29	July 29
Source	Chicoutimi River	Nipisiquit River	S.W. Miramichi River	N.W. Miramichi River
Locality	Chicoutimi, Que.	Bathurst, N.B.	Quarryville, N.B.	Redbank, N.B.
Sample collected	At dam 7 miles from Chicoutimi	Intake pipe at pulp mill	Depth sample midstream	Depth sample midstream

Gauge		high	low	mean	mean
Temperature		20°C	22°C	21°C	21°C
pH		6.7	7.3	7.3	7.3
Dissolved oxygen cc. per litre		6.4	6.2	6.0	6.0
Free carbonic acid (CO ₂)	p.p.m.	3.0	none	none	none
Turbidity	" " "	none	none	none	none
Colour	" " "	55.0	25.0	20.0	40.0
Alkalinity	" " "	6.5	15.0	12.5	6.5
Suspended matter	" " "	1.0	1.0	1.2	2.2
Total dissolved solids dried at 180°C.	" " "	51.2	30.0	19.0	31.5
Silica (SiO ₂)	" " "	3.0	5.2	4.0	5.6
Iron (Fe)	" " "	0.10	0.08	0.07	0.10
Calcium (Ca)	" " "	7.5	10.4	10.7	6.8
Magnesium (Mg)	" " "	4.3	3.1	3.3	4.4
Alkalies as sodium (Na)	" " "	5.1	4.7	4.3	3.1
Hydrocarbonates (HCO ₃)	" " "	7.4	15.0	12.0	12.4
Sulphate (SO ₄)	" " "	1.1	5.1	4.5	3.1
Chloride (Cl)	" " "	1.0	1.0	1.0	1.0
Nitrate (NO ₃)	" " "	0.10	0.44	0.44	1.27
Fluoride as F ₂ (calculated)	" " "				
Total hardness	" " "	51.2	30.0	19.0	31.5
Hardness as CaCO ₃	" " "	51.2	30.0	19.0	31.5
Hardness as CaCO ₃ (temporary)	" " "				
Hardness as CaCO ₃ (permanent)	" " "				

Sample No.	642	643	644	645
Date of sampling	Aug. 25	Aug. 25	Sept. 5	Aug. 30
Source	Grand Lake	St. John River	Herring Cove Lake	St. Francis River
Locality	Near Newcastle Creek, N.B.	Woodstock, N.B.	Brooklyn, N.S.	East Angus, Que.
Sample collected	Depth sample 2 miles from shore	Depth sample midstream	Depth sample from midlake	Depth sample midstream above pulp mill
Gauge	high	low	high	low
Temperature	26°C	23°C	23°C	23°C
pH	7.0	7.3	5.8	7.0
Dissolved oxygen cc. per litre	5.6	8.5	5.3	6.3
Free carbonic acid (CO ₂)	p.p.m. 3.0	1.0	5.0	1.5
Turbidity	" " " none	1.0	none	20.0
Colour	" " " 65.0	65.0	70.0	70.0
Alkalinity	" " " 4.5	36.0	none	33.5
Suspended matter	" " " 1.9	3.6	4.0	23.2
Total dissolved solids dried at 180°C	" " " 48.7	86.2	31.2	76.3
Silica (SiO ₂)	" " " 2.2	5.6	1.6	3.6
Iron (Fe)	" " " 0.23	0.12	0.56	0.15
Calcium (Ca)	" " " 4.8	16.5	2.2	9.1
Magnesium (Mg)	" " " 4.9	6.6	3.9	4.6
Alkalies as sodium (Na)	" " " 6.3	3.5	5.3	3.5
Hydrocarbonate (HCO ₃)	" " " 5.5	43.9	none	40.9
Sulphate (SO ₄)	" " " 6.4	7.8	2.7	5.6
Chloride (Cl)	" " " 3.5	1.0	7.0	1.0
Nitrate (NO ₃)	" " " 0.27	0.44	0.62	1.06
Hardness as CaCO ₃ calculated				
Total hardness	" " " 32.1	68.4	21.5	41.7
Carbonate hardness	" " " 4.5	36.0	none	33.5
Noncarbonate hardness	" " " 27.6	32.4	21.5	18.2
Calcium hardness	" " " 12.0	41.3	5.5	32.6
Magnesium hardness	" " " 20.1	27.1	16.0	13.9

ANALYSIS OF CIVIC WATER SUPPLIES

1939

Nova Scotia

Sample No.		672	676	681	685	679
Date sampled 1939		Aug. 2	Aug. 8	Aug. 4	Aug. 16	Aug. 10
Locality		Amherst	Bridgewater	Dartmouth	Glace Bay (1)	Halifax
Source of Supply		Nappan River	Hebb's Lake	Dartmouth water supply lakes	Sand Lake	Long Lake, Lower service
Method of Purification		No treatment	No treatment	Screens and chlorination	No treatment	Chlorination
Colour	p.p.m.	25.0	15.0	none	10.0	10.0
Alkalinity	" " "	27.5	none	none	none	0.5
Total dissolved solids, dried at 110°C.	" " "	89.5	24.5	23.5	30.0	25.0
Silica (SiO ₂)	" " "	9.0	3.5	1.6	2.0	2.5
Iron (Fe)	" " "	3.7	0.32	0.04	0.06	0.04
Calcium (Ca)	" " "	11.4	1.4	1.4	2.1	2.1
Magnesium (Mg)	" " "	2.4	1.5	1.3	1.3	1.7
Hydrocarbonate (HCO ₃)	" " "	33.6	none	none	none	0.6
Sulphate (SO ₄)	" " "	8.2	5.4	6.2	7.4	7.0
Chloride (Cl)	" " "	3.0	3.5	5.0	10.0	6.5
Nitrate (NO ₃)	" " "	1.77	1.6	1.06	1.33	0.44
Total hardness as CaCO ₃	" " "	38.3	9.7	8.8	10.6	11.3
Calcium hardness	" " "	28.5	3.5	3.5	5.3	4.3
Magnesium hardness	" " "	9.8	6.2	5.3	5.3	7.0

