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Memorandum Series

September 1939

Number 72

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INDUSTRIAL WATERS IN CANADA

Interim Report No. 4.

by

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Contents

	Page
Introductory.....	1
Analysis of Surface Waters.....	6
Analysis of Civic Water Supplies	
Quebec.....	17
Ontario.....	18
Manitoba.....	25
Saskatchewan.....	27
Alberta.....	29
British Columbia.....	32

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INDUSTRIAL WATERS OF CANADA

Interim Report #4.

Three interim reports on the Industrial Waters of Canada have been issued, the first in 1936 which includes the work completed during the years 1934 and 1935, embracing the quality of the natural and treated waters of the province of Ontario, south of the Ottawa River, and Georgian Bay and of the province of Quebec as far east as Riviere du Loup. The second covers the work of 1936 when the whole of the Eastern Canada, east of Sault Ste. Marie was completed, except for the mining and industrial areas north of the Ottawa River and Lake Nipissing. Part of the previous year's work was repeated in order to determine seasonal and periodical variations in quality of these waters. A map showed the distribution of the hardness of the water for supplies from cities and towns of 3,000 inhabitants and over. No. 3 Interim Report extends the investigation as far west as the Columbia River, British Columbia, the northern mining areas in Ontario and Quebec and the industrial area on the Abitibi and Mattagami Rivers and tributaries as far north as Smoky Falls.

These three reports besides giving tabulated analyses of natural and treated waters, discuss the general character of waters, outline the methods of chemical analysis used, furnish tabulations and diagrams compiled from data of public water supplies, and correlate the results with the requirements of purity of waters used in certain industries, as well as the deleterious effect of impurities in some Canadian waters in certain manufacturing processes.

The present report follows the same general trend. It deals with the quality of the surface waters and civic water supplies in western Canada, including British Columbia, and continues the survey of the Ontario arteries and lakes of the Great Lakes watershed from Cornwall on the St. Lawrence to Port Arthur on Lake Superior, to ascertain seasonal and periodical variations in their composition as well as the changes in quality of the civic water supplies.

During 1938, 44 samples of surface waters were collected at the key stations on the large lakes and rivers that are of industrial importance and complete analyses have been made. Civic waters were sampled from 80 supplies. Previously these were analysed for total hardness, calcium, magnesium hardness, and alkalinity, the information being tabulated and plotted on a hardness map, but frequent demands for more complete analyses of these supplies has led this year to the adoption of the following extra determinations, colour, total dissolved solids dried at 110°C., silica, iron, bicarbonate, sulphate, chloride and nitrate.

Of the surface waters investigated in 1938, those from Ontario taken at the freshet from the Great Lakes water shed, were sampled at key stations at Kingston, Toronto, Windsor, Brantford and Chatham, all at high gauge, show uniform decrease in concentration and lower values in most constituents as compared with the previous years' mean gauge and 1938 low gauge. This was to be expected at a spring run-off. In 1938 this occurred early in the season, very suddenly and with unseasonably high temperature. The greatest discrepancies in concentration and composition were found in samples from the lesser

3.

rivers, the Grand and the Thames, in all constituents but especially in alkalies and chlorides, which gave the lowest values thus far recorded in the Industrial Waters Investigation for these rivers. The Ottawa River water varies too often and too much in quality for any conclusions to be drawn from its changes in composition. Lake Superior water shows an increase in concentration at low gauge as compared with the sample taken at mean gauge two months earlier. There is no appreciable change in composition of the waters of the Lake of the Woods judging from samples taken two months apart, other than what is to be expected seasonally from a smaller body of water being more susceptible to concentration, but the water is of decidedly higher concentration than in 1937. The suggestion in Interim Report No. 3, that its analysis except for colour is almost identical with that of Lake Superior near Port Arthur, does not appear permanently true and this year's investigation would classify them as waters of distinctly separate type.

Regarding the western waters, it was suggested in the 1937 report in the absence of previous official records of analyses that the prolonged drought in the Prairie provinces might have affected their quality and the analyses made then might represent abnormally high concentration. Judging from this year's investigation, this appears not to be the case. The Red River and the Assiniboine River, which gave the highest content of dissolved solids of the western surface waters investigated, show no marked dilution except for chlorides, especially the Red River water, otherwise the two samples taken two months apart, differ only as might be expected seasonally,

and the same may be said of the other large arteries, the two Saskatchewan, the Bow, Elbow, Red Deer and Columbia Rivers. The British Columbia rivers apart from the Columbia and Fraser Rivers are not represented by previous official analyses wherefore comparison is impossible. Columbia River at Golden shows somewhat higher concentration for 1938 than for 1937. Of the two samples taken in July the analysis for the Trail key station sample shows less concentration than that from Golden, although the latter is about 400 miles up river. The dilution may be due to appreciable inflow of glacial water during the summer season. Systematic sampling and analysis of the Fraser River were made by the Department of Mines for each month of the year 1909, and reveal large variation in concentration as well as in composition. Of the two samples taken at Hope and Mission in July, 1938, the analysis of the former shows abnormally high content of alkali and chloride as compared with any previous record, and is not likely to represent the normal composition of that water. A second sample was therefore taken at the same key station in December, and yielded on analysis very low content of chloride and alkali, indeed considerably lower than any of our 1909 records. On the whole the 1909 records of analyses except for the minimum low gauge water for April 26 - May 23, show appreciably lower concentration than the 1938 analysis. Analyses of the samples taken at Hope and Mission are not comparable as many tributaries enter the Fraser River between these two places.

5.

The civic water supplies of the Prairie Provinces are mostly drawn from reservoirs, smaller lakes, rivers and wells. Contrary to expectation, of the 22 supplies examined, 14 showed on analysis, higher total hardness and 8 lower hardness than for 1937. The average hardness was 260 p.p.m. for 1937 as compared with 276.5 p.p.m. for 1938. Increase appeared to be greatest in the ground waters and it may be that precipitation during 1938 had not penetrated to a depth of the ground water to cause dilution.

The British Columbia civic waters are on the whole very good, low in colour and most of them can be distributed to the consumers without previous treatment.

ANALYSIS OF SURFACE WATERS

Sample No.	594	484	595	485
Date of sampling	Dec. 19	Mar. 21	Dec. 19	Mar. 22
Source	St. Lawrence River	St. Lawrence River	St. Lawrence River	Lake Ont.
Locality	Cornwall	Kingston	Kingston	Toronto
Sample collected	Depth sample above Howard Smith Mill	Depth sample 20' .1 mile from shore opposite Water Works	Depth sample at Water Works	Depth 70' at Toronto Island Water Works
Gauge	low	high	low	high
Temperature	6.5 ^o C.	2.0 ^o C.	4.5 ^o C.	1.0 ^o C.
pH	8.2	8.0	8.2	7.8
Dissolved oxygen cc. per litre	8.0	9.0	8.0	9.2
Free carbonic acid (CO ₂)	p.p.m. none	none	none	none
Turbidity	" " " none	none	none	none
Colour	" " " none	none	none	none
Alkalinity	" " " 92.0	91.5	91.5	91.5
Suspended matter	" " " 2.2	3.0	1.0	4.5
Total dissolved solids dried at 180 C.	" " " 162.4	157.5	162.9	154.5
Silica (SiO ₂)	" " " 1.3	1.6	3.5	1.7
Iron (Fe)	" " " 0.06	.07	0.06	.07
Calcium (Ca)	" " " 37.7	38.3	38.6	36.1
Magnesium (Mg)	" " " 8.7	9.0	8.8	8.0
Alkalies as sodium (Na)	" " " 10.4	7.1	10.0	8.1
Hydrocarbonate (HCO ₃)	" " " 112.2	111.6	111.6	111.6
Sulphate (SO ₄)	" " " 20.0	22.3	20.2	20.2
Chloride (Cl)	" " " 17.0	16.5	17.5	15.0
Nitrate (NO ₃)	" " " none	.35	none	.40
Hardness as CaCO calculated				
Total hardness	" " " 130.4	132.7	133.6	123.1
Carbonate hardness	" " " 92.0	91.5	91.5	91.5
Noncarbonate hardness	" " " 38.4	41.2	42.1	31.6
Calcium hardness	" " " 94.3	95.8	96.5	90.3
Magnesium hardness	" " " 35.7	36.9	36.1	32.8

