CANADA
DEPARTMENT OF MINES AND TECHNICAL SURVEYS

MINES BRANCH
INDUSTRIAL MINERALS DIVISION

INDUSTRIAL WATER RESOURCES OF CANADA

WATER SURVEY REPORT No. 12

WATER QUALITY AT SOME CANADIAN MILITARY ESTABLISHMENTS, 1956-57

BY
J. F. J. THOMAS

THE QUEEN'S PRINTER AND CONTROLLER OF STATIONERY
OTTAWA, 1959

Price: $1.25

Mines Br. No. 865

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CONTENTS

TABLES

WATER QUALITY AT SOME CANADIAN MILITARY ESTABLISHMENTS, 1956-58

The quality of waters supplied to military establishments including small isolated stations as well as larger training centres is most important to their efficient operation in peace and war. Besides meeting the health standards of the Department of Health and National Welfare these waters must be suitable for a variety of domestic and industrial uses such as cooking, laundering, steam heating, vehicle washing, etc. They also must often meet special requirements in shops, hospitals, and laboratories.

Waters of poor chemical and physical quality may seriously affect the well-being of camp personnel because of irritating problems of taste, discolouration, and/or hardness. Serious corrosion and/or scaling problems cause costly equipment breakdowns and replacements resulting in inefficient operation of the camp or establishment.

For several years the Industrial Waters Section, Mines Branch, Department of Mines and Technical Surveys, has assisted the Maintenance Division, Directorate of Works, Department of National Defence (Army) on problems of water use and treatment. Early in 1956, at the request of the Department of National Defence (Army), a general survey was undertaken of the chemical quality of waters supplied to a large number of Army establishments in Canada. The data from this survey will assist future studies on problems of water use and treatment, including the suitability and economics of new treatment methods to improve the quality at certain camps.

The results of this survey are published as the 12th report in a series of Water Survey Reports covering water quality in various areas of Canada. Previous reports in this series seldom included information on water quality at military establishments so this report does supplement to a considerable extent the knowledge on water quality in Canada. Since many Army establishments are supplied from municipal systems, additional information on these waters may be obtained by reference to pertinent Water Survey Reports.

So that adequate consideration may be given to problems of treatment and use, information on the general operation of most of the water systems is outlined in Table I. These data for the most part originate from questionnaires completed by personnel at each camp or establishment. Most of the data were checked and some additional information was supplied by personnel of the Utilities Section of the Directorate of Works at Ottawa.

Table II tabulates the chemical analyses of most of the waters studied in this survey. Included are a number of calculated values such as per cent sodium, and saturation and stability indices, which assist in assessing the suitability of a water, especially its corrosivity.

Tables III, IV and V summarize further the data of Tables I and II and also the information obtained from the completed questionnaires on plant operation.

For obvious reasons certain data including accurate figures on population are not reported. Also, this report does not by any means include all Army establishments in Canada; only those locations indicated by the Directorate of Works were studied at this time.

The assistance of Army and civilian personnel of the various establishments, and particularly personnel of the Utilities Section at Ottawa, in facilitating the carrying out of this survey and in preparing this report, is gratefully acknowledged.

SURVEY PROCEDURE

In order to ascertain within a limited time and without excessive laboratory work any major seasonal variations occurring in water quality at the several camps a program of quarterly sampling was begun early in 1956.

Sample containers together with a questionnaire on the operation of the camp water works system were forwarded to the several Army Commands or Camps with a request that samples of the raw and finished (treated) water from each supply be collected and shipped to the laboratory at Ottawa. Samples were to be collected first during the spring run-off, then about four months later (summer water supply) and finally four months thereafter (winter water supply). It was considered that these three samples should give satisfactory information on water quality at periods of high, low and normal water level or flow. A copy of the questionnaire forwarded to each camp appears in Appendix B.

Certain establishments, especially those in the far north, were unable to begin sampling in the spring of 1956 so spring run-off samples from these locations were not obtained until 1957. At a number of other locations samples were not always received when requested, hence the lack of complete information on all supplies Fortunately, many of these waters were reserve, or auxiliary supplies, or ground water supplies which showed little seasonal change.

When the initial survey was completed at most locations with the winter sample in late 1956 or early 1957, the Directorate of Works requested a continuing survey of water quality at 15 of the 98 establishments already studied. This continuing survey was begun with the 1957 spring run-off sample and some 40 samples were collected and analysed from these 15 camps. These results are also included in this report. The next samples in this continuing survey will be collected in the summer of 1958, again in the winter of 1959, then in the spring of 1960, and so on.

Water samples were collected in the usual 2-liter glass bottles except those from far northern areas where, because of problems of freezing and/or breakage polyethylene bottles were used. Samples were collected in the same manner as in other surveys (see previous Water Survey Reports), being collected from taps, pumps, reservoirs or direct from the rivers and lakes.

ANALYTICAL PROCEDURE

The same analytical procedures used in the previous survey studies on waters were employed in this study; these are reported in Water Survey Report No. 1 [1] and in subsequent reports of the series especially Report No. 10 [2]. Briefly most of the methods used are those standardized by the American Public Health Association [3] or the American Society for Testing Materials [4]. However, research on analytical methods and techniques is continually under way in the Industrial Waters Section's laboratories so that new procedures are often in use prior to publication in either of the above texts.

Sufficient analytical tests were carried out on all waters so that the experimental error could be calculated by accepted methods (*see* Water Survey Report No. 1). Trace elements were also determined in many waters; with waters low in total dissolved solids it was necessary to include determinations of heavy metals and other normally minor elements if satisfactory experimental accuracy was to be achieved. The amounts of copper, iron and zinc found in many of the supplies are relatively high; this is usually believed due to attack by the waters on galvanized iron, iron and copper piping, tanks or pump parts. Despite the request that taps and pumps be well flushed prior to sample collection it is probable that adequate flushing was not always carried out. It is therefore necessary to consider a number of factors such as water source and sampling location when interpreting these values for iron, copper and zinc.

To assist in the interpretation and usefulness of the analytical data a number of other values were calculated, some of which are reported in Table II. These values,--per cent sodium, saturation index, stability index, sum of constituents, and carbon dioxide--have been discussed in other Water Survey Reports of this series. Sum of constituents is the sum of all the elements including silica determined by the analysis, assuming any bicarbonate ion present as an equivalent amount of carbonate ion. It is therefore another measure of the total dissolved solids and shows a close relationship with the residue on ignition at 550°C. and the specific conductance. Consequently, it is another check on the accuracy of the analytical work.

Carbon dioxide is calculated using basic equilibria from the pH and alkalinity determinations. The free carbon dioxide present is measured at the temperature and pH of the analysis. The water, especially as drawn from a well, may therefore contain a quite different amount of carbon dioxide because of different temperature, pressure, pH and alkalinity. Some well waters may be very high in free carbon dioxide, which accelerates corrosion of both iron and copper.

Per cent sodium is the per cent of sodium cation in relation to the total cations calcium, magnesium, sodium, potassium, iron, copper, zinc, etc. It is of major importance in assessing the value of a water for irrigation. It

[1] Industrial Water Resources of Canada, Department of Mines and Technical Surveys, Ottawa. Water Survey Report No. 1: Scope, Procedure and Interpretation of Survey Studies, Mines Branch Report No. 833, 1952.

[2] Industrial Water Resources of Canada, Department of Mines and Technical Surveys, Ottawa. Water Survey Report No. 10: Nelson River Drainage Basin in Canada, Mines Branch Report No. 861 (in press)

[3] Standard Methods for the Examination of Water, Sewage and Industrial Wastes, 10th Edition, 1955. American Public Health Association, Inc., 1790. Broadway, New York 19, N.Y.

[4] Manual on Industrial Water, A.S.T.M. Special Technical Publication No. 148A, 1954. American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.

also quickly classifies those waters high in sodium salts, which waters are usually more corrosive under normal operating conditions.

Saturation index and stability index are values used to measure or indicate the corrosive or scale-forming tendency of a water. Both are based on the relative saturation of the water with calcium carbonate. The Langelier saturation index is defined as pH-pHs where pH is the measured pH and pHs is the pH at the same temperature when the water is saturated with calcium carbonate. It is evident that if a water has a pH greatly in excess of the pH of saturation (pHs) it is oversaturated with calcium carbonate and scale may deposit. The stability index is defined as 2pHs-pH where the terms pHs and pH have the same meaning as in saturation index. This stabillty index is said to show a closer relationship to actual results in practice.

TABLE I

DESCRIPTION OF SOME ARMY WATERWORKS SYSTEMS

NEWFOUNDLAND

CAMP OR ESTABLISHMENT	ST. JOHN'S
Approximate population served, 1955-56	No data
Ownership	Municipally owned and operated
Source of supply	Petty Harbour, Long Pond and Windsor Lake - supplied by city of St. John's
Treatment	*See* City of St. John's Water Survey Report No. 11
Storage capacity (thousand gallons)	*See* Water Survey Report No. 11
Consumption (average in m.g.d.)	----------
Uses other than domestic	----------
Remarks:	

NOVA SCOTIA

CAMP OR ESTABLISHMENT	ALDERSHOT MILITARY CAMP NEAR KENTVILLE	CAMP DEBERT, DEBERT
Approximate population served, 1955-56	1,000 - 1,500	850* (varies)
Ownership	Dept. of National Defence and Municipality of Kentville	Dept. of National Defence
Source of supply	Magee Lake, treated - Kentville municipal supply: Deep well at Camp as standby supply*	Three deep wells, No. 1, 2 & 12**; R.C.A.F. system as standby.
Treatment	Magee Lake is treated by Municipality by coagulation (alum, lime), settling, rapid-sand filtration, lime stabilization and chlorination. No treatment of well water.	No treatment; water is pumped to reservoirs, tanks and system.
Storage capacity (thousand gallons)	Elev. tank ---------- 62.5	Concrete underground ---------- 100 " ground, (R.C.A.F.) ---- 70 2 elev. tanks (wood) ---------- 25 each 1 elev. tank (steel, R.C.A.F.) --- 25
Consumption (average in m.g.d.)	0.080 - domestic 0.040 - other 0.120 - (Max. 0.142)	0.03 Pump capacity ---------- 0.648
Uses other than domestic	One third of total pumpage is used for heating, fire-fighting, washing vehicles, etc.	2% of pumpage used for fire protection, etc.
Remarks:	* Municipality normally supplies 100% of water used: well is a standby fire-fighting supply.	* about ½ during working hours ** In late 1957 a new well, No. 3 was also being used.

TABLE I (Cont'd)

DESCRIPTION OF SOME ARMY WATERWORKS SYSTEMS

HALIFAX & ENVIRONS

CAMP OR ESTABLISHMENT	BEDFORD RIFLE RANGE	ELKINS BARRACKS
Approx. population served, 1955-56	No data - varies widely	100 to 200
Ownership	Dept. of National Defence	Dept. of National Defence
Source of supply	Shallow well. Sackville River as standby for fire protection.	Brook at Cowbay dam
Treatment	No treatment.	Water is pumped with chlorination (sodium hypochlorite) to reservoirs and system.
Storage capacity ..... (thousand gallons)	Elev. tank (domestic supply) - 13 ..	Reservoir _____142
Consumption ..... (average in m.g.d.)	No data	0.023
Uses other than domestic	No data	Heating (boilers)
Remarks:	.....	.....

HALIFAX & ENVIRONS (Cont'd)

CAMP OR ESTABLISHMENT	GARRISON BARRACKS, WINDSOR PARK	HAMMOND PLAINS
Approx. population served, 1955-56	2000	No data
Ownership	Municipally owned and operated ...	Dept. of National Defence
Source of supply	Lakes, treated - supplied by city of Halifax	Well
Treatment	No treatment by Camp - *see* Halifax (Water Survey Report No. 11)	No treatment; pumped to system.
Storage capacity ..... (thousand gallons)	None at Barracks	No data
Consumption ..... (average in m.g.d.)	0.23 (Max. 0.245) (Min. 0.220)	No data
Uses other than domestic	Heating (steam boilers)	No data
Remarks:	.....	.....

HALIFAX & ENVIRONS (Cont'd)

CAMP OR ESTABLISHMENT	McNAB'S ISLAND	WALLACE HILL
Approx. population served, 1955-56	About 50	No data
Ownership	Dept. of National Defence	Dept. of National Defence
Source of supply	Well	Well
Treatment	Water is pumped with chlorination (sodium hypochlorite) to reservoir and system.	No treatment; pumped to system.
Storage capacity ..... (thousand gallons)	Reservoir _____ 40	No data
Consumption ..... (average in m.g.d.)	Not known	No data
Uses other than domestic	Heating (hot water furnaces)	No data
Remarks:	.....	.....