(1) Supplies Reserve and Dominion

Nova Scotia (contd.)

Sample No.		680	682	677	688	686
Date sampled 1939		Aug. 11	Aug. 16	Aug. 8	Aug. 18	Aug. 16
Locality		Halifax	Inverness	Liverpool	New Glasgow	New Waterford
Source of Supply		Upper service Spruce Hill Lake	Mabot Reservoir fed by springs	Town Lake	Forbes Lake	Waterford Lake
Method of Purification		Chlorination	Intermittent chlorination	No treatment	No treatment	Chlorination
Colour	p.p.m.	5.0	10.0	10.0	5.0	5.0
Alkalinity	" " "	none	13.0	none	10.0	0.5
Total dissolved solids, dried at 110°C.	" " "	21.5	50.0	32.5	51.5	45.0
Silica (SiO ₂)	" " "	1.5	5.5	1.5	2.0	4.0
Iron (Fe)	" " "	0.05	0.05	0.32	0.05	0.05
Calcium (Ca)	" " "	2.1	4.2	1.4	10.0	2.9
Magnesium (Mg)	" " "	1.3	2.3	1.7	2.0	1.7
Hydrocarbonate (HCO ₃)	" " "	none	15.2	none	12.2	0.6
Sulphate (SO ₄)	" " "	6.6	8.0	7.2	14.0	10.7
Chloride (Cl)	" " "	5.5	10.0	5.0	5.5	11.5
Nitrate (NO ₃)	" " "	0.62	0.44	1.77	3.54	0.80
Total hardness as CaCO ₃	" " "	10.6	20.2	10.5	33.2	14.3
Calcium hardness	" " "	5.3	10.0	3.5	25.0	7.3
Magnesium hardness	" " "	5.3	9.4	7.0	8.2	7.0

ANALYSIS OF CIVIC WATER SUPPLIES

1939

Nova Scotia (contd.)

Sample No.	690	673	687	684	683
Date sampled 1939	Aug. 19	Aug. 2	Aug. 18	Aug. 16	Aug. 15
Locality	Pictou	Springhill	Stellarton	Sydney	Sydney Mines
Source of Supply	Wells	Springs	East River	Reservoir fed by springs and brooks	Powell Lake
Method of Purification	No treatment	No treatment	Chlorination	No treatment	No treatment
Colour	none	30.0	5.0	20.0	none
Alkalinity	83.5	none	18.0	1.5	1.0
Total dissolved solids dried at 110°C.	151.0	55.0	103.5	23.0	26.0
Silica (SiO ₂)	3.8	9.0	1.4	1.0	none
Iron (Fe)	.42	0.05	0.06	0.17	0.05
Calcium (Ca)	33.6	3.5	21.4	1.4	1.4
Magnesium (Mg)	5.0	2.8	3.1	1.3	1.5
Hydrocarbonate (HCO ₃)	101.9	none	22.0	1.6	1.2
Sulphate (SO ₄)	18.0	1.2	32.4	5.4	7.4
Chloride (Cl)	10.0	2.5	9.4	6.5	6.5
Nitrate (NO ₃)	1.33	0.17	0.80	2.7	0.62
Total hardness as CaCO ₃	151.0	20.3	66.2	8.8	9.7
Calcium hardness	101.9	3.5	53.4	3.5	3.5
Magnesium hardness	50.1	16.8	12.8	5.3	6.2

2. Supplies

1939

Nova Scotia (contd.)

Sample No.	674	689
Date sampled 1939	Aug. 3	Aug. 19
Locality	Truro	Westville
Source of Supply	Lepper brook	Springs and Middle River
Method of Purification	Chlorination	No treatment
Colour	p.p.m. 70.0	5.0
Alkalinity	" " " 16.5	11.0
Total dissolved solids dried at 110°C†	" " " 54.0	131.0
Silica (SiO ₂)	" " " 2.0	1.4
Iron (Fe)	" " " 3.2	0.2
Calcium (Ca)	" " " 2.1	10.7
Magnesium (Mg)	" " " 1.5	3.5
Hydrocarbonate (HCO ₃)	" " " 20.1	13.4
Sulphate (SO ₄)	" " " 7.0	11.1
Chloride (Cl)	" " " 4.0	52.5
Nitrate (NO ₃)	" " " 0.27	1.33
Total hardness as CaCO ₃	" " " 11.5	41.2
Calcium hardness -	" " " 5.3	26.8
Magnesium hardness	" " " 6.2	14.4