ANALYSIS OF SURFACE WATERS

Sample No.	596	598	486	597
Date of sampling	Dec. 20	Dec. 21	Mar. 23	Dec. 21
Source	Lake Ontario	Lake Erie	Grand River	Grand River
Locality	Toronto	Fort Erie	Brantford	Brantford
Sample collected	Intake pipe Toronto Works 90' depth	Midstream on Niagara River depth sample 20'	Depth sample 6' 1 mile above Water Works	Depth sample 6' midstream 1 mile above city
Gauge	low	low	high	low
Temperature	4.5 ^o C.	3.0 ^o C.	1.0 ^o C.	4.5 ^o C.
pH	7.7	8.0	7.7	7.8
Dissolved oxygen cc. per litre	8.0	8.4	8.4	7.2
Free carbonic acid (CO ₂)	p.p.m. none	none	none	none
Turbidity	" " " none	15.0	300.0	none
Colour	" " " none	10.0	15.0	20.0
Alkalinity	" " " 93.5	98.5	164.0	240.0
Suspended matter	" " " 1.4	17.4	201.6	2.0
Total dissolved solids dried at 180 ^o C.	" " " 164.0	164.9	271.9	476.7
Silica (SiO ₂)	" " " 4.0	2.5	5.4	6.7
Iron (Fe)	" " " 0.07	0.03	.07	0.09
Calcium (Ca)	" " " 40.0	39.3	65.9	104.7
Magnesium (Mg)	" " " 8.9	10.0	15.0	28.1
Alkalies as sodium (Na)	" " " 9.6	10.3	8.3	27.6
Hydrocarbonate (HCO ₃)	" " " 114.1	120.0	200.1	292.8
Sulphate (SO ₄)	" " " 21.2	23.0	49.8	138.0
Chloride (Cl)	" " " 17.0	16.0	7.0	18.3
Nitrate (NO ₃)	" " " 0.2	2.0	1.56	0.1
Hardness as CaCO calculated				
Total hardness	" " " 136.5	139.3	226.5	377.0
Carbonate hardness	" " " 93.5	98.5	164.0	240.0
Noncarbonate hardness	" " " 43.0	40.8	62.5	137.0
Calcium hardness	" " " 100.0	98.3	164.8	261.8
Magnesium hardness	" " " 36.5	41.0	61.5	115.2

ANALYSIS OF SURFACE WATERS

Sample No.	487	488	496	583
Date of sampling	Mar.24	Mar.25	June 18	Oct. 6
Source	Detroit River	Thames River	Ottawa River	
Locality	Windsor	Chatham	Hawkesbury	
Sample collected	Intake pipe Windsor Water Works	Depth sample 10' midstream at Water Works	Depth sample at 15' midstream above pulp mill	

Gauge	high	high	above mean	mean
Temperature	18.0°C.	10.0°C.	15.8°C.	12.0°C.
pH	7.7	7.6	6.8	6.9
Dissolved oxygen cc. per litre	8.0	7.8	6.2	7.9
Free carbonic acid (CO ₂)	p.p.m. none	none	3.0	1.5
Turbidity	" " " 30.0	308.0	10.0	80.0
Colour	" " " 25.0	90.0	50.0	70.0
Alkalinity	" " " 79.0	163.0	16.0	21.0
Suspended matter	" " " 25.4	207.0	14.0	118.9
Total dissolved solids dried at 180°C.	" " " 113.0	282.0	54.4	66.6
Silica (SiO ₂)	" " " 5.9	6.4	7.8	5.7
Iron (Fe)	" " " .24	.48	.28	.40
Calcium (Ca)	" " " 26.1	65.0	10.7	10.7
Magnesium (Mg)	" " " 7.7	13.3	3.6	3.6
Alkalies as sodium (Na)	" " " 3.1	4.9	4.2	3.4
Hydrocarbonate (HCO ₃)	" " " 96.4	198.9	19.5	25.6
Sulphate	" " " 11.8	34.2	6.2	8.3
Chloride	" " " 4.5	4.5	1.5	1.0
Nitrate	" " " .27	3.5	.44	.62
Hardness as CaCO calculated:				
Total hardness	" " " 97.9	217.0	41.6	41.5
Carbonate hardness	" " " 79.0	163.0	16.0	21.0
Noncarbonate hardness	" " " 18.9	54.0	25.2	20.2
Calcium hardness	" " " 65.3	162.5	26.8	26.8
Magnesium hardness	" " " 31.6	54.5	14.8	14.8

ANALYSIS OF SURFACE WATERS

Sample No.	555	556	557	558
Date of sampling	June 17	Aug. 25	June 19	Aug. 21
Source	Lake Nipissing		Lake Superior	
Locality	Sturgeon Falls		Sault Ste. Marie	
Sample collected	2 miles from shore. Depth sample 25'		Intake pipe City Water Works	

	mean	mean	mean	low
Gauge Temperature	21.0 ^o C.	22.0 ^o C.	18.0 ^o C.	20.0 ^o C.
pH	6.9	7.0	7.1	7.5
Dissolved oxygen cc. per litre	6.1	6.7	6.2	6.5
Free carbonic acid (CO ₂)	p.p.m. 2.0	1.0	1.0	none
Turbidity	p.p.m. 11.0	12.0	none	5.0
Colour	p.p.m. 35.0	25.0	none	none
Alkalinity	p.p.m. 14.5	16.5	40.0	44.0
Suspended matter	p.p.m. 7.8	6.0	2.0	3.7
Total dissolved solids dried at 180 ^o C.	p.p.m. 54.0	51.2	63.2	65.4
Silica (SiO ₂)	" " " 5.7	2.7	5.6	9.8
Iron (Fe)	" " " 0.11	0.08	0.07	0.08
Calcium (Ca)	" " " 10.0	9.0	13.9	15.0
Magnesium (Mg)	" " " 2.9	3.3	3.5	4.4
Alkalies as sodium (Na)	" " " 2.5	4.6	2.0	4.2
Hydrocarbonate (HCO ₃)	" " " 17.7	20.1	48.4	53.7
Sulphate	" " " 16.4	11.3	7.5	4.7
Chloride	" " " 1.0	1.5	1.5	2.3
Nitrate	" " " 0.17	0.17	0.08	0.08
Hardness as CaCO calculated:				
Total hardness	" " " 36.9	36.0	49.0	55.5
Carbonate hardness	" " " 14.5	16.5	40.0	44.0
Noncarbonate hardness	" " " 22.4	19.5	9.0	11.5
Calcium hardness	" " " 25.0	22.5	34.8	37.5
Magnesium hardness	" " " 11.9	13.5	14.2	18.0