TABLE I (Cont'd)

DESCRIPTION OF SOME ARMY WATERWORKS SYSTEMS

	HALIFAX & ENVIRONS (Concl'd)	SYDNEY AREA
CAMP OR ESTABLISHMENT	YORK REDOUBT	JOHNSTOWN
Approx. population served, 1955-56	No data	Less than 25
Ownership	Dept. of National Defence	Dept. of National Defence
Source of supply	West Pine Island and East Pine Island Lakes.*	Well, 305 ft. deep
Treatment	Pumped with chlorination to system.	No treatment; pumped to system.
Storage capacity (thousand gallons)	No data	None
Consumption (average in m.g.d.)	No data	100 g.p.d. Capacity ——— 12,000 g.p.d.
Uses other than domestic	No data	Two small hot water furnaces
Remarks:	* In late 1956 source changed from West Pine Island Lake to East Pine Island Lake.	

NEW BRUNSWICK

FREDERICTON AREA (Concl'd)

CAMP OR ESTABLISHMENT	CAMP GAGETOWN	McGIVNEY
Approx. population served, 1955-56	1,800 - 2,000	225
Ownership	Dept. of National Defence	Dept. of National Defence
Source of supply	Two deep wells near junction of Saint John and Oromocto Rivers*	Two wells, 400 & 380 feet deep
Treatment	Water to be chlorinated and treated with Calgon*	No treatment; pumped to reservoirs and system.
Storage capacity (thousand gallons)	Elev. tank ——— 750	Elev. tank (wood) ——— 10 Concrete ground reservoir ——— 10
Consumption (average in m.g.d.)	Plant capacity ——— 3 m.g.d.	Not known
Uses other than domestic	Heating (boilers), cooling.	About 5% for fire-fighting, etc.
Remarks:	* Oromocto River is a standby supply. In 1958 plant to use this river or Saint John River water was being planned.	

TABLE I (Cont'd)

DESCRIPTION OF SOME ARMY WATERWORKS SYSTEMS

SYDNEY AREA (Concl'd)	NEW BRUNSWICK - FREDERICTON AREA	
PETRIE POINT	HANWELL ROAD	MARYLAND HILL
Less than 25	Less than 10	Less than 10
Dept. of National Defence	Dept. of National Defence	Dept. of National Defence
Well, 250 ft. deep	Deep well	Deep well.
No treatment; pumped direct to system .	No treatment; pumped direct to system.	No treatment; pumped direct to system.
None	None	None
200 g.p.d. Capacity ---------- 18,000 g.p.d.	40 g.p.d. Capacity ----------4,800 g.p.d.	40 g.p.d. Capacity ----------4,800 g.p.d.
One small hot water furnace.	None	None

NEW BRUNSWICK (Cont'd)

MONCTON	SAINT JOHN	ST. GEORGE AREA
GARRISON BARRACKS	BARRACK GREEN	PENNFIELD
100 - 300	500	125 - 150
Municipally owned and operated	Municipally owned and operated	Dept. of National Defence
Surface run-off and wells -- supplied by city of Moncton.	Lakes, supplied by city of Saint John.	Well
See Moncton - Water Survey Report No. 11	See Saint John - Water Survey Report No. 11	No treatment; pumped to tanks and system.
None at establishment.	None at establishment	Steel pressure tank ------- 0.50 Elev. tank (wood)------- 50 (fire-fighting only)
1,600 g.p.d.	20,000 g.p.d.	7,000 g.p.d.
10% is used in the Central Heating Plant	About 25% used in hot water boilers and low pressure steam plant.	5% for heating (boilers)

NEW BRUNSWICK - ST. GEORGE AREA (Concl'd)

CAMP OR ESTABLISHMENT	CAMP UTOPIA
Approx. population served, 1955-56	350
Ownership	Dept. of National Defence
Source of supply	Well or spring
Treatment	No treatment; pumped to tank and system.
Storage capacity (thousand gallons)	Tank (wood) ----------50
Consumption (average in m.g.d.)	17,000 g.p.d.
Uses other than domestic	5% for heating (boilers)
Remarks:	

TABLE I (Cont'd)

DESCRIPTION OF SOME ARMY WATERWORKS SYSTEMS

QUEBEC

	NEAR STE. THÉRÈSE	MONTREAL AREA
CAMP OR ESTABLISHMENT	CAMP BOUCHARD	LONGUE POINTE
Approx. population served, 1955-56 ...	600	1,600
Ownership	Dept. of National Defence	Municipally owned and operated .....
Source of supply	Three deep wells in Camp	St. Lawrence River, treated-supplied by city of Montreal
Treatment	Waters pumped to aerating* tank and tower, chlorinated and repumped to reservoirs and system.	River water is filtered, chlorinated and pumped to systems by city of Montreal*.
Storage capacity ..... (thousand gallons)	Reservoir _____ 1,000 Elev. tank _____ 100	No data .....
Consumption ..... (average in m.g.d.)	0.08 domestic) Plant 0.03 other)– capacity - 0.11 total) 1.4	No data .....
Uses other than domestic	30% of pumpage is used for heating, fire-fighting, etc.	Heating, etc. .....
Remarks:	* Water contains H_2S	* *See* also Water Survey Report Nos. 3 & 13

	QUEBEC & ENVIRONS (Concl'd)	ONTARIO
CAMP OR ESTABLISHMENT	CAMP VALCARTIER, VALCARTIER	BARRIEFIELD MILITARY CAMP, BARRIEFIELD
Approx. population served, 1955-56 ...	3,000	6,000 - 7,000
Ownership	Dept. of National Defence	Dept. of National Defence and city of Kingston
Source of supply	Three wells, Nos. 1, 3 & 5.	In 1956 St. Lawrence River; in 1957 St. Lawrence River via city of Kingston
Treatment	No treatment; pumped to system and reservoirs.	In 1956 river water pressure-filtered (diatomaceous-earth filters), chlorine and chlorine dioxide treated and pumped to reservoirs & system. In 1957 water purchased from city of Kingston - St. Lawrence river water, chlorinated*
Storage capacity ..... (thousand gallons)	Two reservoirs _____ 258 & 250	Two elev. tanks _____ 52 each
Consumption ..... (average in m.g.d.)	0.75 Plant capacity - 0.787	0.86 - domestic 0.37 - other 1.23 - total
Uses other than domestic	Boiler feed, vehicle-washing, and fire-protection	30% for heating, laboratories, fire-protection & air-conditioning
Remarks:	.....	* The D.N.D. plant at Barriefield, used in 1956, is now, in 1957 a standby supply.

TABLE I (Cont'd)

DESCRIPTION OF SOME ARMY WATERWORKS SYSTEMS

QUEBEC

MONTREAL AREA (Concl'd)	QUEBEC & ENVIRONS	
ST. BRUNO CAMP	CITADEL, QUEBEC CITY	P.M.Q. AREA, STE. FOY
50 - 200 (summer)	550	1,100
Dept. of National Defence	Municipally owned and operated	Municipally owned and operated .....
Well, 55 feet deep	St. Charles River (Lake)-supplied by city of Quebec	Wells - supplied by municipality of Ste. Foy
No treatment; pumped to reservoir and system.	No treatment by establishment - *See* Quebec - Water Survey Report No. 13.	*See* Ste. Foy; Water Survey Report No. 13
Elev. tank (wood)---------- 20	None at establishment	None at establishment
Not Known Capacity----------23,000 g.p.d.	0.065 - domestic 0.002 - other 0.067	0.040 (Max-0.053)
None, - a summer camp	4% for heating (boilers)	None
.....	.....	.....

ONTARIO

CAMP BORDEN & ENVIRONS

BLACKDOWN PARK CAMP	CAMP BORDEN	COBOURG
400 (summer)	11,000 - 12,000	1,200 - 1,400
Dept. of National Defence	Dept. of National Defence	Municipally owned and operated
Unnamed creek, nearby	Three deep wells in 1956. In 1957 two additional deep wells	Lake Ontario, treated - supplied by town of Cobourg.
Creek water is pumped through a diatomaceous-earth filter with chlorination to reservoir and system.	Water pumped with chlorination to tanks and system.	*See* Cobourg - Water Survey Report No. 3
Pressure reservoir---- 3,400 gal.	Two elev. tanks ------ 85 each	Underground reservoir ------ 150
4,000 g.p.d. Plant capacity ------- 17,000 g.p.d.	1956: 0.8 | 1957: 1.3 Capacity - 2.2	0.090 - 0.120
None - a summer camp	Heating, refrigerant cooling, vehicle-washing, etc.	15 - 20% is used for heating, air conditioning, etc.
.....	.....	.....

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TABLE I (Cont'd)

DESCRIPTION OF SOME ARMY WATERWORKS SYSTEMS

ONTARIO (Cont'd)

CAMP OR ESTABLISHMENT	CAMP HAGERSVILLE, HAGERSVILLE	CAMP IPPERWASH, IPPERWASH
Approx. population served, 1955-56	425	400 - 2,600 (summer)
Ownership	Dept. of National Defence	Dept. of National Defence
Source of supply	Lake Erie; drilled wells as standby supply	Lake Huron
Treatment	Lake water is pumped with chlorination to tanks and system. Well water is not treated.	Lake water is pumped with chlorination to reservoir and system.
Storage capacity (thousand gallons)	1 tank (wood) ——— 106 1 tank (steel) ——— 209	Concrete reservoir ——— 150
Consumption (average in m.g.d.)	0.11 Plant capacity ——— 0.216	0.075 (Max. - 0.243) (Min. - 0.053) Plant capacity —— 0.432
Uses other than domestic	75% of total used for heating, vehicle-washing, fire-protection, swimming pool, etc.	5% of total pumpage for heating, etc.
Remarks:		

ONTARIO (Cont'd)

LONDON & ENVIRONS (Concl'd)

CAMP OR ESTABLISHMENT	WOLSELEY BARRACKS	MEAFORD RANGE, MEAFORD
Approx. population served, 1955-56	2,000	200
Ownership	Municipally owned and operated	Dept. of National Defence
Source of supply	Wells - supplied by city of London	Lake Huron (Georgian Bay) and standby wells
Treatment	*See* London - Water Survey Report No. 3. *	Lake water is pumped with chlorination to standpipe and then flows to reservoir and system.
Storage capacity (thousand gallons)	None at Barracks	Standpipe ——— 40 Concrete ground reservoir ——— 35
Consumption (average in m.g.d.)	0.158 (Max. - 0.180) (Min. - 0.115)	0.03 (Max. - 0.059) (Min. - 0.018) Plant capacity - 0.115)
Uses other than domestic	12% for boiler feed, cooling, vehicle-washing, etc.	Boiler feed, refrigerant cooling
Remarks:	* Zeolite softeners are used on hot water in Barracks Messes.	

TABLE I (Cont'd)

DESCRIPTION OF SOME ARMY WATERWORKS SYSTEMS

ONTARIO (Cont'd)

LONDON & ENVIRONS

LAKEVIEW	LEITRIM STATION, LEITRIM	CEDAR SPRINGS RIFLE RANGE
500	150	125
Municipally owned and operated	Dept. of National Defence	Dept. of National Defence
Lake Ontario, treated - supplied by Toronto Township.	Deep well, and shallow well	Well
See Toronto Township - Water Survey Report No. 3	No treatment; pumped to tanks and system.	No treatment; pumped to tank and system.
None at establishment	None, except two small 100 gal pressure tanks	Elev. tank _____ 2.5
0.025 (Max. - 0.030) (Min. - 0.020)	Not known	1,250 g.p.d. (Max. - 2,000 g.p.d.)
10% for heating, fire-fighting, lawn watering, etc.	50% of water used for boiler feed, air conditioning, washing, etc.	None
.....	.....	.....

ONTARIO (Cont'd)

ORLEANS & ENVIRONS

ORLEANS STATION, ORLEANS	V.E. PROVING ESTABLISHMENT, MONTREAL RD.	OSHAWA STATION, OSHAWA
Less than 25	200	50 to 100
Dept. of National Defence	Dept. of National Defence	Dept. of National Defence and municipally owned and operated
Deep well and artesian well; a new well, 16 feet deep *	Deep well and municipal supply of the city of Ottawa *	Lake Ontario, treated - supplied by Public Utilities Commission, Oshawa. Deep well at Station is a standby supply.
No treatment; deep well water pumped to tank and system. Artesian well water brought by can for drinking.	Deep well is pumped to tank and system for general use. Ottawa city water for drinking purposes is hauled by truck from R.C.A.F. Station, Rockcliffe.	No treatment of well water. Lake water is treated and supplied by Oshawa P.U.C. *
Tank _____300 gal	Steel tank _____ 10	None at Station
75 g.p.d. (Max. - 100 g.p.d.) (Min. - 50 g.p.d.) Plant capacity_ 1,000 g.p.d.)	3,500 g.p.d. (Max.-4,500 g.p.d.) (Min.-1,000 g.p.d.) Capacity _____ 43,200 g.p.d.	Not known
100% of deep well water used for other than domestic purposes	Well water is 100% used.	Boiler feed, vehicle-washing, cooling, etc.
* This well to be used for drinking water. Deep well not used because of high H_2S content.	* A new well drilled in 1957 may replace Ottawa city water for domestic use.	* See also Water Survey Report No. 3.