ANALYSIS OF CIVIC WATER SUPPLIES

1939

Prince Edward Island

Sample No.	671	670
Date sampled 1939	Aug. 1	July 31
Locality	Charlottetown	Summerside
Source of Supply	Wells	Wells
Method of Purification	No treatment	No treatment
Colour	p.p.m. none	5.0
Alkalinity	" " " 87.5	107.0
Total dissolved solids dried at 110°C.	" " " 138.5	187.0
Silica (SiO ₂)	" " " 5.5	14.0
Iron (Fe)	" " " 0.13	0.17
Calcium (Ca)	" " " 24.3	47.9
Magnesium (Mg)	" " " 14.0	3.7
Hydrocarbonate (HCO ₃)	" " " 106.8	131.2
Sulphate (SO ₄)	" " " 9.0	16.1
Chloride (Cl)	" " " 10.5	17.5
Nitrate (NO ₃)	" " " 3.54	3.54
Total hardness as CaCO ₃	" " " 118.2	135.0
Calcium hardness	" " " 60.8	119.8
Magnesium hardness	" " " 57.4	15.2

New Brunswick

		666	664	668	701	692
Date sampled 1939		July 27	July 26	July 30	Aug. 27	Aug. 23
Locality		Bathurst	Campbellton	Chatham	Edmundston	Fredericton
Source of supply		Spring and Creek	Brooks and Springs	Creek	Madawaska River	St. John River
Method of Purification		No treat- ment	No treat- ment	No treat- ment	Chlorina- tion	Alum, lime chlor. filtr.
Colour	p.p.m.	35.0	15.0	70.0	40.0	10.0
Alkalinity	" " "	73.0	47.0	25.0	41.5	14.5
Total dissolved solids dried at 110°C.	" " "	152.5	79.0	75.0	75.0	75.5
Silica (SiO ₂)	" " "	8.5	10.5	9.0	2.0	1.2
Iron (Fe)	" " "	0.21	0.10	0.25	0.08	0.15
Calcium (Ca)	" " "	29.3	16.4	8.6	19.3	15.0
Magnesium (Mg)	" " "	4.8	4.8	3.7	4.4	2.0
Hydrocarbonate (HCO ₃)	" " "	89.0	57.3	31.1	50.6	17.7
Sulphate (SO ₄)	" " "	8.2	4.5	2.0	9.0	25.0
Chloride (Cl)	" " "	3.0	1.5	1.0	2.0	2.3
Nitrate (NO ₃)	" " "	0.17	1.33	0.44	0.27	3.14
Total hardness as CaCO ₃	" " "	93.0	60.7	36.7	66.3	45.7
Calcium hardness	" " "	73.3	41.0	21.5	43.3	37.5
Magnesium hardness	" " "	19.7	19.7	15.2	18.0	8.2

ANALYSIS OF CIVIC WATER SUPPLIES

1939

New Brunswick (contd.)

Sample No.		669	367	694	695	693
Date sampled 1939		July 30	July 29	Aug. 25	Aug. 25	Aug. 23
Locality		Moncton	Newcastle	St. John		St. Stephen ³
Source of Supply		Impounding Reservoirs	Wells	Loch Lomond	Spruce Lake	Wells
Method of Purification		Chlorination	No treatment	Chlorination Ammonium sulphate	Chlorination Ammonium sulphate	No treatment
Colour	p.p.m.	55.0	none	15.0	15.0	10.0
Alkalinity	" " "	7.5	101.5	5.5	none	14.0
Total dissolved solids dried at 110°C.	" " "	30.0	181.5	27.5	22.5	37.5
Silica (SiO ₂)	" " "	2.0	10.5	1.0	0.5	3.5
Iron (Fe)	" " "	0.037	0.06	0.06	0.06	0.05
Calcium (Ca)	" " "	3.5	25.0	5.7	3.5	5.7
Magnesium (Mg)	" " "	2.2	4.0	3.6	1.7	1.7
Hydrocarbonate (HCO ₃)	" " "	2.2	122.5	5.7	none	17.5
Sulphate (SO ₄)	" " "	5.2	22.5	2.4	5.6	5.5
Chloride (Cl)	" " "	1.5	7.5	4.0	5.0	2.5
Fluoride (F)	" " "	0.02	none	1.33	1.06	1.77
Total dissolved solids dried at 100°C.	" " "	30.0	20.5	29.1	15.8	19.0
Total dissolved solids dried at 180°C.	" " "	2.0	60.5	11.3	6.8	14.5
Hardness (as CaCO ₃)	" " "	9.8	18.5	14.8	7.0	5.5

3. supplier milltown and labels

New Brunswick (contd.)