ANALYSIS OF SURFACE WATERS

Sample No.	559	560	561	562
Date of sampling	Aug. 19	June 21	June 22	Aug. 18
Source	Lake Superior	Rainy River		Lake of the Woods
Locality		Fort Francis		Kenora
Sample collected	20' depth from steamer 25 miles east of Port Arthur	Intake pipe at Fort Francis pulp mill		Depth sample 10' 2 miles from town
Gauge	low	high	high	mean
Temperature	13.0°C.	20.0°C.	20.0°C.	22.0°C.
pH	7.4	7.1	7.4	7.1
Dissolved oxygen cc. per litre	7.5	6.7	6.6	6.2
Free carbonic acid (CO ₂)	p.p.m. none	1.5	none	none
Turbidity	" " " none	7.0	8.0	10.0
Colour	" " " none	45.0	40.0	40.0
Alkalinity	" " " 38.5	15.0	44.0	43.5
Suspended matter	" " " 1.7	5.1	5.0	4.2
Total dissolved solids dried at 180°C.	" " " 68.0	58.3	98.0	108.2
Silica (SiO ₂)	" " " 8.0	4.7	4.4	12.1
Iron (Fe)	" " " 0.06	0.15	0.12	0.28
Calcium (Ca)	" " " 14.3	7.5	17.9	20.0
Magnesium (Mg)	" " " 4.6	3.1	6.3	5.5
Alkalies as sodium (Na)	" " " 2.9	3.9	4.1	3.1
Hydrocarbonate (HCO ₃)	" " " 47.0	18.3	53.7	53.1
Sulphate	" " " 4.3	7.4	11.3	10.9
Chloride	" " " 1.8	1.5	1.2	1.5
Nitrate	" " " 0.17	1.33	0.80	1.33
Hardness as CaCO calculated:				
Total hardness	" " " 54.7	31.5	70.6	72.6
Carbonate hardness	" " " 38.5	15.0	44.0	43.5
Noncarbonate hardness	" " " 16.2	16.5	26.6	29.1
Calcium hardness	" " " 35.8	18.8	44.8	50.0
Magnesium hardness	" " " 18.9	12.7	25.8	22.6

ANALYSIS OF SURFACE WATERS

Sample No.	563	564	565	566
Date of sampling	Aug. 20	Aug. 7	June 29	Aug. 8
Source	Wahigoon River	Old Man River	South Saskatchewan River	
Locality	Dryden	Lethbridge	Saskatoon	Medicine Hat
Sample Collected	Intake pipe in pulp mill	midstream 10' depth	Intake pipe City Water Works	Midstream at Water Works 10'
Gauge	mean	mean	4' above mean	low
Temperature	22.0°C.	18.0°C.	20.0°C.	23.0°C.
pH	7.1	8.2	8.2	8.2
Dissolved oxygen cc. per litre	6.3	6.2	6.7	6.0
Free carbonic acid (CO ₂)	p.p.m. none	none	none	none
Turbidity	" " " 10.0	12.0	250.0	20.0
Colour	" " " 40.0	none	10.0	10.0
Alkalinity	" " " 43.5	124.0	106.5	109.5
Suspended matter	" " " 4.2	4.8	261.0	28.2
Total dissolved solids dried at 180°C.	" " " 108.2	163.2	160.0	161.3
Silica (SiO ₂)	" " " 12.1	2.0	6.9	3.2
Iron (Fe)	" " " 0.88	0.54	0.35	0.05
Calcium (Ca)	" " " 20.0	37.2	36.8	37.5
Magnesium (Mg)	" " " 5.5	13.4	11.1	12.9
Alkalies as sodium (Na)	" " " 3.1	9.6	8.0	7.7
Hydrocarbonate (HCO ₃)	" " " 53.1	147.9	129.6	133.6
Sulphate (SO ₄)	" " " 10.9	22.2	33.9	30.5
Chloride (Cl)	" " " 1.5	1.0	1.5	1.0
Nitrate (NO ₃)	" " " 1.33	0.27	1.06	0.44
Hardness as CaCO calculated:				
Total hardness	" " " 72.6	147.9	137.5	146.7
Carbonate hardness	" " " 43.5	124.0	106.5	109.5
Noncarbonate hardness	" " " 29.1	23.9	31.0	37.2
Calcium hardness	" " " 50.0	93.0	92.0	93.8
Magnesium hardness	" " " 22.6	54.9	45.5	52.9

ANALYSIS OF SURFACE WATERS

Sample No.	567	568	569	570
Date of sampling	June 27	July 2	June 22	Aug. 16
Source	North Saskatchewan River		Red River	
Locality	Prince Albert	Edmonton	Winnipeg	
Sample Collected	Intake Pipe City Water Works		midstream 6 miles above city 15' depth	
Gauge	high	high	mean	mean
Temperature	19.0°C.	18.0°C.	24.0°C.	23.0°C.
pH	8.3	8.2	8.3	8.0
Dissolved oxygen cc. per litre	6.8	6.0	6.3	5.8
Free carbonic acid (CO ₂)	p.p.m. none	none	none	none
Turbidity	" " " 250.0	200.0	24.0	58.0
Colour	" " " 10.0	5.0	80.0	50.0
Alkalinity	" " " 103.5	91.5	210.0	197.0
Suspended matter	" " " 384.4	165.0	35.7	62.9
Total dissolved solids dried at 180°C.	" " " 172.7	137.1	644.1	610.0
Silica (SiO ₂)	" " " 9.8	4.3	8.1	17.5
Iron (Fe)	" " " 0.12	0.07	0.05	0.12
Calcium (Ca)	" " " 37.9	35.4	113.6	92.9
Magnesium (Mg)	" " " 12.6	10.3	42.5	38.3
Alkalies as sodium (Na)	" " " 8.2	6.4	29.7	51.6
Hydrocarbonate (HCO ₃)	" " " 126.3	111.6	245.0	240.3
Sulphate (SO ₄)	" " " 29.4	25.7	221.7	185.5
Chloride (Cl)	" " " 1.5	1.5	18.6	49.0
Nitrate (NO ₃)	" " " 0.44	0.53	1.33	2.21
Hardness as CaCO calculated:				
Total hardness	" " " 146.5	130.7	458.3	389.3
Carbonate hardness	" " " 103.5	91.5	210.0	197.0
Noncarbonate hardness	" " " 43.0	39.2	248.3	192.3
Calcium hardness	" " " 94.8	88.5	284.0	232.3
Magnesium hardness	" " " 51.7	42.2	174.3	157.0

ANALYSIS OF SURFACE WATERS

Sample No.	571	572	573	574
Date of sampling	Aug. 14	July 4	July 6	July 6
Source	Assiniboine River	Red Deer River	Elbow River	Bow River
Locality	Brandon	Red Deer	Calgary	Calgary
Sample collected	midstream 6' depth	intake pipe City Water Works	midstream at old pumping station 6' depth	intake pipe City Water Works
Gauge	high	above mean	high	high
Temperature	20.0°C.	21.0°C.	15.0°C.	15.0°C.
pH	8.3	8.0	8.4	8.3
Dissolved oxygen cc. per litre	6.1	6.2	6.3	6.4
Free carbonic acid (CO ₂)	p.p.m. none	none	none	none
Turbidity	" " " 25.0	400.0	63.0	26.0
Colour	" " " 25.0	25.0	5.0	5.0
Alkalinity	" " " 213.5	118.0	118.0	97.0
Suspended matter	" " " 27.0	372.0	56.0	35.0
Total dissolved solids dried at 180°C.	" " " 631.6	174.4	174.0	137.0
Silica (SiO ₂)	" " " 18.9	10.2	4.9	4.2
Iron (Fe)	" " " 0.06	0.34	0.10	0.06
Calcium (Ca)	" " " 86.1	38.5	45.0	36.5
Magnesium (Mg)	" " " 44.0	11.9	12.3	11.1
Alkalies as sodium (Na)	" " " 48.2	8.9	5.5	5.1
Hydrocarbonate (HCO ₃)	" " " 260.5	144.0	144.0	118.3
Sulphate (SO ₄)	" " " 228.5	21.6	30.7	20.4
Chloride (Cl)	" " " 11.3	1.2	1.5	1.5
Nitrate (NO ₃)	" " " 0.62	1.06	0.53	0.44
Hardness as CaCO calculated:				
Total hardness	" " " 396.9	145.1	162.9	136.8
Carbonate hardness	" " " 213.5	118.0	118.0	97.0
Noncarbonate hardness	" " " 193.4	27.1	44.9	39.8
Calcium hardness	" " " 215.3	96.3	112.5	91.3
Magnesium hardness	" " " 181.6	48.8	50.4	45.6