TABLE I (Cont'd)

DESCRIPTION OF SOME ARMY WATERWORKS SYSTEMS

ONTARIO (Cont'd)

OTTAWA & ENVIRONS

CAMP OR ESTABLISHMENT	HEADQUARTERS ESTABLISHMENTS	CONNAUGHT RIFLE RANGES
Approx. population served, 1955-56 ...	———	200 - 5,000
Ownership	Municipally owned and operated	Dept. of National Defence .....
Source of supply	Ottawa River, treated - supplied by city of Ottawa	Six wells, average depth 100 ft. .....
Treatment	Coagulated, filtered, lime-stabilized and chlorinated by city of Ottawa- *See* also Water Survey Report No. 2	No treatment; pumped to tanks and system.
Storage capacity ..... (thousand gallons)	———	Two tanks —— 50 each
Consumption ..... (average in m.g.d.)	———	0.021 (Max. -0.057) (Min. -0.006)
Uses other than domestic	———	60% of pumpage is used for watering the grounds, fire-protection, etc.
Remarks:	.....	.....

MANITOBA

CAMP OR ESTABLISHMENT	CLEAR LAKE CAMP	FORT CHURCHILL
Approx. population served, 1955-56 ...	400 (summer)	2,000 - 2,500 *
Ownership	Dept. of National Defence	Dept. of National Defence .....
Source of supply	Clear Lake	Lake Isabelle .....
Treatment	Water is pumped with chlorination. A filter plant is planned for the summer of 1958.	Water is pumped with chlorination to a solids contact reactor, lime, alum & soda added for softening, & H_2SO_4 added to clear well for stabilization. Water then pumped through pressure filters (4) to tank and system**
Storage capacity ..... (thousand gallons)	One —— 5	Elev. tank ——50 Three ground reservoirs — 100, 100 & 250
Consumption ..... (average in m.g.d.)	25,000 g.p.d.	1956: 0.270 (Max. -0.405) Plant capacity -0.504 | 1957: 0.285
Uses other than domestic	None	15% used for boiler feed, cooling, etc ..
Remarks:	.....	* Also supplies National Harbours Board ** Activated silica also added at solids contact reactor. During spring run-off activated carbon also added; $CuSO_4$ is added to lake in summer and fall.

TABLE I (Cont'd)

DESCRIPTION OF SOME ARMY WATERWORKS SYSTEMS

ONTARIO (Cont'd)

PICTON & ENVIRONS

CAMP PETAWAWA	PICTON	POINT PETRIE
5,700 - 6,800	2,100	500 - 1,200
Dept. of National Defence.....	Municipally owned and operated	Dept. of National Defence
Mixed supply of Ottawa River and springs (15%)	Lake Ontario (Bay of Quinte) - supplied by town of Picton *	Lake Ontario
River water is chlorinated, mixed, with spring water which is collected in a storage tank and then pumped to system.	Lake water, filtered, chlorinated and treated with chlorine dioxide by town of Picton * - *See* also Water Survey Report No. 3	Lake water is pumped with chlorination (calcium hypochlorite) to tank and system.
Three elev. tanks ——————50 each	Open ground reservoir ——————750	Elev. tank (open) ——————15
1956: 0.8 (Max. -2.5, Min. -0.3) | 1957: 1.27	1955: 0.175 | 1956: 0.262 Plant capacity ——————0.360	0.030 - 0.060
60% including construction	10 - 15% for heating (steam boilers, etc. * Additional pumps and distribution system at camp.	None
.....	.....	.....

MANITOBA (Cont'd)

WINNIPEG & ENVIRONS

FORT OSBORNE BARRACKS	FORT WHYTE STATION	CAMP SHILO, SHILO
3,000	Less than 10	3,300 - 3,500
Municipally owned and operated	Dept. of National Defence	Dept. of National Defence
Shoal Lake - supplied by Greater Winnipeg Water District	Well and city of Winnipeg municipal supply	Six deep wells, 4 normally being used.
See Winnipeg ---- Water Survey Report No. 10.	Well water pumped to washroom only; Winnipeg city water is delivered by truck for drinking use.	Well waters, especially those normally used, are zeolite-softened, mixed and pumped to tanks and system.
None at Barracks.	Tank ——————680 gal.	Two elev. tanks ——————50 each
Not known	50 g.p.d. - domestic * 100 " - other 150 g.p.d. - total	1956: 0.47 | 1957: 1.2 Plant capacity - 1.224
20% for heating, washing, etc.	About 15% of total (all well water) is used for washing, cooling, etc.	One third of water pumped is used for heating, etc.
.....	* All drinking water is municipal water.	.....

TABLE I (Cont'd)

DESCRIPTION OF SOME ARMY WATERWORKS SYSTEMS

SASKATCHEWAN

CAMP OR ESTABLISHMENT	CAMP DUNDURN, DUNDURN	GRENFELL
Approx. population served 1955-56	1,200 (varies)	Varies widely
Ownership	Dept. of National Defence	Dept. of National Defence
Source of supply	Two wells, 63' deep	Well, near Armoury
Treatment	In 1956 no treatment. In near future to be aerated (pressure), zeolite-softened and pumped with chlorination to system.	No treatment; pumped direct to system
Storage capacity (thousand gallons)	Elev. tank ——— 50 Underground reservoir ——— 85	None, except 200 gal. pressure tank.
Consumption (average in m.g.d.)	0.247 (Max. - 0.285) (Min. - 0.216) Plant capacity ——— 0.432	No record
Uses other than domestic	About 6% used for heating, swimming pool, etc.	Very small - a hot water heating system.
Remarks		

ALBERTA

CALGARY & ENVIRONS

CAMP OR ESTABLISHMENT	BANFF CADET CAMP, BANFF	CURRIE BARRACKS
Approx. population served, 1955-56	400 (summer)	3,600
Ownership	Dept. of National Defence	Municipally owned and operated
Source of supply	Spring on Cascade Mountain	Elbow River, treated - supplied by city of Calgary
Treatment	No treatment; water flows by gravity to system.	*See* Calgary - Water Survey Report No. 7.
Storage capacity (thousand gallons)	One reservoir under construction ——50	None at Barracks
Consumption (average in m.g.d.)	No record	Not known
Uses other than domestic	25% of total use is for lawns, fire-fighting, etc.	No data
Remarks:		

TABLE I (Cont'd)

DESCRIPTION OF SOME ARMY WATERWORKS SYSTEMS

SASKATCHEWAN (Concl'd)

LLOYDMINSTER	REGINA
Varies-usually less than 10	450
Municipally owned and operated	Owned and operated by city of Regina and by D.N.D.
Three wells* - supplied by Lloydminster	Municipal supply from Regina and one well on D.N.D. property
See Lloydminster, Water Survey Report No. 7	*See* Regina - Water Survey Report No. 10 Well on D.N.D. property is pumped direct for other than domestic use.
None at establishment	Elev. tank ---------- 125 Concrete underground reservoir ---------- 125
No data	(Max. - 40,000 g.p.d.) 27,500 g.p.d.* (Min. - 15,000 g.p.d.)
No data	35% of total use; municipal water for boilers and vehicle-washing; D.N.D. well for fire-fighting, lawns, etc.
* Two wells, mixed, are normally used.	* 90% from Regina City.

ALBERTA (Cont'd)

CALGARY & ENVIRONS (Concl'd) — EDMONTON & ENVIRONS

SARCEE CAMP	GRIESBACH BARRACKS	BISSELL STATION
50	2,000	5
Dept. of National Defence	Municipally owned and operated	Dept. of National Defence
Two wells, 200 ft. deep, one at Tank Hangar and one at caretaker's residence	North Saskatchewan River, treated-from city of Edmonton	Well
No treatment; pumped direct to system.	Treatment by city of Edmonton - *See* Water Survey Report No. 7	Well water is zeolite-softened and pumped to small system.
None	None at Barracks	None, except 250 gal. pressure tank
Not known	0.045 (Max. - 0.052)	12 g.p.d. (Max. - 20 g.p.d.)
None	60% used for Central Heating Plant, etc.	Heating.
.....	.....	.....

TABLE I (Cont'd)

DESCRIPTION OF SOME ARMY WATERWORKS SYSTEMS

ALBERTA (Cont'd)

EDMONTON & ENVIRONS (Cont'd)

CAMP OR ESTABLISHMENT	WINTERBURN RIFLE RANGE	FORT CHIPEWYAN
Approx. population served, 1955-56	Varies widely	Less than 15
Ownership	Dept. of National Defence	Dept. of National Defence
Source of supply	Well	Four wells, each supplying a building; 4 small systems
Treatment	No treatment; pumped to system.	No treatment; pumped direct to each system.
Storage capacity (average in m.g.d.)	None	None
Consumption (average in m.g.d.)	None at survey date	50 g.p.d. (Max.-75 g.p.d.) (Min.-25 g.p.d.)
Uses other than domestic	None	None
Remarks:		

BRITISH COLUMBIA

CAMP OR ESTABLISHMENT	CAMP CHILLIWACK, CHILLIWACK	COURTENAY
Approx. population served, 1955-56	3,500	50 - 350 (summer)
Ownership	Dept. of National Defence	Dept. of National Defence
Source of supply	Vedder River and well at Wet Bridging Area*.	Springs
Treatment	Vedder River water is chlorinated and pumped to system. Well at Wet Bridging Area is pumped with hypo-chlorination to tank and system.	Spring water flows into open reservoir and then with hypo-chlorination by gravity to tank and system.
Storage capacity (thousand gallons)	Concrete reservoir (Vedder River)- 250 One elev. tank (wood) at Wet Bridging Area	Open reservoir ——— Tank, wood ——— 16
Consumption (average in m.g.d.)	0.300** (Max.-0.540) Plant capacity ———0.6	600 g.p.d. (Max. - 1,000 g.p.d.)
Uses other than domestic	40% for Central Heating Plant, lawn sprinkling, fire-fighting, etc.	None; - a summer camp
Remarks:	* Present well serves caretaker & occasional work party. A new well is being drilled and a pressure tank will replace old wooden tank. ** Vedder River water	

TABLE I (Cont'd)

DESCRIPTION OF SOME ARMY WATERWORKS SYSTEMS

ALBERTA (Concl'd)

McMURRAY	STRATHMORE HALL, STRATHMORE	CAMP WAINWRIGHT, WAINWRIGHT
15 - 25	70 (varies)	1,050 - 4,250
Dept. of National Defence	Dept. of National Defence	Dept. of National Defence
Clearwater River and wells.	Drilled well	Battle River and Betty Lake; two standby wells
No treatment. A privately-owned tanker delivers river water to cisterns in buildings. Well waters may be pumped to systems also.	No treatment; pumped direct to system. A water softener was installed in 1957.	Betty Lake, & Battle River waters are mixed, lime-softened, coagulated (alum), recarbonated, rapid sand-filtered (2), chlorinated and pumped to reservoirs and system*
5 cement cisterns -- 1,000 gal. each	None, except pressure tank - 250 gal.	One underground reservoir -- 1,000 One elev. tank ---------- 250
1956 600 g.p.d. 1957 250 g.p.d. Capacity ------ 20,000 g.p.d.	100 g.p.d. (Max.-175 g.p.d.) (Min. - 25 g.p.d.)	0.225 (Max.-0.300) Plant capacity - 3.6
None	A very small amount is used in the heating plant.	30% for heating, washing, etc.
.....	.....	* Activated carbon used at times. Calcium chloride is also added along with lime.

BRITISH COLUMBIA (Cont'd)

FORT NELSON & ENVIRONS

FORT NELSON - MILE 295 ALASKA HIGHWAY	MAINTENANCE CAMP - MILE 392 ALASKA HIGHWAY	MAINTENANCE CAMP - MILE 456 ALASKA HIGHWAY
About 235 (varies)	28	35
Dept. of National Defence	Dept. of National Defence	Dept. of National Defence
Well	Summit Lake	Well in camp
Pumped with heating and iron removal (aeration) to solids contact unit, with lime, alum and calcium hypochlorite addition, thence to clear well and elev. tank and system. Activated silica used in 1958.	No treatment; pumped direct to system.	No treatment; pumped direct to system.
Clear well ---------- 1,000 Elev. tank ---------- 30	None, except pressure tank - 250 gal.	None, except a 500 gal. pressure tank.
1957 - 58 30,000 g.p.d. (Max. - 70,000 g.p.d.)	950 g.p.d. (Max. - 1,100 g.p.d.)	1,150 g.p.d. (Max. - 1,300 g.p.d.)
Central heating plant*	None	None
See special report IR 58-215, Dec. 1958. *Zeolite softened	.....	.....