Sample No.	691	696
Date sampled 1939	Aug. 21	Aug. 27
Locality	Sussex	Woodstock
Source of Supply	Ward's Creek	St. John River
Method of Purification	Black alum, lime chlor. filtr.	Alum, chlor. filtr.
Colour	p.p.m. 5.0	30.0
Alkalinity	" " " 43.0	16.5
Total dissolved solids dried at 110°C.	" " " 84.0	75.0
Silica (SiO ₂)	" " " 3.2	3.0
Iron (Fe)	" " " 0.04	0.06
Calcium (Ca)	" " " 15.0	16.4
Magnesium (Mg)	" " " 3.3	3.5
Hydrocarbonate (HCO ₃)	" " " 52.5	20.1
Sulphate (SO ₄)	" " " 12.8	26.8
Chloride (Cl)	" " " 7.0	3.0
Nitrate (NO ₃)	" " " 3.14	0.17
Total hardness as CaCO ₃	" " " 91.0	55.4
Calcium hardness	" " " 37.5	41.6
Magnesium hardness	" " " 13.5	14.4

1939

Quebec

Sample No.	660	708	655	709	656
Date sampled 1939	July 23	May 18	July 20	July 11	July 21
Locality	Beauport	Bourlamaque	Cap de la Madeleine	Chicoutimi (4)	Donnacona
Source of Supply	Springs	Blouin Lake	Springs	Chicoutimi River	Jacques Cartier River
Method of Purification	No treatment	No treatment	No treatment	Chlorination	Chlorination, filtration
Colour	p.p.m. 5.0	170.0	15.0	50.0	60.0
Alkalinity	" " " 106.0	9.0	4.5	6.0	2.5
Total dissolved solids dried at 110°C.	" " " 132.0	68.0	34.0	40.0	44.0
Silica (SiO ₂)	" " " 5.1	2.0	2.0	4.5	4.0
Iron (Fe)	" " " 0.45	0.60	1.5	0.09	0.11
Calcium (Ca)	" " " 40.1	7.5	5.0	8.0	7.4
Magnesium (Mg)	" " " 4.2	2.5	2.5	4.5	2.4
Hydrocarbonate (HCO ₃)	" " " 129.3	11.0	5.5	7.3	3.5
Sulphate (SO ₄)	" " " 8.6	7.0	4.9	6.5	5.4
Chloride (Cl)	" " " 2.0	3.5	1.5	1.0	2.0
Nitrate (NO ₃)	" " " 1.53	1.77	none	0.70	0.18
Total hardness as CaCO ₃	" " " 116.8	29.3	23.1	38.4	28.3
Calcium hardness	" " " 100.0	18.8	12.5	20.0	16.5
Magnesium hardness	" " " 16.8	10.5	10.6	18.4	9.8

(4) Supplies Riviere du Moulin

1939

Quebec (contd.)

Sample No.	703	706	654	711	661
Date sampled 1939	Aug. 29	Aug. 30	July 20	Dec. 30	July 23 (5)
Locality	East Angus	Granby	Grande Mere	Hull	Jonquiere
Source of Supply	Willard & Hollowbrook	Shefford Mountain Lake	Lac de Pile	Ottawa River	Riviere aux Sables
Method of Purification	No treatment	Alum, soda, chlorination, filtration	No treatment	Chlorination	Chlorination
Colour	10.0	10.0	30.0	60.0	65.0
Alkalinity	13.5	35.0	2.5	4.0	none
Total dissolved solids dried at 110°C.	43.0	60.0	39.5	40.0	45.0
Silica (SiO ₂)	6.0	1.2	9.0	2.0	2.0
Iron (Fe)	0.30	0.06	0.11	0.06	0.06
Calcium (Ca)	2.9	12.2	4.3	6.5	3.6
Magnesium (Mg)	4.4	3.2	2.2	2.9	1.7
Hydrocarbonate (HCO ₃)	16.3	43.7	3.1	4.9	none
Sulphate (SO ₄)	8.2	16.8	0.8	1.6	0.2
Chloride (Cl)	1.0	0.5	1.5	1.8	3.0
Nitrate (NO ₃)	1.33	0.20	none	0.20	0.44
Total hardness as CaCO ₃	37.0	64.0	19.8	22.8	16.0
Calcium hardness	19.8	43.0	10.8	16.3	9.0
Magnesium hardness	17.0	21.0	9.0	6.5	7.0

(5) Supplies Available

ANALYSIS OF CIVIC WATER SUPPLIES

1939

Quebec (contd.)

Sample No.	659	663	699	702	705
Date sampled 1939	July 22	July 24	Aug. 29	Aug. 29	Aug. 30
Locality	Kenogami	La Malbaie	Lauzon	Levis	Magog
Source of Supply	Lac Long	Desbien and Tremblay Rivers	St. Lawrence River		Lake Memphremagog
Method of Purification	No treatment	Chlorination	Alum, chlor., filtration	alum, chlor., filtration	Chlorination
Colour	p.p.m. 50.0	30.0	10.0	20.0	15.0
Alkalinity	" " " 9.0	50.5	46.5	56.6	38.0
Total dissolved solids dried at 110°C.	" " " 44.0	90.0	123.5	119.5	61.8
Silica (SiO ₂)	" " " 5.1	15.0	1.0	1.0	3.0
Iron (Fe)	" " " 0.09	0.53	0.08	0.11	0.03
Calcium (Ca)	" " " 7.4	15.0	24.5	17.8	16.4
Magnesium (Mg)	" " " 2.4	2.6	7.2	8.1	5.7
Hydrocarbonate (HCO ₃)	" " " 11.0	61.6	56.7	67.7	46.3
Sulphate (SO ₄)	" " " 8.2	7.0	35.4	20.0	8.6
Chloride (Cl)	" " " 1.5	1.5	11.5	13.0	2.5
Nitrate (NO ₃)	" " " 0.80	1.06	0.27	2.7	0.18
Total hardness as CaCO ₃	" " " 28.3	48.2	90.2	77.7	64.4
Calcium hardness	" " " 18.5	37.5	60.8	44.5	41.0
Magnesium hardness	" " " 9.8	10.7	25.9	33.2	23.4