ANALYSIS OF SURFACE WATERS

Sample No.	575	576	577	578
Date of sampling	July 10	July 29	July 12	July 26
Source	Columbia River		Okanagan Valley	Fraser River
Locality	Golden	Trail	Kelowna	Hope
Sample collected	Midstream 12' depth	Midstream 12' depth	Midlake 25' depth	Midstream 15' depth
Gauge	high	high	mean	mean
Temperature	19.0°C.	19.0°C.	18.0°C.	17.0°C.
pH	7.6	7.4	8.0	7.7
Dissolved oxygen cc. per litre	6.4	6.7	6.7	7.8
Free carbonic acid (CO ₂)	p.p.m. none	none	none	none
Turbidity	" " " 15.0	" " " 11.0	" " " 14.0	" " " 100.0
Colour	" " " 5.0	" " " 5.0	" " " none	" " " 5.0
Alkalinity	" " " 60.7	" " " 52.0	" " " 95.5	" " " 43.0
Suspended matter	" " " 21.5	" " " 4.8	" " " 10.6	" " " 84.1
Total dissolved solids dried at 180°C.	" " " 95.1	" " " 76.3	" " " 146.6	" " " 438.3
Silica (SiO ₂)	" " " 5.0	" " " 5.3	" " " 10.6	" " " 3.8
Iron (Fe)	" " " 0.06	" " " 0.05	" " " 0.05	" " " 0.03
Calcium (Ca)	" " " 23.0	" " " 19.3	" " " 30.4	" " " 17.9
Magnesium (Mg)	" " " 8.8	" " " 4.4	" " " 9.0	" " " 15.0
Alkalies as sodium (Na)	" " " 3.9	" " " 4.2	" " " 12.2	" " " 110.2
Hydrocarbonate (HCO ₃)	" " " 74.1	" " " 63.4	" " " 116.5	" " " 52.2
Sulphate (SO ₄)	" " " 16.1	" " " 8.9	" " " 19.2	" " " 33.4
Chloride (Cl)	" " " 1.5	" " " 1.1	" " " 1.3	" " " 186.2
Nitrate (NO ₃)	" " " 0.53	" " " 0.62	" " " 0.27	" " " 0.17
Hardness as CaCO calculated:				
Total hardness	" " " 93.5	" " " 66.3	" " " 112.9	" " " 105.5
Carbonate hardness	" " " 60.7	" " " 52.0	" " " 95.9	" " " 43.0
Noncarbonate hardness	" " " 32.8	" " " 14.3	" " " 17.0	" " " 62.5
Calcium hardness	" " " 57.5	" " " 48.3	" " " 76.0	" " " 44.8
Magnesium hardness	" " " 36.0	" " " 18.0	" " " 36.9	" " " 61.5

ANALYSIS OF SURFACE WATERS

Sample No.	586	587	579	580
Date of sampling	Dec. 4	July 26	July 27	Aug. 4
Source	Fraser River	Fraser River	Thompson River	Mark Creek
Locality	Hope	Mission	Kamloops	Kimberley
Sample collected	Midstream 15' depth	Midstream 15' depth	Bridge near outlet of lake 15' depth	Intake pipe C.M.S. Co.
Gauge	low	mean	mean	mean
Temperature	4.0°C.	16.5°C.	22.0°C.	13.0°C.
pH	7.1	7.5	7.4	7.1
Dissolved oxygen cc. per litre	---	6.8	6.7	7.0
Free carbonic acid (CO ₂)	p.p.m. none	none	none	none
Turbidity	" " " 5.0	80.0	16.0	7.0
Colour	" " " 15.0	5.0	none	10.0
Alkalinity	" " " 50.0	40.0	29.5	13.3
Suspended matter	" " " 5.4	100.0	15.3	1.2
Total dissolved solids dried at 180°C.	" " " 83.1	71.3	63.9	36.0
Silica (SiO ₂)	" " " 7.3	4.5	5.6	6.4
Iron (Fe)	" " " .07	0.08	0.03	0.06
Calcium (Ca)	" " " 19.8	14.2	7.9	8.0
Magnesium (Mg)	" " " 4.5	3.5	2.6	2.5
Alkalies as sodium (Na)	" " " 1.9	4.5	4.7	4.2
Hydrocarbonate (HCO ₃)	" " " 61.0	48.4	36.0	16.2
Sulphate (SO ₄)	" " " 10.0	14.8	6.4	5.2
Chloride (Cl)	" " " 1.5	3.5	5.5	1.2
Nitrate (NO ₃)	" " " none	0.20	0.44	0.44
Hardness as CaCO calculated:				
Total hardness	" " " 68.0	49.9	30.5	30.2
Carbonate hardness	" " " 50.0	40.0	29.5	13.3
Noncarbonate hardness	" " " 18.0	9.9	1.0	16.9
Calcium hardness	" " " 49.5	35.5	19.8	20.0
Magnesium hardness	" " " 18.5	14.4	10.7	10.2

ANALYSIS OF SURFACE WATERS

Sample No.	581	582	584	585
Date of sampling	July 27	July 19	Oct. 7	Nov. 11
Source	Strait of Juan de Fuca	Barkley Sound	China Clay Lake	Iroquois Lake
Locality	midway Port Townsend and Victoria	Port Alberni	Canada China Clay Ltd. Mill near St. Remi	Canada China Clay Ltd. Mill near St. Remi
Sample collected	taken from stream 20' depth	at buoy seaward 25' depth	at wharf 6' depth	at widest part of lake 6' depth
Gauge	mean	mean	mean	mean
Temperature	12.0 ^o C.	11.5 ^o C.	12.0 ^o C.	11.0 ^o C.
pH	8.5	8.5	6.9	7.0
Dissolved oxygen cc. per litre	8.2	8.0	7.4	7.9
Free carbonic acid (CO ₂)	none	none	none	none
Turbidity	10.0	11.0	60.0	none
Colour	none	none	50.0	10.0
Alkalinity	102.0	105.0	18.0	4.3
Suspended matter	1.6	4.4	52.0	.4
Total dissolved solids dried at 180 ^o C.	30,964.0	31,108.0	70.0	27.2
Silica (SiO ₂)	17.0	8.0	8.1	0.8
Iron (Fe)	0.04	0.03	1.0	0.03
Calcium (Ca)	200.0	211.5	7.9	5.0
Magnesium (Mg)	575.3	573.2	4.0	2.0
Alkalies as sodium (Na)	11,478.9 10,936.5	11,495.9 10,979.8	4.4	4.6
Hydrocarbonate (HCO ₃)	124.0	128.1	20.2	5.2
Sulphate (SO ₄)	1,113.8	1,113.8	9.5	4.5
Chloride (Cl)	17,676.9 18,000.3	17,727.8 18,068.0	1.5	1.1
Nitrate (NO ₃)	-----	-----	0.80	0.09
Hardness as CaCO calculated:				
Total hardness	2,858.7	2,878.9	36.2	20.5
Carbonate hardness	102.0	105.0	18.0	4.3
Noncarbonate hardness	2,756.7	2,773.9	18.2	16.2
Calcium hardness	500.0	528.8	19.8	12.5
Magnesium hardness	2,358.7	2,350.1	16.4	8.0