TABLE I (Cont'd)

DESCRIPTION OF SOME ARMY WATERWORKS SYSTEMS

BRITISH COLUMBIA (Cont'd)

FORT NELSON & ENVIRONS (Concl'd)

CAMP OR ESTABLISHMENT	MAINTENANCE CAMP - MILE 546 ALASKA HIGHWAY	MAINTENANCE CAMP - WATSON LAKE, MILE 635 - ALASKA HIGHWAY
Approx. population served, 1955-56	Less than 50	Less than 35
Ownership	Dept. of National Defence	Dept. of National Defence
Source of supply	Gravel well alongside Coal River	Deep well; water seeps into pipe (10") through gravel.
Treatment	No treatment; pumped direct to system.	No treatment; pumped direct to system.
Storage capacity (thousand gallons)	None, except 500 gal. pressure tank	None, except 500 gal. pressure tank.
Consumption (average in m.g.d.)	No data	No data
Uses other than domestic	None	None
Remarks.		

BRITISH COLUMBIA (Cont'd)

CAMP OR ESTABLISHMENT	CAMP NANAIMO, NANAIMO	RAYLEIGH
Approx. population served, 1955-56	1,300	50
Ownership	Municipally owned and operated	Dept. of National Defence
Source of supply	South Fork Nanaimo River- supplied by city of Nanaimo	Artesian well, shallow well and North Thompson River
Treatment	*See* Nanaimo - Water Survey Report No.5. Water is also pumped at the camp.	Artesian well flows into tank and to waste; it is pumped with chlorination to system. Shallow well is an alternative domestic supply.*
Storage capacity (thousand gallons)	Two tanks (wood) ——————250 each	Tank (wood) —————————— 28
Consumption (average in m.g.d.)	No data	2,400 g.p.d. (Max. - 3,200 g.p.d.)
Uses other than domestic	Heating at camp, at Indian Hospital and at Nanaimo High School	10% of water pumped is used for heating and fire-protection (river water).
Remarks:		* River water is pumped and used only for heating. There is a separate system and mains for fire-protection.

TABLE I (Cont'd)

DESCRIPTION OF SOME ARMY WATERWORKS SYSTEMS

BRITISH COLUMBIA (Cont'd)

KAMLOOPS	BOUNDARY BAY, LADNER
Less than 10	650
Dept. of National Defence	Owned and operated by Delta Municipality
South Thompson River	Municipal water from Delta Municipality
Water is pumped with chlorination to tank, and then flows by gravity to system.	*See* Ladner - Water Survey Report No. 6. Municipal water is chlorinated at camp.
Elev. tank (wood) ---------- 20	Cement reservoir ---------- 300
800 g.p.d. - domestic 2,000 g.p.d. - other 2,800 g.p.d. - total Plant capacity - 0.72 m.g.d.	0.065 (Max.- 0.090) Plant capacity ---2.3
50% used for heating and lost by leakage	12% used for boiler feed and cooling.
.....	.....

BRITISH COLUMBIA (Cont'd)

		VICTORIA AND ENVIRONS
JERICHO BEACH, VANCOUVER	CAMP VERNON, VERNON	ALBERT HEAD
1,000	150--1,400	About 10
Municipally owned and operated	Municipally owned and operated	Municipally owned and operated by Greater Victoria Water Board
Supplied by city of Vancouver.	Mixed creeks, treated - supplied by city of Vernon	Sooke & Goldstream Lakes - supplied by Victoria
See Vancouver - Water Survey Report No. 6	*See* Vernon, - Water Survey Report No. 6; additional pumping by camp.	*See* Greater Victoria Water Board - Water Survey Report No. 5
None at establishment	Concrete reservoir ------ 125	None at establishment
0.115	0.007 to 0.285	No data
3% used for heating in the Central Heating Plant.	None	None
.....	.....	.....

TABLE I (Cont'd)

DESCRIPTION OF SOME ARMY WATERWORKS SYSTEMS

BRITISH COLUMBIA (Cont'd)

VICTORIA & ENVIRONS (Cont'd)

CAMP OR ESTABLISHMENT	GORDON HEAD	MARY HILL
Approx. population served, 1955-56	500	Less than 10
Ownership	Municipally owned and operated by Greater Victoria Water Board	Municipally owned and operated by Greater Victoria Water Board
Source of supply	Lakes - supplied by Victoria	Lakes - supplied by Victoria
Treatment	*See* Greater Victoria Water Board - Water Survey Report No. 5	*See* Greater Victoria Water Board - Water Survey Report No. 5
Storage capacity (thousand gallons)	None at establishment	None at establishment
Consumption (average in m.g.d.)	17,500 g.p.d. (Max.- 20,000 g.p.d.)	No data
Uses other than domestic	About 12% for hot water heating	None
Remarks:		

YUKON TERRITORY

CAMP OR ESTABLISHMENT	MAINTENANCE CAMP - MILE 733 ALASKA HIGHWAY	MAINTENANCE CAMP - MILE 830 ALASKA HIGHWAY
Approx. population served, 1955-56	Less than 50	Less than 50
Ownership	Dept. of National Defence	Dept. of National Defence
Source of supply	Swift River - seepage from river to sump well alongside.	Brooks Creek
Treatment	No treatment; pumped direct to system.	No treatment; pumped direct to system.
Storage capacity (thousand gallons)	None, except 500 gal. pressure tank.	None, except 200 gal. pressure tank.
Consumption (average in m.g.d.)	No data	No data
Uses other than domestic	None	None
Remarks:		

TABLE I (Cont'd)

DESCRIPTION OF SOME ARMY WATERWORKS SYSTEMS

BRITISH COLUMBIA (Concl'd)

VICTORIA & ENVIRONS (Concl'd)

YORK POINT	HEALES RIFLE RANGE
1,200	Variable
Municipally owned and operated by Greater Victoria Water Board	Dept. of National Defence.
Lakes- supplied by Victoria	Well, 196 feet deep
See Greater Victoria Water Board - Water Survey Report No. 5	No treatment; pumped to reservoir and system.
None at establishment	One ---------- 25
0.040 (Max. - 0.048)	No data, but very little used
10% for boiler feed	100% . Drinking water is hauled to Range from city of Victoria.
.....	.....

YUKON TERRITORY (Cont'd)

MAINTENANCE CAMP - MILE 1016 ALASKA HIGHWAY	MAINTENANCE CAMP - MILE 1083 ALASKA HIGHWAY	MAINTENANCE CAMP - MILE 1202 ALASKA HIGHWAY
About 60	50 - 75	30 - 40
Dept. of National Defence	Dept. of National Defence	Dept. of National Defence
Shallow well on bank of Desadeash River	Well, 90 feet deep - below permafrost	Well, 60 feet deep
Water is pumped with chlorination to system.	Water is pumped with chlorination to tank and system.	Water is pumped with chlorination to tank and system.
Pressure tank ---------800 gal.	Tank (steel) ---------1,000 gal.	Tank (wood) ---------20
No data	No data	No data
None	None	None
.....	.....	.....

TABLE I (Cont'd)

DESCRIPTION OF SOME ARMY WATERWORKS SYSTEMS

YUKON TERRITORY (Cont'd)

CAMP OR ESTABLISHMENT	MAYO
Approx. population served, 1955-56	Less than 20
Ownership	Dept. of National Defence
Source of supply	4 shallow wells Nos. 1, 2, 3A & 3B
Treatment	Each water is zeolite - softened in each building. Wells 3A & 3B are also filtered through charcoal.
Storage capacity (thousand gallons)	None, except small pressure tanks.
Consumption (average in m.g.d.)	100 g.p.d.
Uses other than domestic	None
Remarks:	

NORTH WEST TERRITORIES

CAMP OR ESTABLISHMENT	AKLAVIK	FORT GOOD HOPE
Approx. population served, 1955-56	Less than 15	Less than 10
Ownership	Aklavik Water Works	Dept. of National Defence
Source of supply	A small lake; Peel Channel, Mackenzie River*	Mackenzie River
Treatment	Lake water treated by the Municipality. This water is taken from standpipe by gravity in surface hose to Station. In winter water hauled by barrel from Peel Channel.**	No treatment; pumped direct to cisterns in buildings. Water is boiled before domestic use.
Storage capacity (thousand gallons)	Three small tanks -- 1,000 gal. each	Three cisterns ---- 1,800, 1,200 & 1,200 gal.
Consumption (average in m.g.d.)	75 g.p.d.	75 g.p.d.
Uses other than domestic	None	None
Remarks:	* A new system being installed for New Aklavik, using Mackenzie River water. ** Ice water normally used for drinking.	

TABLE I (Cont'd)

DESCRIPTION OF SOME ARMY WATERWORKS SYSTEMS

YUKON TERRITORY (Concl'd)
WHITEHORSE & ENVIRONS

CAMP TAKHINI, WHITEHORSE	MAINTENANCE CAMP - MILE 75 HAINES ROAD
6,000	Less than 15
Dept. of National Defence	Dept. of National Defence
McIntyre Creek, nearby	Mule Creek - a small mountain stream
Water is pumped with chlorination to reservoirs and system.	Water is pumped with chlorination to system.
Two steel reservoirs --- 250 total	Pressure tank ---------- 500 gal.
1.0 (Max. - 2.0) (Min. - 0.8) Plant capacity - 3.0	No data
50% used for heating and running to waste in winter	None

NORTH WEST TERRITORIES (Cont'd)

FORT NORMAN	FORT PROVIDENCE	FORT RELIANCE
Less than 10	5 - 10	Less than 10
Dept. of National Defence	Dept. of National Defence	Dept. of National Defence
Mackenzie River	Mackenzie River	McLeod Bay (Great Slave Lake)
No treatment; pumped direct to system.	No treatment; pumped to cisterns in buildings. Ice used in winter. Water is boiled in fall and winter before domestic use.	No treatment; pumped to cistern in building.
Steel cisterns ----- 1,500 gal.	Two steel tanks --- 1,500 gal. each	One cistern ----- 1,400 gal.
200 g.p.d. Plant capacity -- 4,500 g.p.d.	150 g.p.d.	150 g.p.d.
Cooling water for diesel plant	None	None

TABLE I (Cont'd)

DESCRIPTION OF SOME ARMY WATERWORKS SYSTEMS

NORTHWEST TERRITORIES (Cont'd)

CAMP OR ESTABLISHMENT	FORT RESOLUTION
Approx. population served, 1955-56	Less than 15
Ownership	Dept. of National Defence
Source of supply	Great Slave Lake
Treatment	No treatment; pumped to tanks in buildings. Ice is used for drinking water.
Storage capacity (thousand gallons)	Tanks——————each 1,500 gal.
Consumption (average in m.g.d.)	300 g.p.d.
Uses other than domestic	None
Remarks:	

TABLE I (Concl'd)

DESCRIPTION OF SOME ARMY WATERWORKS SYSTEMS

NORTHWEST TERRITORIES (Concl'd)

FORT SIMPSON	HAY RIVER STATION, HAY RIVER
Less than 30	500
Dept. of National Defence	Dept. of National Defence
Mackenzie (Snye) River*	Great Slave Lake
No treatment; water or ice hauled to cisterns in each building. Ice water used for drinking.	Water hauled by tank truck to cisterns in building with hypochlorite treatment.
Cisterns——————2,000 gal. each.	Cisterns——————1,200 gal.
570 g.p.d.	2,000 g.p.d.
None	None
* At junction of Liard and Mackenzie Rivers.	