65

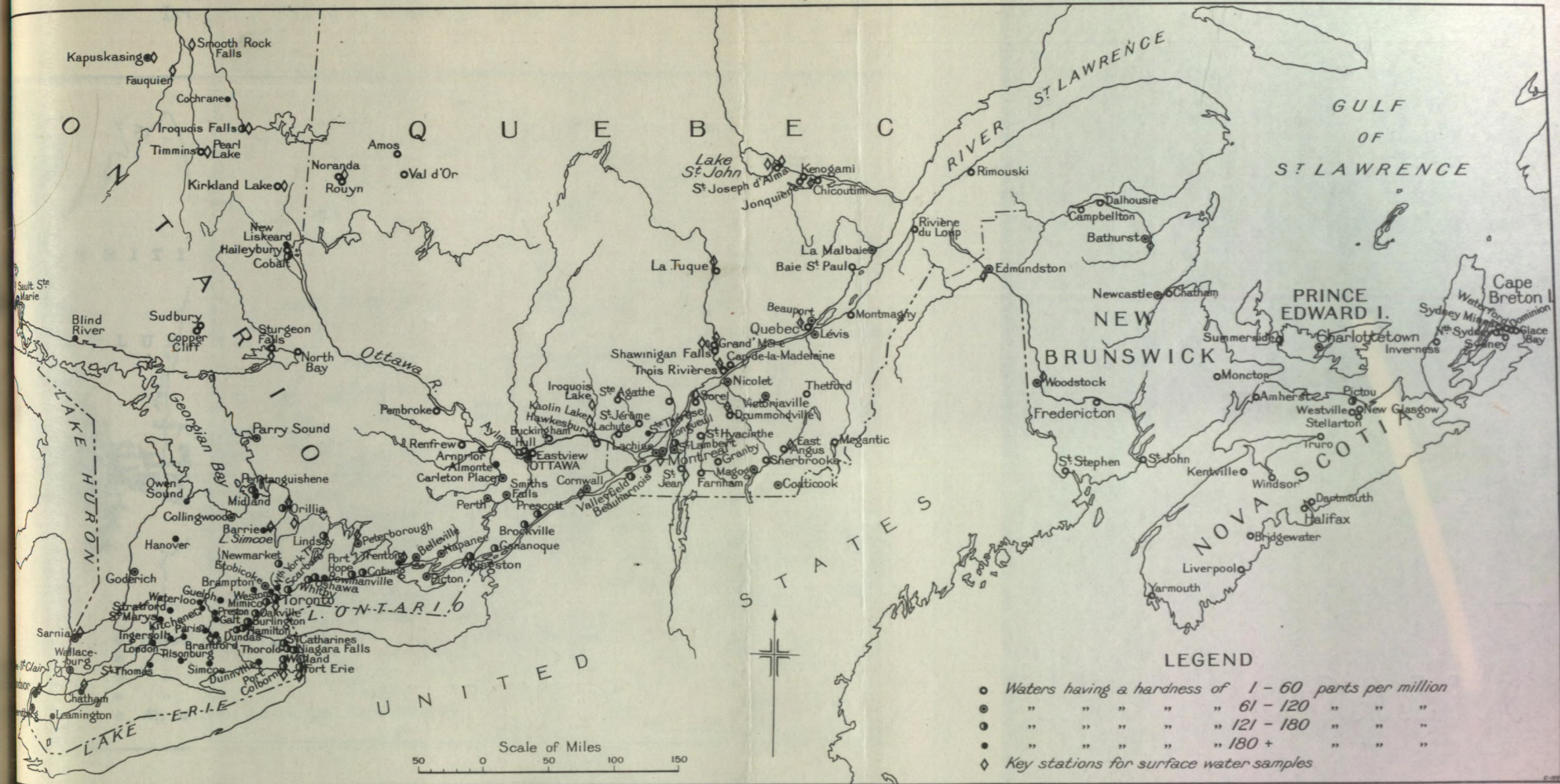


Fig. 2 Map of eastern Canada showing distribution of the larger civic water supplies according to hardness

Errata :