ANALYSIS OF CIVIC WATER SUPPLIES

1938

Quebec

Sample No.	590	605	588
Date sampled 1938	June 16	Oct. 10	Oct. 6
Locality	Aylmer,	Hull	Lachute
Source of Supply	Ottawa River	Ottawa River	St. John Lake 2 miles below from stream
Method of Purification	Chlorination	Chlorination	No treatment
Colour	80.0	60.0	50.0
Alkalinity	4.5	21.0	9.5
Total dissolved solids, dried at 110°C.	50.0	75.0	44.0
Silica (SiO ₂)	2.5	7.0	3.0
Iron (Fe)	0.07	0.06	0.25
Calcium (Ca)	7.8	11.0	7.9
Magnesium (Mg)	3.7	3.2	3.5
Hydrocarbonate (HCO ₃)	5.4	25.6	11.6
Sulphate (SO ₄)	4.9	26.0	12.8
Chloride (Cl)	2.0	7.5	2.0
Nitrate (NO ₃)	2.0	1.0	3.0
Total hardness as CaCO ₃	34.7	40.6	34.2
Calcium hardness	19.5	27.5	19.8
Magnesium hardness	15.2	13.1	14.4

ANALYSIS OF CIVIC WATER SUPPLIES

ONTARIO

Sample No.	551	494	592	490
Date sampled 1938	Aug. 26	Mar. 24	Dec. 21	Mar. 21
Locality	Arnprior	Brantford		Chatham
Source of supply	Madawaska River	Grand River		Thames River
Method of purification	Filtr. Chlor.	Coag. Filtr. Chlor.		Double Coag. Filtr. Double Chlor.
Colour	p.p.m. 40.0	10.0	20.0	15.0
Alkalinity	" " " 37.0	177.0	250.0	117.0
Total dissolved solids, dried at 110°C.	" " " 75.0	358.8	500.0	294.5
Silica (SiO ₂)	" " " 6.0	6.8	7.0	1.8
Iron (Fe)	" " " 0.05	0.16	0.08	0.07
Calcium (Ca)	" " " 15.0	82.9	108.1	80.0
Magnesium (Mg)	" " " 5.4	21.8	30.0	23.3
Hydrocarbonate (HCO ₃)	" " " 45.1	216.6	280.0	142.7
Sulphate (SO ₄)	" " " 9.1	79.9	150.0	55.0
Chloride (Cl)	" " " 4.0	10.0	18.0	5.0
Nitrate (NO ₃)	" " " 2.0	0.6	0.1	4.0
Total hardness as CaCO ₃	" " " 59.6	248.3	393.0	294.3
Calcium hardness	" " " 37.5	207.3	270.0	200.0
Magnesium hardness	" " " 22.1	41.0	123.0	94.3

ANALYSIS OF CIVIC WATER SUPPLIES

ONTARIO (cont.)

Sample No.	497	599	498
Date sampled 1938	Aug. 24	Dec. 19	Aug. 18
Locality	Copper Cliff	Cornwall	Dryden
Source of supply	Meat Bird Lake	St. Lawrence River	Wabigon River
Method of purification	Chlorination	Chlorination	Chlorination
Colour	p.p.m. 5.0	none	65.0
Alkalinity	" " " none	92.0	38.5
Total dissolved solids, dried at 110°C.	" " " 51.0	160.0	72.0
Silica (SiO ₂)	" " " 3.5	1.0	1.5
Iron (Fe)	" " " 0.08	0.05	0.55
Calcium (Ca)	" " " 12.0	38.0	16.0
Magnesium (Mg)	" " " 4.1	8.8	5.0
Hydrocarbonate (HCO ₃)	" " " none	112.2	47.0
Sulphate (SO ₄)	" " " 33.0	20.5	6.2
Chloride (Cl)	" " " 1.5	17.5	1.5
Nitrate (NO ₃)	" " " 0.1	none	4.5
Total hardness as CaCO ₃	" " " 46.8	131.0	60.5
Calcium hardness	" " " 30.0	95.0	40.0
Magnesium hardness	" " " 16.8	36.0	20.5

ANALYSIS OF CIVIC WATER SUPPLIES

1938

ONTARIO (cont.)

Sample No.	499	602	604
Date sampled 1938	June 20	Dec. 22	Aug. 20
Locality	Fort Francis	Fort Erie	Fort William
Source of supply	Rainy Lake	Lake Erie	Loch Lomond
Method of purification	Filtr. Chlor.	Chlor.	No treatment
Colour	p.p.m. 80.0	none	30.0
Alkalinity	" " " 15.0	93.5	18.0
Total dissolved solids, dried at 110°C.	" " " 58.3	165.0	40.8
Silica (SiO ₂)	" " " 4.7	4.2	4.2
Iron (Fe)	" " " 0.15	0.06	none
Calcium (Ca)	" " " 7.5	40.0	11.0
Magnesium (Mg)	" " " 3.1	10.1	7.0
Hydrocarbonate (HCO ₃)	" " " 18.3	120.0	---
Sulphate (SO ₄)	" " " 7.4	23.2	6.6
Chloride (Cl)	" " " 1.5	16.5	8.5
Nitrate (NO ₃)	" " " 1.5	1.6	.5
Total hardness as CaCO ₃	" " " 31.2	141.4	66.2
Calcium hardness	" " " 18.5	100.0	27.5
Magnesium hardness	" " " 12.7	41.4	28.7

ANALYSIS OF CIVIC WATER SUPPLIES

1938

ONTARIO (cont.)

Sample No.	589	587	491	600
Date sampled 1938	June 18	Oct. 6	Mar. 21	Dec. 19
Locality	Hawkesbury		Kingston	
Source of supply	Ottawa River		St. Lawrence River	
Method of purification	Rapid sand filtr. chlor.		Chlorination	
Colour	p.p.m. 40.0	60.0	5.0	5.0
Alkalinity	" " " 18.0	22.0	90.7	91.0
Total dissolved solids, dried at 110°C.	" " " 50.0	63.0	186.2	162.0
Silica (SiO ₂)	" " " 6.5	5.1	1.8	3.0
Iron (Fe)	" " " 0.30	0.41	0.05	0.05
Calcium (Ca)	" " " 10.0	11.0	42.3	38.6
Magnesium (Mg)	" " " 3.4	3.5	10.5	8.8
Hydrocarbonate (HCO ₃)	" " " 18.5	24.0	110.7	111.0
Sulphate (SO ₄)	" " " 5.8	8.1	23.0	20.0
Chloride (Cl)	" " " 1.5	1.1	17.0	17.0
Nitrate (NO ₃)	" " " 0.3	0.6	0.2	none
Total hardness as CaCO ₃	" " " 31.9	34.7	148.1	132.5
Calcium hardness	" " " 27.5	19.5	105.0	96.5
Magnesium hardness	" " " 14.4	15.2	43.1	36.0

ANALYSIS OF CIVIC WATER SUPPLIES

1938

ONTARIO (cont.)

Sample No.	603	500	501
Date sampled 1938	Dec. 16	June 16	Aug. 20
Locality	Ottawa	Pembroke	Port Arthur
Source of Supply	Ottawa River	Ottawa River	Lake Superior
Method of purification	Coag. filtr. alum, chlor. lime	Chlorination	Chlorination
Colour	p.p.m. 4.0	75.0	5.0
Alkalinity	" " " 28.0	3.0	38.0
Total dissolved solids, dried at 110 ^o C.	" " " 82.8	50.0	85.0
Silica (SiO ₂)	" " " 4.5	2.5	6.5
Iron (Fe)	" " " 0.04	0.07	0.12
Calcium (Ca)	" " " 22.5	7.8	15.7
Magnesium (Mg)	" " " 2.0	3.7	4.5
Hydrocarbonate (HCO ₃)	" " " 34.2	3.7	46.4
Sulphate (SO ₄)	" " " 22.8	4.9	4.1
Chloride (Cl)	" " " 2.0	2.0	3.0
Nitrate (NO ₃)	" " " 0.4	0.7	1.0
Total hardness as CaCO ₃	" " " 65.2	34.7	57.8
Calcium hardness	" " " 57.0	19.5	39.3
Magnesium hardness	" " " 8.2	15.2	18.5

ANALYSIS OF CIVIC WATER SUPPLIES

1938

ONTARIO (cont.)