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TABLE II

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

NO.	PROVINCE	NEWFOUNDLAND				NOVA SCOTIA			
		ST. JOHN'S				NEAR KENTVILLE			
	Camp or Establishment					Aldershot Military Camp			
	Source(s)	Lakes - Municipal Supply				Magee Lake- treated. Municipal Supply from Kentville*			
		Petty Harbour Long Pond		Windsor Lake					
		Finished Water				Finished Water			
	Sampling Point	At Tap		At Tap		At Camp Tap			
1	Date of sampling	Dec. 6/56	Apr. 30/58	June 5/56	Apr. 28/58	Aug. 20/54	Apr. 16/56	Aug. 8/56	Dec. 13/56
2	Storage period (days)	12:33	15:28	8:17	17:30	20:196	56:85	7:12	46:167
3	Sampling temperature, °C.	1.1	-	5.0	-	17.8	5.6	10.6	5.6
4	Test temperature, °C.	23.0	26.7	24.6	26.7	21.2	23.8	25.6	23.6
5	Oxygen consumed by $KMnO_4$	-	5.3	6	3.7	-	8	10	14
6	Carbon dioxide (CO_2),(calculated)	1.3	1.4	1.8	0.5	1.0	1.9	1.7	2.9
7	pH	6.2	6.1	6.2	6.6	7.4 (7.0)	6.8	6.9	6.7
8	Colour	30	25	10	10	15 (30)	5	10	40
9	Turbidity	3	0.8	0.7	0.3	0	3	0	1
10	Suspended matter, dried at 105°C.	-	-	-	-	-	13.3	-	-
11	Suspended matter, ignited at 550°C.	-	-	-	-	-	3.4	-	-
12	Residue on evaporation, dried at 105°C.	-	28.4	34.0	27.6	53.2	57.6	34.8	52.4
13	Ignition loss at 550°C.	-	10.4	8.0	8.4	14.4	15.2	12.4	16.8
14	Specific conductance, micromhos at 25°C.	34.42	32.8	36.44	35.7	60.7	74.13	72.50	67.03
15	Calcium (Ca)	0.8	0.6	0.9	0.5	7.0	7.8	7.3	4.2
16	Magnesium (Mg)	0.5	0.5	0.5	0.7	1.2	1.2	1.2	2.1
17	Iron (Fe) Total	-		-		-	-	-	-
18	Dissolved	0.03	0.0	0.03	0.02	Trace	0.05	0.08	0.64
19	Manganese (Mn)	0.0	0.0	0.0	0.0	Trace	0.01	0.02	0.02
20	Aluminum (Al)	0.12	0.0	0.01	0.02	0.4	0.58	0.35	0.33
21	Copper (Cu)	0.01	0.0	0.0	0.0	0.0	0.0	0.0	Trace
22	Zinc (Zn)	0.0	0.0	0.0	0.0	-	0.0	0.01	0.05
23	Sodium (Na)	3.8	3.8	4.3	4.3	2.9	2.8	2.9	3.5
24	Potassium (K)	0.5	0.4	0.3	0.3	0.4	0.5	0.4	0.5
25	Ammonium (NH_4)	0.2	0.1	0.2	0.05	-	0.1	0.1	0.0
26	Carbonate (CO_3)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
27	Bicarbonate (HCO_3)	1.5	1.2	1.8	1.3	14.7	7.4	8.4	8.7
28	Sulphate (SO_4)	2.5	2.9	2.7	3.8	14.0	16.0	14.6	12.3
29	Chloride (Cl)	6.5	6.5	7.1	6.9	2.9	4.4	4.8	4.7
30	Fluoride (F)	0.0	0.0	0.0	0.0	0.25	1.0	0.75	0.3
31	Nitrate (NO_3)	0.8	0.1	1.6	0.2	0.0	1.2	2.4	0.6
32	Silica (SiO_2), colorimetric	1.3	0.8	1.6	1.2	2.2	3.8	3.9	3.8
33	Carbonate hardness as $CaCO_3$	1.2	1.0	1.5	1.1	12.1	6.1	6.9	7.2
34	Non-carbonate hardness as $CaCO_3$	2.9	2.6	4.4	3.0	10.7	18.3	16.3	11.9
35	Total hardness as $CaCO_3$	4.1	3.6	5.9	4.1	22.8 (23.4)	24.4	23.2	19.1
36	Sum of constituents	17.4	16.2	19.9	18.6	38.7	43.1	42.8	37.4
37	Per cent sodium	58.0	67.0	59.2	66.7	19.8	17.7	19.6	25.0
38	Saturation index at test temperature	-5.1	-5.2	-4.9	-4.6	-2.2	-2.9	-2.7	-3.2
39	Stability index at test temperature	16.4	16.5	16.0	15.8	11.8	12.6	12.3	13.1
	Remarks:					* *See* Water Survey Report No. 11			

TABLE II

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

NOVA SCOTIA (Cont'd)

NEAR KENTVILLE (Concl'd)			DEBERT									
Aldershot Military Camp (Concl'd)			Camp Debert									
Deep Well			Deep Wells†									
			Well No. 1			Well No. 2			Well No. 12			NO.
Raw and Finished Water			Raw and Finished Water									
At Pump			At Pump			At Pump			At Pump			
Apr. 16/56	Aug. 8/56	Dec. 13/56	Apr. 19/56	Aug. 29/56	Jan. 29/57	Apr. 19/56	Aug. 29/56	Jan. 29/57	Apr. 19/56	Aug. 29/56	Jan. 28/57	1
56:85	7:12	42:167	57:82	41:55	42:135	57:82	41:55	42:135	57:82	41:55	43:136	2
7.2	8.9	7.2	-	-	3.9	-	-	3.9	-	-	-	3
22.9	25.4	21.6	24.0	20.6	25.5	23.8	20.6	25.4	24.0	20.8	25.4	4
7	8	-	9	-	2	7	-	-	8	-	-	5
0.0	0.0	0.0	1.4	1.5	1.9	1.8	1.8	1.5	0.9	1.1	1.0	6
8.8	8.8	8.6	8.0	7.9	7.8	7.7	7.6	7.9	8.0	8.0	8.0	7
0	0	5	0	5	0	0	5	5	0	5	5	8
2	4	2	0	0	0	0	2	0	9	15	0	9
-	8.9	-	-	-	-	-	-	-	16.3	-	-	10
-	4.3	-	-	-	-	-	-	-	9.1	-	-	11
94.8	97.6	95.2	119	-	117	87.2	-	106	84.8	-	95.6	12
18.8	20.8	18.8	13.6	-	27.2	14.0	-	18.8	13.2	-	24.8	13
135.4	142.4	133.3	190.7	149.1	154.3	135.3	118.4	165.2	116.8	123.1	125.9	14
3.9	4.9	4.2	33.2	26.2	26.6	22.9	19.4	27.0	15.2	15.7	15.8	15
0.4	0.1	0.1	0.6	0.3	0.3	0.4	0.7	1.1	2.4	2.6	2.6	16
-	-	-	-	-	-	-	-	-	-	-	-	17
0.10	0.03	Trace	0.02	-	0.0	Trace	-	Trace	0.06	-	Trace	18
0.0	0.0	0.0	0.0	-	0.0	0.0	-	0.0	0.0	-	0.0	19
Trace	0.08	0.14	0.13	-	0.39	0.10	-	0.16	Trace	-	0.24	20
0.0	0.0	0.0	0.0	-	Trace	0.0	-	0.0	0.0	-	0.0	21
0.0	0.0	0.0	0.0	-	0.02	0.4	-	0.0	0.0	-	0.0	22
21.0	22.0	24.0	3.7	2.7	3.2	2.0	2.0	2.1	4.0	4.6	4.7	23
2.4	2.7	2.3	1.0	0.8	0.8	0.8	0.7	0.7	0.9	1.0	1.0	24
0.0	0.0	0.1	0.1	0.1	0.0	0.1	0.1	0.0	0.1	0.1	0.0	25
3.6	3.6	1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26
49.4	54.6	55.1	89.7	70.2	77.9	56.8	45.1	74.2	57.2	64.0	66.6	27
3.3	3.3	3.9	13.2	8.9	7.9	8.5	10.7	7.8	3.8	4.2	2.5	28
6.5	6.8	6.9	2.9	3.8	3.2	4.9	4.9	4.7	3.1	3.2	3.6	29
0.2	0.0	0.0	0.0	-	0.0	0.1	-	0.0	0.1	-	0.0	30
0.8	4.0	4.0	3.2	1.6	0.8	0.8	1.6	1.2	0.8	1.2	0.6	31
11	8.8	12	7.4	7.7	7.9	6.3	5.5	9.5	13	14	15	32
11.4	12.6	10.9	73.6	57.6	63.9	46.6	37.0	60.9	46.9	49.9	50.1	33
0.0	0.0	0.0	11.7	9.0	3.1	12.2	14.3	11.0	0.9	0.0	0.0	34
11.4	12.6	10.9	85.3	66.6	67.0	58.8	51.3	71.9	47.8	49.9	50.1	35
76.4	83.2	87.1	110	86.6	89.4	74.8	67.7	90.1	71.2	78.3	78.6	36
75.7	74.2	77.8	8.4	8.0	9.0	6.7	7.7	5.8	15.1	16.4	16.2	37
-0.4	-0.2	-0.5	0.0	-0.4	-0.4	-0.7	-1.0	-0.3	-0.6	0.0	-0.4	38
9.6	9.2	9.6	8.0	8.7	8.6	9.1	9.6	8.5	9.2	8.0	8.8	39

† New Well No. 3 is near Well No. 2

68664-3½

TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

PROVINCE NOVA SCOTIA (Cont'd)

NO.		HALIFAX & ENVIRONS				
	Camp or Establishment	Bedford Rifle Range			Elkins Barracks	
	Source (s)	Shallow Well			Brook at Cowbay Dam	
		Raw and Finished Water			Raw and Finished Water	
	Sampling Point	At N.S.R.A. Hut Tap			At Pump	
1	Date of sampling	Apr.20/56	Aug.8/56	Dec.4/56	Apr.18/56	Aug.6/56
2	Storage period (days)	55:81	28:49	49:169	57:83	25:30
3	Sampling temperature, °C.	-	-	-	1.1	12.8
4	Test temperature, °C.	26.0	24.2	26.1	27.0	21.6
5	Oxygen consumed by $KMnO_4$	8	9	10	12	-
6	Carbon dioxide (CO_2), (calculated)	4.0	5	3.9	7.0	4.1
7	pH	7.0	6.8	6.7	5.4	6.3
8	Colour	0	5	5	30	20
9	Turbidity	4	3	0	5	1
10	Suspended matter, dried at 105°C.	2.1	-	-	3.5	-
11	Suspended matter, ignited at 550°C.	1.0	-	-	2.9	-
12	Residue on evaporation, dried at 105°C.	56.8	-	41.6	39.6	-
13	Ignition loss at 550°C	8.8	-	9.6	13.2	-
14	Specific conductance, micromhos at 25°C.	85.80	54.94	60.16	48.07	51.57
15	Calcium (Ca)	8.5	5.8	4.4	2.6	3.0
16	Magnesium (Mg)	0.4	0.3	0.8	0.6	0.7
17	Iron (Fe) Total	-	-	-	-	-
18	Dissolved	Trace	-	0.0	0.04	0.08
19	Manganese (Mn)	0.0	-	Trace	0.01	-
20	Aluminum (Al)	0.03	-	0.25	0.05	-
21	Copper (Cu)	0.0	0.03	0.0	0.0	-
22	Zinc (Zn)	0.0	0.5	0.0	0.0	-
23	Sodium (Na)	5.1	2.4	3.7	3.7	4.3
24	Potassium (K)	3.7	0.5	1.0	0.8	0.7
25	Ammonium (NH_4)	0.1	0.1	0.1	0.1	0.3
26	Carbonate (CO_3)	0.0	0.0	0.0	0.0	0.0
27	Bicarbonate (HCO_3)	26.6	18.9	12.9	1.1	4.8
28	Sulphate (SO_4)	7.1	3.8	7.6	7.5	6.6
29	Chloride (Cl)	4.9	2.6	3.1	6.9	6.9
30	Fluoride (F)	0.1	-	0.0	0.2	-
31	Nitrate (NO_3)	4.0	0.6	1.2	1.2	0.8
32	Silica (SiO_2), colorimetric	5.8	4.3	4.2	2.0	1.2
33	Carbonate hardness as $CaCO_3$	21.8	15.5	10.6	0.9	3.9
34	Non-carbonate hardness as $CaCO_3$	1.1	0.2	3.7	8.1	6.5
35	Total hardness as $CaCo_3$	22.9	15.7	14.3	9.0	10.4
36	Sum of constituents	52.7	29.8	32.7	26.1	26.9
37	Per cent sodium	28.3	23.3	31.8	43.1	45.0
38	Saturation index at test temperature	-2.1	-2.6	-2.9	-5.5	-4.0
39	Stability index at test temperature	11.2	12.0	12.5	16.4	14.3
	Remarks:				High level	Medium high level

TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

NOVA SCOTIA (Cont'd)