Cobalt - ● should be ○
 Iroquois Falls - ● should be ○

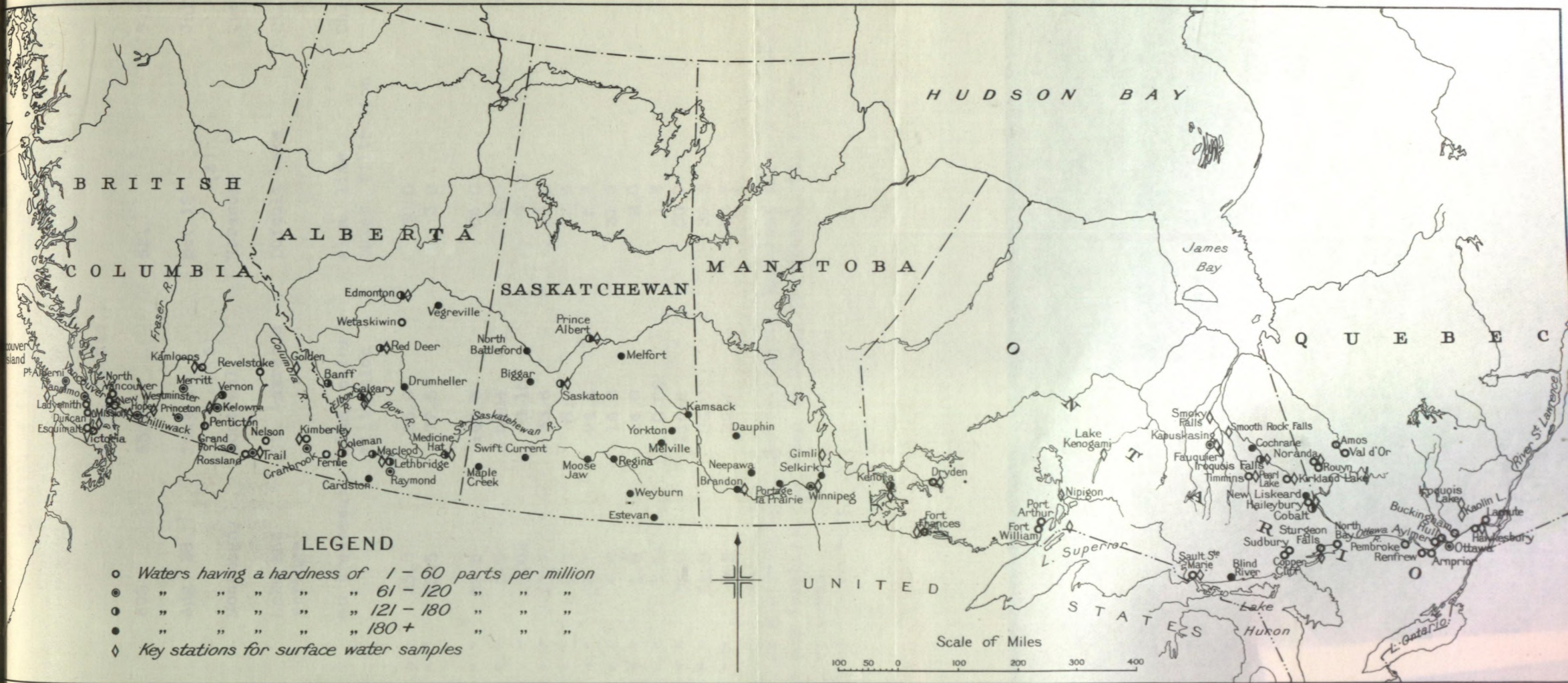


Fig. Map of ~~western~~ Canada showing distribution of the larger civic water supplies according to hardness

1939

Quebec (contd.)

Sample No.	698	653	621	712
Date sampled 1939	Aug. 28	July 19 (5)	May 18 (6)	July 22 (7)
Locality	Montmagny	Montreal	Noranda	Quebec
Source of Supply	Lake and springs	St. Lawrence	Dufault Lake	St. Charles River
Method of Purification	No treatment	Alum, chlor. filtration	Alum, lime chlor. filtration	Chlorination
Colour	p.p.m. 35.0	25.0	30.0	30.0
Alkalinity	" " " 23.5	77.5	3.0	7.5
Total dissolved solids dried at 110°C.	" " " 52.5	149.5	86.0	42.0
Silica (SiO ₂)	" " " 5.0	none	4.5	none
Iron (Fe)	" " " 0.08	0.15	0.19	0.20
Calcium (Ca)	" " " 10.7	33.6	15.7	4.8
Magnesium (Mg)	" " " 2.0	8.0	2.6	2.5
Hydrocarbonate (HCO ₃)	" " " 28.7	94.6	3.7	9.2
Sulphate (SO ₄)	" " " 7.0	16.0	31.0	9.0
Chloride (Cl)	" " " 1.5	14.0	2.0	1.5
Nitrate (NO ₃)	" " " 1.0	0.20	1.2	1.7
Total hardness as CaCO ₃	" " " 35.0	116.8	50.0	22.3
Calcium hardness	" " " 26.8	84.0	39.3	12.0
Magnesium hardness	" " " 8.2	32.8	10.7	10.3

(5) Supplies Montreal East, Montreal North, Montreal West, Mount Royal, Outremont, Point aux Trembles, St. Jean de Dieu, St. Michel, St. Pierre.

(6) Supplies Rouyn.

(7) Supplies Quebec West.

ANALYSIS OF CIVIC WATER SUPPLIES

1939

Quebec (contd.)