Sample No.	502	550	503	504
Date sampled 1938	June 16	Aug. 26	Aug. 3	Aug. 3
Locality	Renfrew		Sault Ste. Marie	
Source of supply	Bonnechere River		Lake Superior	Wells
Method of purification	chlorination		chlorination	
Colour	p.p.m. 80.0	50.0	none	5.0
Alkalinity	" " " 39.0	39.4	38.6	44.0
Total dissolved solids, dried at 110°C.	" " " 55.5	80.0	62.5	76.5
Silica (SiO ₂)	" " " 2.5	5.5	4.6	10.0
Iron (Fe)	" " " 0.07	0.05	0.05	0.05
Calcium (Ca)	" " " 15.0	14.3	13.0	14.3
Magnesium (Mg)	" " " 2.2	10.0	3.0	5.5
Hydrocarbonate (HCO ₃)	" " " 47.6	48.1	47.1	53.7
Sulphate (SO ₄)	" " " 6.2	7.4	2.0	8.2
Chloride (Cl)	" " " 2.5	3.5	3.5	3.0
Nitrate (NO ₃)	" " " 0.2	0.3	1.0	3.5
Total hardness as CaCO ₃	" " " 46.5	76.8	44.8	57.1
Calcium hardness	" " " 37.5	35.8	32.5	35.7
Magnesium hardness	" " " 9.0	41.0	12.3	22.6

ANALYSIS OF CIVIC WATER SUPPLIES

1938

ONTARIO (cont.)

Sample No.	505	492	601	493
Date sampled 1938	Aug. 25	Mar. 22	Dec. 20	Mar. 24
Locality	Sudbury	Toronto		Windsor
Source of supply	Ramsay Lake	Lake Ontario		Detroit River
Method of purification	Chlorination	filtr. chlorination		coag. filtr. chlor.
Colour	p.p.m. 15.0	none	none	none
Alkalinity	" " " 7.0	89.3	93.5	66.5
Total dissolved solids, dried at 110°C.	" " " 56.0	180.5	164.0	148.0
Silica (SiO ₂)	" " " 3.5	1.6	3.0	2.8
Iron (Fe)	" " " 0.02	0.05	0.04	0.12
Calcium (Ca)	" " " 9.2	41.3	41.0	40.0
Magnesium (Mg)	" " " 4.8	10.0	9.2	9.0
Hydrocarbonate (HCO ₃)	" " " 8.5	108.9	114.1	81.0
Sulphate (SO ₄)	" " " 21.4	23.9	22.1	16.0
Chloride (Cl)	" " " 2.5	16.0	17.5	4.5
Nitrate (NO ₃)	" " " 0.1	0.5	0.2	0.3
Total hardness as CaCO ₃	" " " 42.7	147.1	140.2	136.9
Calcium hardness	" " " 23.0	103.2	102.5	100.0
Magnesium hardness	" " " 19.7	43.9	37.7	36.9

ANALYSIS OF CIVIC WATER SUPPLIES

1938

MANITOBA

Sample No.	506	507	508
Date sampled 1938	Aug. 15	June 20	June 25
Locality	Brandon	Dauphin	Neepawa
Source of supply	Assiniboine River	Edwards Lake	White Mud River
Method of purification	Filtr. coag. lime, alum, chlor.	No treat- ment	Alum, filtration, chlorination
Colour	p.p.m. 20.0	65.0	40.0
Alkalinity	" " " 204.0	174.5	241.5
Total dissolved solids, dried at 110°C.	" " " 609.0	293.0	354.0
Silica (SiO ₂)	" " " 11.0	13.0	21.5
Iron (Fe)	" " " 0.28	0.43	0.29
Calcium (Ca)	" " " 86.3	57.2	80.0
Magnesium (Mg)	" " " 45.9	22.3	25.1
Hydrocarbonate (HCO ₃)	" " " 246.4	210.8	294.6
Sulphate (SO ₄)	" " " 244.1	42.0	43.6
Chloride (Cl)	" " " 13.0	1.5	1.0
Nitrate (NO ₃)	" " " 0.40	4.0	3.0
Total hardness as CaCO ₃	" " " 334.0	234.4	521.8
Calcium hardness	" " " 215.8	143.0	200.0
Magnesium hardness	" " " 188.2	91.4	321.8

ANALYSIS OF CIVIC WATER SUPPLIES

1938

MANITOBA (contd.)

Sample No.	509	510	511
Date sampled 1938	June 25	Aug. 11	Aug. 16
Locality	Portage La Prairie	Selkirk	Winnipeg ^x
Source of supply	Assiniboine River	Wells	Shoal Lake
Method of purification	Sand filtr. chlor.	No treat- ment	Chlorination
Colour	p.p.m. 10.0	none	5.0
Alkalinity	" " " 196.5	462.0	78.0
Total dissolved solids, dried at 110 ^o C.	" " " 545.0	1,620.0	116.5
Silica (SiO ₂)	" " " 17.5	3.5	none
Iron (Fe)	" " " 0.03	23.6	0.22
Calcium (Ca)	" " " 71.5	95.8	26.4
Magnesium (Mg)	" " " 42.1	96.1	7.9
Hydrocarbonate (HCO ₃)	" " " 239.7	563.6	95.2
Sulphate (SO ₄)	" " " 199.6	232.1	8.2
Chloride (Cl)	" " " 15.0	49.2	3.0
Nitrate (NO ₃)	" " " 1.5	0.5	1.5
Total hardness as CaCO ₃	" " " 351.4	633.5	98.4
Calcium hardness	" " " 178.8	239.5	66.0
Magnesium hardness	" " " 172.6	394.0	32.4

^x Also supplies: East Kildonan, St. Boniface, St. James, St. Vital, Transcona and Tuxedo of a combined population of 57,000 inhabitants.

ANALYSIS OF CIVIC WATER SUPPLIES

1938

SASKATCHEWAN

Sample No.	512	513	514	515
Date sampled 1938	June 24	Aug. 12	June 3	June 28
Locality	Melfort	Moose Jaw	North Battleford	Prince Albert
Source of Supply	Melfort Creek	3 wells	wells on bank of North Saskatchewan River	North Saskatchewan River
Method of purification	alum, filtr. chlor. Intermittent copper sulphate	chlorination	no treatment	alum, filtr. chlor.
Colour	p.p.m. 55.0	5.0	15.0	10.0
Alkalinity	" " " 180.0	291.2	237.5	108.5
Total dissolved solids, dried at 110°C.	" " " 596.0	1,002.0	530.0	175.0
Silica (SiO ₂)	" " " 1.0	13.0	6.0	11.0
Iron (Fe)	" " " 0.13	0.11	3.16	0.12
Calcium (Ca)	" " " 91.5	63.6	57.2	38.6
Magnesium (Mg)	" " " 45.9	43.9	21.4	12.2
Hydrocarbonate (HCO ₃)	" " " 219.6	355.0	289.8	132.4
Sulphate (SO ₄)	" " " 237.1	426.0	71.6	39.5
Chloride (Cl)	" " " 9.0	12.0	4.0	1.0
Nitrate (NO ₃)	" " " 1.2	1.5	2.0	0.7
Total hardness as CaCO ₃	" " " 439.5	339.0	230.7	146.5
Calcium hardness	" " " 228.8	159.0	143.0	96.5
Magnesium hardness	" " " 210.7	180.0	87.7	50.0

ANALYSIS OF CIVIC WATER SUPPLIES

1938

SASKATCHEWAN (contd.)

Sample No.	516	517	518	519
Date sampled 1938	Aug. 13	June 28	Aug. 11	June 26
Locality	Regina	Saskatoon	Swift Current	Yorkton
Source of supply	wells	South Saskatchewan River	Swift Current Creek	wells
Method of purification	no treatment chlorination when necessary	alum, filtration chlorination	alum, filtration chlorination	no treatment
Colour	p.p.m. 5.0	25.0	20.0	10.0
Alkalinity	" " " 445.0	97.5	135.0	502.0
Total dissolved solids, dried at 110°C.	" " " 1,128.0	168.0	416.0	776.5
Silica (SiO ₂)	" " " 27.0	4.0	4.0	27.0
Iron (Fe)	" " " 0.13	0.40	0.10	8.71
Calcium (Ca)	" " " 163.6	32.2	25.7	125.8
Magnesium (Mg)	" " " 86.5	10.0	34.7	66.0
Hydrocarbonate (HCO ₃)	" " " 542.9	119.0	164.7	612.4
Sulphate (SO ₄)	" " " 423.9	32.0	171.6	220.2
Chloride (Cl)	" " " 9.0	1.0	4.0	11.0
Nitrate (NO ₃)	" " " 0.50	0.2	2.0	1.5
Total hardness as CaCO ₃	" " " 622.3	120.6	206.6	582.1
Calcium hardness	" " " 267.6	80.5	64.3	312.5
Magnesium hardness	" " " 354.7	40.1	142.3	270.6

ANALYSIS OF CIVIC WATER SUPPLIES

1938

ALBERTA

Sample No.	520	521	522	523
Date sampled 1938	July 8	July 6	Aug. 6	Aug. 4
Locality	Banff	Calgary	Cardston	Coleman
Source of supply	Mountain Stream	Elbow River	Lee's Creek	Wells
Method of purification	No treatment	Alum, filtr. chlor., activated carbon.	No treatment	No treatment
Colour	p.p.m. 15.0	5.0	5.0	10.0
Alkalinity	" " " 132.0	140.0	193.2	155.5
Total dissolved solids, dried at 110°C.	" " " 179.5	180.0	247.0	195.0
Silica (SiO ₂)	" " " 6.0	6.0	6.0	2.0
Iron (Fe)	" " " 0.08	0.10	0.51	0.02
Calcium (Ca)	" " " 40.0	41.0	47.2	52.9
Magnesium (Mg)	" " " 13.0	12.0	24.7	12.2
Hydrocarbonate (HCO ₃)	" " " 161.0	170.1	235.7	189.7
Sulphate (SO ₄)	" " " 39.0	42.0	23.0	15.2
Chloride (Cl)	" " " 1.0	1.0	1.5	1.0
Nitrate (NO ₃)	" " " 0.2	0.10	1.2	2.2
Total hardness as CaCO ₃	" " " 153.3	151.7	207.1	179.7
Calcium hardness	" " " 100.0	102.5	106.8	130.5
Magnesium hardness	" " " 53.3	49.2	101.3	49.2

ANALYSIS OF CIVIC WATER SUPPLIES

1938

ALBERTA (cont.)

Sample No.	524	525	526	527
Date sampled 1938	July 4	Aug. 8	Aug. 8	Aug. 7
Locality	Edmonton	Lethbridge	Medicine Hat	McLeod
Source of supply	North Sask. River	Old Man River	South Sask. River	Old Man River
Method of purification	Alum, filtr. intermittent chlor.	Alum, filtr. chlor.	Alum, filtr. chlor.	Alum, filtr. chlor.
Colour	p.p.m. 5.0	20.0	10.0	5.0
Alkalinity	" " " 99.0	116.0	108.0	143.6
Total dissolved solids, dried at 110°C.	" " " 171.0	163.5	191.0	200.0
Silica (SiO ₂)	" " " none	none	2.0	2.0
Iron (Fe)	" " " 0.08	0.08	0.40	0.3
Calcium (Ca)	" " " 41.7	37.2	37.1	35.7
Magnesium (Mg)	" " " 9.8	13.5	15.0	15.7
Hydrocarbonate (HCO ₃)	" " " 120.8	141.5	131.8	175.2
Sulphate (SO ₄)	" " " 44.0	26.8	27.0	25.9
Chloride (Cl)	" " " 1.0	1.0	1.5	1.5
Nitrate (NO ₃)	" " " 1.0	none	.05	1.3
Total hardness as CaCO ₃	" " " 144.5	138.4	140.8	153.7
Calcium hardness	" " " 104.3	93.0	79.3	89.3
Magnesium hardness	" " " 40.2	55.4	61.5	64.4

ANALYSIS OF CIVIC WATER SUPPLIES

1938

ALBERTA (cont.)

Sample No.	528	588	529	554
Date sampled 1938	Aug. 7	July 4	July 1	July 5
Locality	Raymond	Red Deer	Vegreville	Wetaskiwin
Source of supply	Impounding reservoir	Red Deer River	Wells	Wells
Method of purification	chlorination	filtr..chlor.	no treatment	no treatment
Colour	p.p.m. 35.0	20.0	40.0	60.0
Alkalinity	" " " 245.5	118.0	533.0	472.0
Total dissolved solids, dried at 110°C.	" " " 205.0	168.0	897.0	857.5
Silica (SiO ₂)	" " " 12.0	2.0	11.0	2.0
Iron (Fe)	" " " 0.40	0.18	0.20	.17
Calcium (Ca)	" " " 28.6	37.5	55.0	7.9
Magnesium (Mg)	" " " 10.9	11.2	41.7	3.7
Hydrocarbonate (HCO ₃)	" " " 299.5	14.4	655.6	575.8
Sulphate (SO ₄)	" " " ---	20.8	398.8	21.8
Chloride (Cl)	" " " 1.4	1.5	7.5	168.0
Nitrate (NO ₃)	" " " 4.0	1.3	4.0	0.1
Total hardness as CaCO ₃	" " " 116.2	139.7	308.5	35.0
Calcium hardness	" " " 71.5	93.8	137.5	19.8
Magnesium hardness	" " " 44.7	45.9	171.0	15.2

ANALYSIS OF CIVIC WATER SUPPLIES

1938

BRITISH COLUMBIA

Sample No.	530	531	532	533
Date sampled 1938	July 15	Aug. 4	July 21	Aug. 4
Locality	Chilliwack	Cranbrook	Duncan	Fernie
Source of supply	Elk Creek	St. Joseph Creek and Gold Creek	Lone Chain River	Fairy Creek
Method of purification	no treatment	no treatment	no treatment	no treatment
Colour	p.p.m. 10.0	10.0	40.0	5.0
Alkalinity	" " " 89.0	104.0	16.9	95.3
Total dissolved solids, dried at 110°C.	" " " 150.0	118.0	81.0	129.0
Silica (SiO ₂)	" " " 8.0	9.5	8.5	5.0
Iron (Fe)	" " " .17	0.5	0.7	0.7
Calcium (Ca)	" " " 44.0	35.7	17.0	35.7
Magnesium (Mg)	" " " 3.7	9.6	5.2	12.7
Hydrocarbonate (HCO ₃)	" " " 108.6	126.9	98.8	115.9
Sulphate (SO ₄)	" " " 34.1	5.8	7.0	11.9
Chloride (Cl)	" " " 1.5	1.0	3.0	1.0
Nitrate (NO ₃)	" " " 0.9	1.2	0.3	1.7
Total hardness as CaCO ₃	" " " 89.4	93.0	46.8	53.6
Calcium hardness	" " " 66.0	53.6	25.5	52.1
Magnesium hardness	" " " 23.4	39.4	21.3	105.7

ANALYSIS OF CIVIC WATER SUPPLIES

1938

BRITISH COLUMBIA (cont.)