Sample No.	665	697	662	657	704
Date sampled 1939	July 27	Aug. 28	July 23	July 20	Aug. 30
Locality	Rimouski	Riviere du Loup	St. Joseph d'Alma	Shawinigan Falls ⁽⁸⁾	Sherbrooke
Source of Supply	Lake	Lac Municipal	Saguenay River	Lake and River	Magog River
Method of Purification	No treatment	No treatment	Chlorination	Alum, Lime chlorination, filtration.	Chlorination
Colour	p.p.m. 15.0	50.0	60.0	15.0	15.0
Alkalinity	" " " 44.5	9.5	10.0	13.0	34.0
Total dissolved solids dried at 110°C.	" " " 81.0	44.0	32.5	47.0	74.0
Silica (SiO ₂)	" " " 5.0	2.0	3.0	3.5	4.5
Iron (Fe)	" " " 0.05	0.15	0.20	0.11	0.03
Calcium (Ca)	" " " 12.1	5.7	5.0	13.6	17.8
Magnesium (Mg)	" " " 3.9	2.2	2.0	2.2	5.7
Hydrocarbonate (HCO ₃)	" " " 54.3	11.6	12.2	15.9	41.5
Sulphate (SO ₄)	" " " 5.3	4.9	4.5	9.9	9.5
Chloride (Cl)	" " " 3.0	1.0	0.5	0.5	1.0
Nitrate (NO ₃)	" " " 2.7	0.62	0.44	0.18	1.33
Total hardness as CaCO ₃	" " " 46.3	23.3	20.7	43.0	67.9
Calcium hardness	" " " 30.3	14.3	12.5	34.0	44.5
Magnesium hardness	" " " 16.0	9.0	8.2	9.0	23.4

(8) Supplies Baie de Shawinigan

ANALYSIS OF CIVIC WATER SUPPLIES

1939

Quebec (contd.)

Sample No.	700	658	622
Date sampled 1939	Aug. 28	July 30	May 20
Locality	Thetford Mines	Three Rivers	Val d'Or
Source of Supply	Wells	St. Maurice River	Spring
Method of Purification	No treatment	Chlor. Alum filtration	Intermittent chlorination
Colour	p.p.m. 25.0	30.0	5.0
Alkalinity	" " " 28.5	16.0	49.0
Total dissolved solids dried at 110°C.	" " " 56.0	56.5	30.0
Silica (SiO ₂)	" " " 1.5	3.5	11.0
Iron (Fe)	" " " 0.18	0.10	0.20
Calcium (Ca)	" " " 11.4	5.0	10.0
Magnesium (Mg)	" " " 3.5	2.4	2.4
Hydrocarbonate (HCO ₃)	" " " 34.8	19.5	59.8
Sulphate (SO ₄)	" " " 11.5	4.5	11.5
Chloride (Cl)	" " " 1.5	1.0	---
Nitrate (NO ₃)	" " " 1.0	0.18	---
Total hardness as CaCO ₃	" " " 42.9	22.3	34.8
Calcium hardness	" " " 8.5	12.5	25.0
Magnesium hardness	" " " 14.4	9.8	9.8

ANALYSIS OF CIVIC WATER SUPPLIES

1939

Ontario

Sample No.	618	625	627	624
Date sampled 1939	May 8	May 23	May 26	May 24
Locality	Cochrane	Cobalt	Copper Cliff	Haileybury
Source of Supply	Wells	Lake Sasaganiga	Meat Bird Lake	Lake Timiskaming
Method of Purification	No treatment	Chlorination	Chlorination	Alum, Chlor. filtration
Colour	p.p.m. 5.0	10.0	10.0	45.0
Alkalinity	" " " 305.0	42.5	none	3.5
Total dissolved solids dried at 110°C.	" " " 368.0	85.0	77.5	67.5
Silica (SiO ₂)	" " " 37.5	2.0	3.2	4.5
Iron (Fe)	" " " 1.67	0.20	0.50	0.45
Calcium (Ca)	" " " 95.0	2.3	8.6	7.4
Magnesium (Mg)	" " " 20.0	2.8	2.6	3.1
Hydrocarbonate (HCO ₃)	" " " 372.1	51.9	none	4.3
Sulphate (SO ₄)	" " " 21.4	18.5	48.1	21.4
Chloride (Cl)	" " " 7.0	1.5	1.0	3.0
Nitrate (NO ₃)	" " " 0.27	0.62	0.62	1.06
Total hardness as CaCO ₃	" " " 319.5	34.8	32.2	31.2
Calcium hardness	" " " 237.5	23.3	21.5	18.5
Magnesium hardness	" " " 82.0	11.5	10.7	12.7

ANALYSIS OF CIVIC WATER SUPPLIES

1939

Ontario (contd.)

Sample No.	617	619	623	629
Date sampled 1939	May 17	May 12	May 23	May 6
Locality	Iroquois Falls ⁽⁹⁾	Kapuskasing	Kirkland Lake	New Liskeard
Source of Supply	Abitibi River	Kapuskasing River	Gull Lake	Wells
Method of Purification	Alum, soda ash chlorination, filtration	Lime, chlorination, filtration	Chlorination	No treatment
Colour	p.p.m. none	5.0	40.0	10.0
Alkalinity	" " " 56.5	25.0	26.0	237.5
Total dissolved solids dried at 110°C.	" " " 143.0	174.0	84.0	364.0
Silica (SiO ₂)	" " " 4.0	6.0	3.5	12.5
Iron (Fe)	" " " 0.25	0.60	0.11	0.68
Calcium (Ca)	" " " 13.9	28.9	15.7	50.0
Magnesium (Mg)	" " " 3.7	8.2	3.7	37.1
Hydrocarbonate (HCO ₃)	" " " 68.9	30.5	31.7	289.8
Sulphate (SO ₄)	" " " 41.8	66.0	17.3	104.5
Chloride (Cl)	" " " 0.5	2.0	2.5	2.0
Nitrate (NO ₃)	" " " 0.44	0.44	1.33	3.54
Total hardness as CaCO ₃	" " " 49.0	105.9	54.5	277.5
Calcium hardness	" " " 33.8	72.3	39.3	125.0
Magnesium hardness	" " " 15.2	33.6	15.2	152.5

(9) Supplies Ansonville

ANALYSIS OF CIVIC WATER SUPPLIES

1939

Ontario (contd.)