Sample No.	534	543	535	589
Date sampled 1938	Aug. 1	July 27	July 12	Aug. 4
Locality	Grand Forks	Kamloops	Kelowna	Kimberley
Source of supply	Yettie River	Thompson River	Okanagan Lake	Mark Creek
Method of purification	Intermittent chlorination	Intermittent chlorination	Intermittent chlorination	No treatment
Colour	p.p.m. 10.0	none	none	5.0
Alkalinity	" " " 98.5	26.0	97.0	13.5
Total dissolved solids, dried at 110°C.	" " " 147.5	60.0	150.2	36.2
Silica (SiO ₂)	" " " 11.5	5.0	10.0	6.3
Iron (Fe)	" " " 0.07	0.03	0.06	0.05
Calcium (Ca)	" " " 31.4	7.6	31.3	8.0
Magnesium (Mg)	" " " 9.8	2.6	9.2	2.5
Hydrocarbonate (HCO ₃)	" " " 120.8	31.7	119.0	16.4
Sulphate (SO ₄)	" " " 20.6	6.5	20.0	5.2
Chloride (Cl)	" " " 1.0	1.0	1.0	1.0
Nitrate (NO ₃)	" " " 1.6	1.5	0.1	0.4
Total hardness as CaCO ₃	" " " 114.6	29.7	118.3	30.2
Calcium hardness	" " " 78.5	19.0	78.3	20.0
Magnesium hardness	" " " 36.1	10.7	40.0	10.2

ANALYSIS OF CIVIC WATER SUPPLIES

1938

BRITISH COLUMBIA (cont.)

Sample No.	536	537	553	538
Date sampled 1938	July 27	July 14	Sept. 6	Aug. 1
Locality	Ladysmith	Merritt	Nanaimo	Nelson
Source of supply	Stocking Lake	Wells	Dam, 3 miles from city	Mountain Lake
Method of purification	No treatment	No treatment	No treatment	No treatment
Colour	p.p.m. 25.0	10.0	15.0	15.0
Alkalinity	" " " 5.4	36.5	13.0	5.5
Total dissolved solids, dried at 110°C.	" " " 25.0	77.5	31.0	39.5
Silica (SiO ₂)	" " " 2.0	7.0	1.5	8.5
Iron (Fe)	" " " 0.07	0.05	0.12	0.02
Calcium (Ca)	" " " 5.7	20.7	9.2	10.0
Magnesium (Mg)	" " " 3.8	5.9	10.2	3.8
Hydrocarbonate (HCO ₃)	" " " 6.6	96.1	15.6	48.2
Sulphate (SO ₄)	" " " 2.0	8.2	6.6	6.2
Chloride (Cl)	" " " 1.0	1.0	5.0	1.0
Nitrate (NO ₃)	" " " 0.1	0.3	1.0	0.3
Total hardness as CaCO ₃	" " " 29.9	76.0	63.8	40.0
Calcium hardness	" " " 14.3	51.8	23.0	25.0
Magnesium hardness	" " " 15.6	24.2	41.8	15.6

ANALYSIS OF CIVIC WATER SUPPLIES

1938

BRITISH COLUMBIA (cont.)

Sample No.		539	540	541	542
Date sampled 1938		July 25	July 13	July 14	July 20
Locality		New Westminster	Penticton	Princeton	Port Alberni
Source of supply		Coquitlam Lake Squamour Creek	Mountain Spring	Tulameen River	China Creek
Method of purification		No treatment	Sand gravel filters	Gravel filters no chemicals	No treatment
Colour	p.p.m.	40.0	35.0	20.0	10.0
Alkalinity	" " "	none	2.6	66.0	51.5
Total dissolved solids, dried at 110°C.	" " "	19.0	52.0	104.0	75.0
Silica (SiO ₂)	" " "	1.0	12.5	8.0	4.0
Iron (Fe)	" " "	0.16	0.12	0.02	none
Calcium (Ca)	" " "	3.5	7.1	22.9	23.6
Magnesium (Mg)	" " "	4.4	5.0	6.6	8.5
Hydrocarbonate (HCO ₃)	" " "	none	3.2	80.5	62.8
Sulphate (SO ₄)	" " "	6.2	5.8	12.5	5.3
Chloride (Cl)	" " "	1.0	1.0	1.0	4.0
Nitrate (NO ₃)	" " "	0.2	0.5	3.5	0.4
Total hardness as CaCO ₃	" " "	26.7	38.3	84.4	93.9
Calcium hardness	" " "	8.7	17.8	57.3	59.0
Magnesium hardness	" " "	18.0	20.5	27.1	34.9

ANALYSIS OF CIVIC WATER SUPPLIES

1938

BRITISH COLUMBIA (cont.)

Sample No.		544	545	546	547
Date sampled 1938		July 11	July 29	July 30	July 25
Locality		Revelstoke	Rossland	Trail	Vancouver ^x
Source of supply		Bridge and Hamilton Creeks	Mountain Stream	Mountain Stream	Capilano Lake
Method of Purification		No treatment	No treatment	No treatment	No treatment
Colour	p.p.m.	25.0	15.0	15.0	5.0
Alkalinity	" " "	3.5	13.6	50.0	4.0
Total dissolved solids, dried at 110°C,	" " "	27.0	55.0	77.0	17.0
Silica (SiO ₂)	" " "	4.0	2.0	3.0	4.0
Iron (Fe)	" " "	0.02	0.07	trace	0.07
Calcium (Ca)	" " "	5.7	10.7	20.0	4.3
Magnesium (Mg)	" " "	3.2	2.6	4.8	1.6
Hydrocarbonate (HCO ₃)	" " "	4.3	16.6	61.0	4.9
Sulphate (SO ₄)	" " "	7.0	21.0	10.7	4.1
Chloride (Cl)	" " "	1.0	1.0	1.0	1.0
Nitrate (NO ₃)	" " "	0.7	0.2	0.5	0.7
Total hardness as CaCO ₃	" " "	27.4	37.5	69.7	17.4
Calcium hardness	" " "	14.3	26.8	50.0	10.8
Magnesium hardness	" " "	13.1	10.7	19.7	6.6

^x Also supplies Burnaby, Coquitlam, Port Coquitlam, West Vancouver

MINISTRY OF CROWN LANDS
ANALYSIS OF CIVIC WATER SUPPLIES

1938

BRITISH COLUMBIA (cont.)

Sample No.	548	549
Date sampled 1938	July 12	July 23
Locality	Vernon	Victoria ^x
Source of supply	B. X. Creek, main source, Kalamalka Lake, auxiliary	Sooke Lake
Method of purification	no treatment	no treatment
Colour	p.p.m. 20.0	15.0
Alkalinity	" " " 122.0	1.2
Total dissolved solids, dried at 110°C.	" " " 186.5	26.5
Silica (SiO ₂)	" " " 11.5	3.5
Iron (Fe)	" " " trace	trace
Calcium (Ca)	" " " 32.9	5.7
Magnesium (Mg)	" " " 10.2	2.8
Hydrocarbonate (HCO ₃)	" " " 155.4	1.5
Sulphate (SO ₄)	" " " 34.2	2.9
Chloride (Cl)	" " " 1.0	3.5
Nitrate (NO ₃)	" " " 0.3	0.1
Total hardness as CaCO ₃	" " " 123.1	25.8
Calcium hardness	" " " 82.3	14.3
Magnesium hardness	" " " 41.8	11.5

^x Also supplies Esquimalt, Oak Bay, Seanch