Sample No.	626	707	630	714	625
Date sampled 1939	May 24	Dec. 30 (10)	June 30	Oct. 5	May 15 (11)
Locality	North Bay	Ottawa	Smiths Falls		Timmins
Source of Supply	Trout Lake	Ottawa River	Rideau River		Mattagami River
Method of Purification	Chlorination	Alum, filtr. lime	Filtration, Chlorination		Chlorination
Colour	p.p.m. 10.0	15.0	20.0	25.0	70.0
Alkalinity	" " " 7.5	19.0	75.0	65.0	15.0
Total dissolved solids dried at 110°C.	" " " 39.0	100.0	133.0	106.3	74.0
Silica (SiO ₂)	" " " 3.3	1.6	0.5	1.0	5.0
Iron (Fe)	" " " 0.20	0.10	0.04	0.06	0.12
Calcium (Ca)	" " " 5.7	8.8	28.3	25.0	7.9
Magnesium (Mg)	" " " 2.3	5.9	7.5	9.1	2.1
Hydrocarbonate (HCO ₃)	" " " 9.2	23.2	91.5	79.3	18.3
Sulphate (SO ₄)	" " " 18.5	24.7	18.0	15.0	21.4
Chloride (Cl)	" " " 2.5	1.0	1.0	1.0	5.0
Nitrate (NO ₃)	" " " 1.33	0.35	0.75	0.80	1.5
Total hardness as CaCO ₃	" " " 23.7	46.2	101.6	99.8	28.4
Calcium hardness	" " " 14.4	22.0	70.8	62.5	19.8
Magnesium hardness	" " " 9.4	24.2	30.8	37.3	8.6

(10) Supplies Eastview, Nepean Twp. and Rockliffe.

(11) Supplies Schumacher and Tisdale Twp.

Analyses of the Waters collected from the Moser River and

its Tributaries

No.	645	646	647	648
Date	Aug. 12	Aug. 12	Aug. 12	Aug. 12
Source	Mill Lake Brook	Moser River	Gold Mine Creek	West Brook
Locality		Moser River	Village, N. S.	
Sample collected	midstream	midstream	midstream	midstream
Gauge	low	low	low	low
Temperature	26°C.	25°C.	20°C.	23°C.
pH	6.1	6.7	6.0	6.5
Dissolved oxygen cc. per litre	5.2	6.3	5.3	5.3
Free carbonic acid CO ₂	3.0	2.0	5.0	5.0
Turbidity	none	none	none	none
Colour	25.0	60.0	65.0	65.0
Alkalinity	0.5	1.0	none	0.5
Suspended matter	3.0	1.8	none	0.6
Total dissolved solids dried at 180°C.	41.0	32.6	52.4	40.3
Silica (SiO ₂)	2.6	2.6	1.7	2.9
Iron (Fe)	0.20	0.15	0.12	.12
Calcium (Ca)	7.8	4.3	4.3	4.3
Magnesium (Mg)	4.7	3.3	4.2	4.9
Alkalies as Sodium (Na)	6.4	4.9	6.4	7.4
Hydrocarbonate (HCO ₃)	0.6	1.2	none	0.6
Sulphate (SO ₄)	5.2	5.7	5.7	5.0
Chloride (Cl)	10.0	4.5	8.5	7.5
Nitrate (NO ₃)	0.44	0.44	0.80	0.35
Phosphate (PO ₄)	.80	.60	.82	1.32
Hardness as CaCO ₃ calculated:				
Total hardness	38.8	24.3	28.0	30.9
Carbonate hardness	0.5	1.0	none	0.5
Noncarbonate hardness	38.3	23.3	28.0	30.4
Calcium hardness	19.5	10.8	10.8	10.8

Sea water

Sample no.	Date of sampling	Locality	Samples collected	Specific gravity at 20°C.	Total solids in solution at 180°C.	Bromine
					grams per litre	
4976	Aug. 4 - 1939	Bay of Fundy	Midway between St. John, N.B. and Digby, N.S.	1.0242	32.918	0.060
4977	Aug. 7 - 1939	St. Mary Bay, N.S.	Midway 2 miles from head of bay	1.0239	32.458	0.059
4978	Aug. 9 - 1939	Lunenburg, N.S.	3 miles at sea	1.0232	31.426	0.057
4979	Aug. 20 - 1939	Northumberland Strait	Midway between Cape Tormentine, N.B. and Borden, P.E.I.	1.0224	30.024	0.054
4980	July 27 - 1938	Strait of Juan de Fuca	Midway, Port Townsend and Victoria, B.C.	1.0229	30.964	0.057
673	Nov. 15 - 1939	Moncton, N.B.	Midstream, Petitcodiac River opposite mouth of Weldon Creek	1.0220	29.775	0.053

Analysed by: R. A. Rogers.

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Analysed by: R. A. Rogers.