HALIFAX & ENVIRONS (Cont'd)								
Elkins Barracks	Garrison Barracks, Windsor Park							
Brook at Cowbay Dam	Halifax Municipal Supply - Long and Chain Lakes and/or Spruce Lake, Treated*.							
Raw and Finished Water	Finished Water							NO.
At Pump	At City Tap	At Tap, C.H.P., Windsor Park						
Dec.12/56	Aug.27/54	July 18/55	Nov. 1955	Jan.10/56	Apr.10/56	May 10/56	July 3/56	1
47:168	20:34	16:22	-	16:23	16:23	6:15	10:14	2
-0.6	18.9	16.7	-	6.7	9.4	11.1	-	3
23.4	20.9 (21.5)	29.0	24.0	22.5	23.4	23.0	23.4	4
17	6	11	-	-	-	5	6	5
8.4	1.5	1.7	1.3	1.4	2.0	2.4	0	6
5.5	6.9 (7.6)	6.7	7.1	6.9	6.8	6.7	7.9	7
60	8	20	30	30	35	20	30	8
0	0	2	-	0	0	0.2	0	9
-	-	-	-	-	-	-	-	10
-	-	-	-	-	-	-	-	11
50.0	35.8	42.8	-	-	42.4	48.8	48.0	12
24.8	13.8	16.0	-	-	17.6	17.6	17.6	13
62.74	45.31	49.9	62.13	51.19	52.44	42.99	56.2	14
3.3	3.5	3.5	4.3	4.3	5.1	4.1	6.1	15
0.9	0.5	0.6	0.9	0.5	0.4	0.3	0.5	16
-	-	-	-	-	-	-	-	17
0.04	0.09	0.42	0.67	-	0.29	0.24	0.07	18
0.0	0.02	0.06	0.02	-	0.02	0.04	0.02	19
0.16	0.03	0.06	0.0	-	0.07	0.28	0.31	20
0.0	0.06	0.03	Trace	-	-	Trace	0.0	21
0.0	-	-	-	-	-	0.1	0.3	22
5.5	3.4	2.8	3.4	3.2	3.2	2.7	3.3	23
0.7	0.3	0.4	0.4	0.4	0.4	0.3	0.4	24
0.2	0.0	0.2	0.0	0.0	0.1	0.0	0.1	25
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26
1.6	7.1	4.3	10.4	6.6	8.0	7.2	11.1	27
9.8	5.0	5.3	2.8	3.6	4.6	3.6	2.8	28
9.7	6.7	7.6	7.2	7.3	6.5	6.4	7.4	29
0.0	0.1	0.0	0.0	-	-	0.0	0.9	30
0.2	Trace	0.4	0.8	0.8	1.2	1.2	2.8	31
3.1	2.0	1.8	2.4	2.7	2.8	1.9	4.8	32
1.3	5.8	3.5	8.5	5.4	6.6	5.9	9.1	33
10.6	5.0	9.4	5.9	7.4	7.8	5.6	8.2	34
11.9	10.8	12.9	14.4	12.8	14.4	11.5	17.3	35
34.4	25.1	25.3	28.0	26.0	28.6	24.5	34.9	36
45.5	39.9	32.0	31.4	34.3	30.6	29.7	26.8	37
-5.3	-3.2	-3.4	-2.7	-3.1	-3.0	-3.3	-1.7	38
10.6	13.3	13.5	12.5	13.1	12.8	13.3	11.3	39
	* *See* also W.S.R. No. 11		Normal flow	Flood	Normal level	Spring floods	Medium flow	

TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

PROVINCE NOVA SCOTIA (Cont'd)

NO.		HALIFAX & ENVIRONS (Cont'd)				
	Camp or Establishment	Hammond Plains		McNab's Island		
	Source (s)	Well		Well		
		Raw and Finished Water		Raw and Finished Water		
	Sampling Point	At Station Tap		At Tap		
1	Date of sampling	Apr.20/56	Dec.4/56	Apr.17/56	Aug.6/56	Dec.12/56
2	Storage period (days)	55:81	49:169	59:84	25:30	47:168
3	Sampling temperature, °C.	-	-	2.2	8.9	0.0
4	Test temperature, °C.	25.8	25.8	24.0	21.6	23.6
5	Oxygen consumed by $KMnO_4$	7	9	10	-	-
6	Carbon dioxide (CO_2), (calculated)	1.2	1.0	18	22	10
7	pH	8.2	8.3	5.2	5.8	5.7
8	Colour	0	5	0	0	5
9	Turbidity	3	0	0.3	0	0
10	Suspended matter, dried at 105° C.	2.2	-	-	-	-
11	Suspended matter, ignited at 550° C.	1.3	-	-	-	-
12	Residue on evaporation, dried at 105° C.	144	145	48.0	-	60.4
13	Ignition loss at 550° C	7.2	14.8	13.6	-	18.4
14	Specific conductance, micromhos at 25° C.	233.2	233.5	65.58	111.1	95.84
15	Calcium (Ca)	21.1	21.4	2.1	5.0	4.0
16	Magnesium (Mg)	3.4	2.7	1.2	2.1	1.6
17	Iron (Fe) Total	-	-	-	-	-
18	Dissolved	0.02	0.0	0.04	0.06	0.0
19	Manganese (Mn)	0.01	Trace	0.04	-	0.15
20	Aluminum (Al)	0.06	0.37	0.31	-	0.13
21	Copper (Cu)	0.0	Trace	0.0	-	0.0
22	Zinc (Zn)	0.3	0.1	0.1	-	0.0
23	Sodium (Na)	24.0	24.0	6.3	10.9	9.1
24	Potassium (K)	1.5	1.5	0.4	0.5	0.4
25	Ammonium (NH_4)	0.1	0.0	0.1	0.0	0.05
26	Carbonate (CO_3)	0.0	0.0	0.0	0.0	0.0
27	Bicarbonate (HCO_3)	120	124	1.8	7.7	3.2
28	Sulphate (SO_4)	14.6	14.7	9.6	13.7	12.7
29	Chloride (Cl)	4.4	3.1	9.6	16.7	15.4
30	Fluoride (F)	1.0	1.0	0.1	-	0.0
31	Nitrate (NO_3)	2.4	0.4	2.4	1.6	0.2
32	Silica (SiO_2), colorimetric	10	11	3.5	7.7	6.4
33	Carbonate hardness as $CaCO_3$	66.0	64.5	1.5	6.3	2.6
34	Non-carbonate hardness as $CaCO_3$	0.0	0.0	8.7	14.8	14.0
35	Total hardness as $CaCO_3$	66.0	64.5	10.2	21.1	16.6
36	Sum of constituents	142	142	36.5	61.7	51.7
37	Per cent sodium	42.8	43.2	52.1	52.0	52.1
38	Saturation index at test temperature	+0.1	+0.2	-5.6	-4.1	-4.7
39	Stability index at test temperature	8.0	7.9	16.4	14.0	15.1
	Remarks:					

TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

NOVA SCOTIA (Cont'd)

HALIFAX & ENVIRONS (Concl'd)							NO.
Wallace Hill			York Redoubt				
Well			West Pine Island Lake		East Pine Island Lake		
Raw and Finished Water			Raw and Finished Water				
At Pump			At Station Tap		At Station Tap		
Apr.20/56	Aug.8/56	Dec.4/56	Apr.24/56	Aug.8/56	Aug.8/56	Dec.5/56	1
55:81	43:56	52:169	51:77	43:63	28:49	48:168	2
-	-	-	-	-	-	-	3
25.9	22.6	22.1	26.0	22.6	24.2	25.8	4
7	9	10	13	16	12	17	5
4.3	5.8	1.8	8.0	3.5	10	30	6
7.3	7.2	7.7	5.1	6.8	4.9	4.5	7
0	10	5	40	85	20	50	8
40	25	35	9	0	0	0	9
6.4	-	3.3	2.7	-	-	-	10
5.5	-	1.7	0.9	-	-	-	11
84.8	-	102	36.0	64.0	-	41.2	12
9.2	-	14.4	10.4	28.0	-	18.8	13
121.2	118.7	122.9	40.45	65.52	40.84	68.92	14
11.5	11.4	11.8	1.6	6.9	1.1	1.2	15
3.3	3.3	3.5	0.3	0.4	0.1	0.7	16
-	2.5	-	-	-	-	-	17
1.5	0.45	0.19	0.09	0.42	-	0.05	18
0.10	-	0.10	0.02	-	-	0.02	19
0.0	-	0.10	0.19	-	-	0.5	20
0.0	Trace	0.0	0.0	0.0	0.0	Trace	21
0.4	1.0	0.3	0.0	0.02	0.01	0.0	22
6.7	6.9	7.0	3.5	4.6	3.9	5.5	23
1.2	1.2	1.2	0.5	0.3	0.2	0.4	24
0.1	0.1	0.0	0.2	0.1	0.1	0.2	25
0.0	0.0	0.0	0.0	0.0	0.0	0.0	26
57.4	59.5	59.6	0.5	15.1	0.5	0	27
4.5	4.7	5.4	5.4	5.4	4.7	7.8	28
4.8	4.2	3.8	5.4	8.5	5.5	8.6	29
0.2	-	0.13	0.2	0.0	-	0.0	30
2.4	0.4	0.6	4.0	0.6	0.4	0.2	31
18	19	23	2.5	1.1	0.2	4.2	32
42.3	42.0	43.8	0.4	12.4	0.4	0.0	33
0.0	0.0	0.0	4.8	6.5	2.8	5.9	34
42.3	42.0	43.8	5.2	18.9	3.2	5.9	35
82.8	81.7	86.9	23.9	35.7	16.3	29.4	36
23.8	24.6	24.5	49.8	33.0	71.3	54.8	37
-1.4	-1.5	-1.0	-6.0	-2.7	-6.4	-6.7	38
10.0	10.2	9.7	17.1	12.2	17.7	17.9	39
			High water				

TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

PROVINCE NOVA SCOTIA (Concl'd)

NO.		SYDNEY and ENVIRONS			
	Camp or Establishment	Johnstown		Petrie Point	
	Source(s)	Deep Well		Deep Well	
		Raw and Finished Water			
	Sampling Point	At Tap in Bldg. No. 4.		At Tap in Bldg. No. 4.	
1	Date of sampling	May 16/56	Oct. 19/56	May 16/56	Oct. 19/56
2	Storage period (days)	41:77	14:23	41:77	14:23
3	Sampling temperature, °C.	5.6	12.2	8.9	10.0
4	Test temperature, °C.	23.8	21.8	23.8	21.8
5	Oxygen consumed by $KMnO_4$	8	-	9	-
6	Carbon dioxide (CO_2), (calculated)	2.4	3.9	3.1	6.5
7	pH	8.1	7.9	8.0	7.7
8	Colour	0	20	0	20
9	Turbidity	20	-	4	6
10	Suspended matter, dried at 105° C.	4.6	-	3.7	-
11	Suspended matter, ignited at 550° C.	2.0	-	2.4	-
12	Residue on evaporation, dried at 105° C.	226	-	328	-
13	Ignition loss at 550° C.	95.2	-	42.0	-
14	Specific conductance, micromhos at 25° C.	372.3	380.3	445.7	412.7
15	Calcium (Ca)	62.8	63.2	58.1	46.9
16	Magnesium (Mg)	3.3	3.6	10.3	8.6
17	Iron (Fe) Total	-	-	-	-
18	Dissolved	0.05	-	0.01	-
19	Manganese (Mn)	0.04	-	0.0	-
20	Aluminum (Al)	0.07	-	0.11	-
21	Copper (Cu)	0.0	-	0.0	-
22	Zinc (Zn)	0.05	-	0.0	-
23	Sodium (Na)	10.3	11.1	20.0	26.4
24	Potassium (K)	1.2	1.1	3.3	4.4
25	Ammonium (NH_4)	0.0	0.05	0.0	0.2
26	Carbonate (CO_3)	0.0	0.0	0.0	0.0
27	Bicarbonate (HCO_3)	190	200	184	218
28	Sulphate (SO_4)	17.6	16.8	46.5	16.1
29	Chloride (Cl)	13.8	13.5	21.9	14.8
30	Fluoride (F)	0.15	-	0.05	-
31	Nitrate (NO_3)	2.4	0.4	1.6	1.6
32	Silica (SiO_2), colorimetric	7.6	13	11	9.1
33	Carbonate hardness as $CaCO_3$	156	164	151	152
34	Non-carbonate hardness as $CaCO_3$	14.7	8.1	36.3	0.0
35	Total hardness as $CaCO_3$	170	172	187	152
36	Sum of constituents	213	221	264	236
37	Per cent sodium	11.5	12.2	18.5	26.6
38	Saturation index at test temperature	+0.6	+0.4	+0.5	+0.1
39	Stability index at test temperature	6.9	7.1	7.0	7.5
	Remarks:				

TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

NEW BRUNSWICK

FREDERICTON and ENVIRONS						NO.
Hanwell Road			Maryland Hill			
Deep Well			Deep Well			
Raw and Finished Water			Raw and Finished Water			
At Tap			At Pump			
Apr. 30/56	Sept. 10/56	Jan. 23/57	Apr. 30/56	Sept. 10/56	Jan. 23/57	1
50:88	36:43	65:141	50:88	42:50	65:141	2
-	-	-	-	-	-	3
22.9	24.9	26.0	22.9	24.3	26.0	4
8	-	3	9	-	3	5
2.1	1.8	2.5	8.0	8.5	11	6
8.0	8.0	7.9	7.2	7.4	7.1	7
0	5	0	0	0	5	8
0	5	0	4	75	30	9
-	-	-	1.8	-	-	10
-	-	-	0.7	-	-	11
145	-	180	115	-	98.8	12
21.4	-	28.8	24.8	-	19.2	13
233.4	236.2	234.8	175.8	246.1	145.9	14
31.7	30.0	30.0	22.8	35.0	16.8	15
2.4	2.6	3.0	4.9	6.2	3.6	16
-	-	-	1.0	-	-	17
0.01	-	0.0	0.17	0.03	0.0	18
0.08	0.06	0.07	0.02	-	0.33	19
0.0	-	0.18	-	-	0.0	20
0.0	-	0.0	0.0	0.0	0.0	21
0.6	0.3	0.05	1.0	2.0	8.0	22
16.5	17.5	16.6	4.1	5.4	3.7	23
0.6	0.6	0.5	0.6	0.8	0.6	24
0.0	0.0	0.0	0.0	0.1	0.0	25
0.0	0.0	0.0	0.0	0.0	0.0	26
132	137	137	78.0	151	83.7	27
13.2	14.3	13.7	17.4	5.9	6.4	28
0.9	1.5	0.6	2.5	2.4	1.1	29
0.0	-	0.1	0.0	-	0.0	30
2.8	0.4	0.2	5.2	0.8	0.0	31
11	11	12	8.0	12	6.9	32
89.0	86.3	87.2	64.0	113	56.7	33
0.0	0.0	0.0	13.0	0.0	0.0	34
89.0	86.3	87.2	77.0	113	56.7	35
145	146	145	105	145	88.7	36
28.3	30.3	28.8	10.1	9.0	10.3	37
0.0	+0.1	0.0	-1.1	-0.4	-1.2	38
8.0	7.8	7.9	9.4	8.2	9.5	39

TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

PROVINCE NEW BRUNSWICK (Cont'd)

NO.	Camp or Establishment	CAMP GAGETOWN				
	Source (s)	Deep Wells and Oromocto River*				
		Well No. 1			Well No. 2 or Mixed Wells	
		Raw and Finished Water				
	Sampling Point	At Pump			At Pump or at Tap, Central Heating Plant	
1	Date of sampling	Oct.1/55	June 3/57	Feb. 1957	Oct. 29/55	Nov. 29/55
2	Storage period (days)	-	16:36		-	8:16
3	Sampling temperature, °C	-	-		-	4.4
4	Test temperature, °C.	24.0	27.5		23.0	23.8
5	Oxygen consumed by $KMnO_4$	2	3		9.5	6
6	Carbon dioxide (CO_2), (calculated)	2.9	1.7		4.8	1.5
7	pH	8.0	8.2	7.7	7.8	8.3
8	Colour	15	0		25	0
9	Turbidity	-	5		-	2
10	Suspended matter, dried at 105 °C.	-	0.0		-	-
11	Suspended matter, ignited at 550 °C	-	0.0		-	-
12	Residue on evaporation, dried at 105 °C	-	557		-	410
13	Ignition loss at 550 °C.	-	9.2		-	18.0
14	Specific conductance, micromhos at 25 °C.	741.3	1054	1150	735.8	751.4
15	Calcium (Ca)	38.0	51.7		37.0	37.6
16	Magnesium (Mg)	2.9	4.9		3.3	3.3
17	Iron (Fe) Total	-	-		-	-
18	Dissolved	0.0	0.0		0.01	0.0
19	Manganese (Mn)	2.0	0.0		2.0	0.0
20	Aluminum (Al)	0.1	0.0		0.07	0.0
21	Copper (Cu)	0.0	0.0		Trace	0.0
22	Zinc (Zn)	0.0	0.0		-	0.0
23	Sodium (Na)	116	157	153	116	111
24	Potassium (K)	1.2	1.0		1.3	0.8
25	Ammonium (NH_4)	0.0	0.0		0.2	0.0
26	Carbonate (CO_3)	0.0	0.0		0.0	0.0
27	Bicarbonate (HCO_3)	202	200		203	199
28	Sulphate (SO_4)	27.5	27.7		24.5	25.0
29	Chloride (Cl)	116	213	252	116	114
30	Fluoride (F)	0.67	0.4		0.67	0.6
31	Nitrate (NO_3)	0.8	0.6		1.2	0.2
32	Silica (SiO_2), colorimetric	7.4	7.5		7.8	6.8
33	Carbonate hardness as $CaCO_3$	107	149		106	107
34	Non-carbonate hardness as $CaCO_3$	0.0	0.0		0.0	0.0
35	Total hardness as $CaCO_3$	107	149	181	106	107
36	Sum of constituents	412	562		410	397
37	Per cent sodium	692	69.4		69.3	69.0
38	Saturation index at test temperature	+0.3	+0.7		+0.1	+0.6
39	Stability index at test temperature	7.4	6.8		7.6	7.1
	Remarks:				* *See* also W.S.R. No. 11	

TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

NEW BRUNSWICK (Cont'd)

CAMP GAGETOWN (Concl'd)							
Deep Wells and Oromocto River* (Concl'd)							
Well No.2 or Mixed Wells (Concl'd)						Oromocto River*	
Raw and Finished Water (Cont'd)						Raw Water	NO.
At Pump or atTap, Central Heating Plant.						From River.	
Dec. 6/55	Feb. 27/56	May 25/56	Oct. 10/56	Dec. 11/56	Feb. 1957	June 3/57	1
3:9	3:9	4:17	13:15	3:7	-	16:36	2
8.9	-	-	-	-	-	-	3
21.8	24.6	23.4	24.6	23.0	24.0	27.5	4
2	-	4	9	-	-	12	5
1.3	1.3	1.9	1.4	1.5	1.8	3.9	6
8.4	8.4	8.2	8.3	8.3	8.2	6.8	7
5	10	5	10	-	0	65	8
-	-	-	-	-	-	20	9
-	-	-	-	-	-	16.0	10
-	-	-	-	-	-	9.5	11
406	-	436	471	-	-	46.4	12
12.0	-	23.6	11.2	-	-	21.2	13
744.9	777.5	760.3	855.1	867.6	969.3	45.9	14
37.9	39.9	40.3	43.8	-	52.3	4.8	15
3.0	2.8	3.0	3.1	-	4.1	1.2	16
-	-	-	-	-	-	0.34	17
0.01	-	0.02	0.03	-	-	0.19	18
0.22	-	0.0	0.0	-	-	0.0	19
0.04	-	0.09	0.04	-	-	0.01	20
0.0	-	0.0	0.0	-	-	0.0	21
0.0	-	0.0	0.05	-	-	0.0	22
111	-	117	137	134	152	1.6	23
0.8	-	0.9	1.0	1.4	-	0.4	24
0.0	-	0.0	0.0	-	-	0.15	25
2.6	3.8	0.0	0.0	0.0	0.0	0.0	26
192	192	194	201	202	204	16.9	27
25.3	-	26.3	34.1	-	-	3.4	28
112	121	124	153	154	208	2.0	29
0.6	-	1.6	0.6	-	-	0.0	30
0.8	-	2.4	0.8	-	-	0.8	31
7.0	9.9	6.5	6.5	-	-	2.3	32
107	111	113	122	128	147	13.9	33
0.0	0.0	0.0	0.0	0.0	0.0	3.0	34
107	111	113	122	128	147	16.9	35
396	-	418	479	389	516	25.3	36
69.0	-	68.9	70.7	99.5	69.0	16.0	37
+0.6	-	+0.5	+0.7	-	+0.6	-2.6	38
7.2	-	7.2	6.9	-	6.0	12.0	39
		*Standby supply				* *See* also W.S.R. No. 11	

TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

PROVINCE NEW BRUNSWICK (Cont'd)

NO.									
	Camp or Establishment	Mc GIVNEY							
	Source(s)	Deep Wells							
		PMQ Area Well				Administration Area Well			
		Raw and Finished Water							
	Sampling Point	At Pumps							
1	Date of sampling	Apr.24/56	Sept.18/56	Jan.29/57	Apr.11/57	Apr.24/56	Sept.18/56	Jan.29/57	Apr.11/57
2	Storage period (days)	56:94	34:37	42:129	20:96	51:94	34:37	42:129	20:96
3	Sampling temperature, °C.	5.0	5.0	-	5.0	5.0	5.6	5.6	4.4
4	Test temperature, °C.	22.9	24.1	25.4	23.9	23.0	24.4	25.4	23.9
5	Oxygen consumed by $KMnO_4$	8.8	-	1.4	2.4	8.5	-	1.3	3.0
6	Carbon dioxide (CO_2), (calculated)	4.6	3.0	3.9	2.4	5.8	1.3	4.8	12
7	pH	7.3	7.5	7.4	7.6	6.5	7.7	7.1	6.6
8	Colour	0	0	0	0	0	5	5	30
9	Turbidity	0	0	0	5	0	2	0	5
10	Suspended matter, dried at 105 °C.	-	-	-	1.0	-	-	-	1.0
11	Suspended matter, ignited at 550 °C.	-	-	-	0.0	-	-	-	0.0
12	Residue on evaporation, dried at 105°C.	81.6	-	108.	88.4	50.0	-	90.4	80.0
13	Ignition loss at 550° C.	11.2	-	20.0	28.0	22.4	-	20.0	25.2
14	Specific conductance, micromhos at 25°C.	115.0	121.9	124.3	117.4	61.09 *	113.5	111.9	93.75
15	Calcium (Ca)	18.4	18.5	19.7	18.0	5.0 *	16.4	15.2	13.4
16	Magnesium (Mg)	1.3	0.9	1.1	1.5	1.7	1.4	1.2	1.5
17	Iron (Fe) Total	-	-	-	-	-	-	-	-
18	Dissolved	Trace	-	Trace	0.0	0.02	-	0.0	0.0
19	Manganese (Mn)	0.01	-	0.02	0.03	0.04	-	0.01	Trace
20	Aluminum (Al)	0.03	-	0.11	0.02	0.06	-	0.04	0.07
21	Copper (Cu)	Trace	Trace	Trace	0.05	0.0	Trace	0.0	0.04
22	Zjnc (Zn)	0.0	0.0	0.0	0.0	0.2	0.05	0.05	0.08
23	Sodium (Na)	2.9	4.1	3.4	3.0	2.8	3.0	3.0	2.9
24	Potassium (K)	0.5	0.5	0.4	0.4	0.7	0.5	0.4	0.5
25	Ammonium (NH_4)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.05
26	Carbonate (CO_3)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
27	Bicarbonate (HCO_3)	54.9	58.4	61.4	57.5	10.8*	40.7	39.4	32.1
28	Sulphate (SO_4)	8.0	9.5	8.8	8.4	4.0	10.5	9.8	6.9
29	Chloride (Cl)	1.1	2.0	1.6	2.1	6.7	6.0	4.1	7.7
30	Fluoride (F)	0.0	-	0.1	0.0	0.0	0.0	0.1	0.0
31	Nitrate (NO_3)	4.0	Trace	0.2	0.2	8.0	2.4	1.2	3.0
32	Silica (SiO_2), colorimetric	11	11	14	11	7.1	16	9.4	8.5
33	Carbonate hardness as $CaCO_3$	45.0	47.9	50.4	47.2	8.9 *	33.4	32.3	26.3
34	Non-carbonate hardness as $CaCO_3$	6.3	2.0	3.3	3.9	10.6	13.3	10.6	13.3
35	Total harness as $CaCO_3$	51.3	49.9	53.7	51.1	19.5 *	46.7	42.9	39.6
36	Sum of constituents	74.4	75.5	79.2	72.9	41.4 *	6.2	64.0	60.7
37	Per cent sodium	10.8	15.0	11.9	11.2	22.4	12.1	13.0	13.3
38	Saturation index at test temperature	-1.2	-1.0	-1.0	-0.9	-3.2	-1.0	-1.7	-2.2
39	Stability index at test temperature	9.7	9.5	9.4	9.4	12.9	9.7	10.5	11.0
	Remarks:					* May have lost some $CaCO_3$ on storage.			

TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

NEW BRUNSWICK (Concl'd)

MONCTON			SAINT JOHN			SAINT GEORGE AREA						
Garrison Barracks			Barrack Green			Pennfield			Camp Utopia			
Moncton Municipal Supply - Surface Run-off and Wells			Saint John Municipal Supply Lakes *			Well			Well or Spring			
Raw and Finished Water			Finished Water			Raw and Finished Water			Raw and Finished Water			NO
From Irishtown Reservoir	From McLaughlin Reservoir	At Barracks Tap	At Town Taps		At Central Heating Plant Tap	At Pump at Airport			At Pump			
Aug.17/54	Aug.17/54	Dec.5/56	Aug.13/54	Aug.13/54	Mar.14/57	Apr.24/56	Aug.20/56	Dec.10/56	Apr.24/56	Aug.20/56	Dec.10/56	1
16:176	16:176	48:168	12:169	12:169	26:99	55:90	24:35	46:163	55:77	24:35	46:168	2
17.8	14.1	5.6	22.1	18.9	5.0	6.7	6.7	5.6	7.2	-	4.4	3
22.3	22.3	26.3	22.7	22.2	24.1	23.6	23.0	22.2	23.8	22.8	21.6	4
-	-	16	-	-	5.8	7.5	-	9.6	7.7	-	-	5
3.4	3.3	4.5	0.5	0.4	2.5	0.9	1.8	1.0	8.1	3.4	5.2	6
6.8	6.9	6.9	7.7	7.3	6.8	8.2	7.9	8.2	6.4	6.8	6.7	7
70	60	40	20	15	15	0	0	5	0	5	5	8
2.5	3	12	1	1	2	0	0	0	0	0	0	9
-	-	7.6	-	-	-	-	-	-	-	-	-	10
-	-	4.6	-	-	-	-	-	-	-	-	-	11
48.4	53.2	60.4	30.4	28.8	46.8	110.4	-	68.0	41.6	-	-	12
28.0	26.4	22.0	18.0	16.8	24.0	23.6	-	14.4	10.0	-	-	13
31.9	45.4	69.27	42.9	31.9	44.32	182.0	182.1	174.7	49.61	51.44	61.78	14
2.9	4.7	7.5	4.2	1.5	4.0	26.5	26.3	25.9	4.9	4.7	5.2	15
0.6	0.9	1.4	0.7	0.7	1.0	2.8	2.5	2.7	0.6	1.0	0.7	16
-	-	-	-	-	-	-	-	-	-	-	-	17
0.36	0.23	0.19	0.2	Trace	0.0	Trace	-	0.01	0.03	-	0.0	18
0.0	0.0	0.0	0.01	0.01	0.0	0.0	-	0.0	0.0	-	0.01	19
0.0	0.03	0.43	0.2	0.08	0.31	0.02	-	0.38	0.01	-	0.16	20
0.04	0.0	Trace	0.2	0.1	0.0	0.0	-	0.0	0.0	-	Trace	21
0.0	-	0.0	-	-	0.1	0.0	-	0.0	0.0	-	0.3	22
1.7	2.0	3.1	1.9	2.3	2.3	6.2	6.5	5.5	2.6	2.7	3.8	23
0.4	0.8	0.8	0.3	0.2	0.3	1.0	0.9	0.8	0.6	0.6	1.4	24
-	-	0.1	-	-	0.0	0.1	0.1	0.0	0.1	0.1	0.5	25
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26
13.2	16.5	23.3	12.9	3.8	10.1	90.2	91.4	93.0	12.9	14.0	16.8	27
1.5	4.3	7.4	2.9	1.6	5.8	7.1	8.3	6.9	2.4	3.3	3.9	28
1.4	2.0	3.6	4.0	5.4	4.3	4.5	5.3	5.5	4.3	4.2	5.2	29
0.0	0.0	0.0	0.0	0.0	0.0	0.0	-	0.1	0.15	-	0.0	30
0.6	1.2	0.8	0.4	0.2	0.5	3.2	2.4	0.8	0.8	1.6	4.0	31
0.9	2.1	2.4	1.8	2.0	2.4	13	19	13	10	10	12	32
9.7	13.5	19.1	10.6	3.1	8.3	74.0	75.0	75.7	10.6	11.5	13.8	33
0.0	1.9	5.4	2.8	3.5	5.8	3.6	0.9	0.0	4.1	4.3	2.1	34
9.7	15.4	24.5	13.4	6.6	14.1	77.6	75.9	75.7	14.7	15.8	15.9	35
16.9	26.4	39.2	23.2	16.0	26.1	10.9	116	107	32.8	35.2	45.1	36
25.3	20.4	19.1	21.4	40.0	23.4	14.5	15.5	13.2	26.7	26.1	28.8	37
-3.1	-2.7	-2.2	-1.9	-3.4	-3.0	+0.1	-0.3	0.0	-3.2	-2.8	-2.9	38
13.0	12.3	11.3	11.5	14.1	12.8	8.0	8.5	8.2	12.8	12.4	12.5	39
See also W.S.R. No. 11			* *See* W.S.R.No. 11								High level	

TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

NO.	PROVINCE	QUEBEC			
		NEAR STE. THÉRÈSE			
	Camp or Establishment	Camp Bouchard			
	Source(s)	Deep Wells			
		Well No.1			
		Raw Water			
	Sampling Point	At Tap or Pump, Bldg. No. 43			
1	Date of sampling	Apr.18/56	Aug.23/56	Jan.23/57	Apr.8/57
2	Storage period (days)	54:83	49:54	43:135	4:81
3	Sampling temperature, °C.	7.2	8.9	7.8	7.8
4	Test temperature, °C.	23.0	24.6	24.2	22.7
5	Oxygen consumed by $KMnO_4$	11	12	4.8	-
6	Carbon dioxide (CO_2), (calculated)	2.6	1.6	2.2	2.2
7	pH	8.3	8.5	8.4	8.4
8	Colour	30	30	30	30
9	Turbidity	0.3	5	0	5.
10	Suspended matter, dried at 105 °C.	-	5.0	-	1.4
11	Suspended matter ignited at 550°C.	-	1.3	-	1.4
12	Residue on evaporation, dried at 105°C	387	384	393	410
13	Ignition loss at 550°C.	47.2	39.2	98.6	87.6
14	Specific conductance, micromhos at 25°C	613.4	650.9	618.0	624.5
15	Calcium (Ca)	6.4	6.4	8.0	6.1
16	Magnesium (Mg)	7.3	7.6	6.7	8.0
17	Iron (Fe), Total	-	-	-	-
18	Dissolved	0.02	Trace	Trace	Trace
19	Manganese (Mn)	0.0	0.0	0.0	0.0
20	Aluminum (Al)	0.03	-	0.0	0.0
21	Copper (Cu)	0.0	0.0	0.0	0.0
22	Zinc (Zn)	0.0	0.3	0.0	0.0
23	Sodium (Na)	126	128	126	124
24	Potassium (K)	8.8	9.3	9.0	9.3
25	Ammonium (NH_4)	0.1	0.1	0.0	0.25
26	Carbonate (CO_3)	0.0	7.2	4.7	2.5
27	Bicarbonate (HCO_3)	334	327	332	343
28	Sulphate (SO_4)	7.1	7.1	6.9	7.8
29	Chloride (Cl)	29.4	29.8	28.6	29.9
30	Fluoride (F)	1.0	1.0	1.2	0.1
31	Nitrate (NO_3)	1.6	3.2	1.2	0.4
32	Silica (SiO_2), colorimetric	10	11	11	10
33	Carbonate hardness as $CaCO_3$	46.0	47.2	47.5	48.1
34	Non-carbonate hardness as $CaCO_3$	0.0	0.0	0.0	0.0
35	Total hardness as $CaCO_3$	46.0	47.2	47.5	48.1
36	Sum of constituents	363	372	339	367
37	Per cent sodium	82.7	82.5	82.3	81.6
38	Saturation index at test temperature	0.0	+0.3	+0.3	+0.1
39	Stability index at test temperature	8.3	7.9	7.8	8.2
	Remarks:				

TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

QUEBEC (Cont'd)

NEAR STE. THERESE (Concl'd)									
Camp Bouchard (Concl'd)									
Deep Wells									
Well No. 2			Well No. 4		Mixed Wells				NO.
Raw Water			Raw Water		Finished Water				
At Tap or Pump, Bldg. No. 40			At Tap or Pump, Bldg. No.42		At Camp Tap, Bldg. No. 39				
Aug.23/56	Jan.23/57	Apr.8/57	Aug.23/56	Apr.8/57	Apr.13/56	Aug.23/56	Jan.23/57	Apr.8/57	1
64:68	7:135	4:81	49:54	4:81	-	64:68	7:135	4:81	2
8.9	7.8	7.8	-	8.3	10.0	10.6	8.9	8.3	3
23.7	21.9	22.5	24.6	22.5	24.0	23.7	22.0	22.41	4
15	-	-	8.9	-	11	14	-	6.2	5
2.2	3.5	2.8	1.6	2.7	1.7	2.8	5.4	2.3	6
8.4	8.3	8.3	8.4	8.2	8.5	8.3	8.0	8.4	7
40	40	20	10	10	40	40	40	30	8
0.3	1	4	5	4	0.8	0	0	3	9
-	-	3.9	6.5	4.8	-	-	-	-	10
-	-	0.0	3.1	0.0	-	-	-	-	11
566	506	689	254	260	445	443	428	434	12
42.0	12.0	74.4	19.2	32.8	40.8	40.8	52.4	50.8	13
970.2	796.3	1132	414.2	414.6	716.6	735.8	719.4	688.4	14
9.8	8.0	8.7	62.5	60.5	7.5	8.2	8.2	6.0	15
11.5	9.8	10.9	8.9	9.6	8.3	8.7	8.2	9.0	16
0.1	-	-	-	-	-	-	-	-	17
-	Trace	Trace	0.08	0.02	0.14	Trace	0.0	0.02	18
0.0	0.0	0.0	0.0	0.14	0.0	0.0	0.0	0.13	19
0.08	0.0	0.12	0.09	0.04	Trace	0.05	0.0	0.0	20
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21
0.0	0.0	0.0	0.05	0.0	0.05	0.0	0.05	0.0	22
195	156	220	12.8	12.2	146	150	145	135	23
12.0	10.6	12.6	3.0	3.0	9.8	10.0	9.7	9.7	24
0.1	-	0.25	0.0	0.05	0.2	0.0	-	0.15	25
4.0	0.0	0.0	4.0	0.0	12.0	0.0	0.0	2.8	26
377	391	385	238	246	330	370	364	356	27
22.2	11.8	35.8	20.1	21.1	8.9	11.4	9.8	8.3	28
106	58.9	150	2.3	1.7	48.6	51.2	48.2	42.0	29
1.4	1.2	2.0	0.0	0.13	1.0	0.8	1.2	1.0	30
0.4	1.2	1.6	0.8	0.6	1.6	2.0	0.0	0.8	31
9.7	11	8.1	16	14	9.3	10	11	9.8	32
71.7	60.3	65.5	193	190	52.8	56.2	54.2	52.0	33
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	34
71.7	60.3	65.5	193	190	52.8	56.2	54.2	52.0	35
553	461	640	248	244	396	435	420	400	36
82.5	82.1	85.1	12.4	12.0	84.0	82.5	82.5	81.8	37
+0.4	+0.2	+0.2	+1.0	+0.8	+0.4	+0.2	-0.1	+0.1	38
7.6	7.9	7.9	6.4	6.6	7.7	7.9	8.2	8.2	39

TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

PROVINCE — QUEBEC (Cont'd)

NO.		MONTREAL AREA		QUEBEC CITY and ENVIRONS		
	Camp or Establishment	Longue Pointe		Citadel, Quebec City		
	Source (s)	Montreal Municipal Supply-St. Lawrence River,		Municipal Supply - St. Charles River		
		Finished Water		Finished Water		
	Sampling Point	At Taps		At Tap, Central Heating Plant, Citadel		
1	Date of sampling	Aug.15/56†	Jan,1958	Feb.8-28/55	Mar.26/55	Apr.27/55
2	Storage period (days)	-	-	-	18:33	13:22
3	Sampling temperature, °C.	-	-	6.7*	3.3	5.6
4	Test temperature, °C.	-	24.6	22.8	25.4	22.4
5	Oxygen consumed by $KMnO_4$	-	3	3.0	3.9	-
6	Carbon dioxide (CO_2), (calculated)	7.0	1.4	1.4	2.7	5.1
7	pH	7.4	8.1	7.3	7.0	6.1
8	Colour	15	10	20	25	25
9	Turbidity	2	2	0.2	0.8	7
10	Suspended matter, dried at 105°C.	Trace	-	-	-	-
11	Suspended matter, ignited at 550°C.	-	-	-	-	-
12	Residue on evaporation, dried at 105°C.	180	182	56.4	41.6	-
13	Ignition loss at 550°C.	-	30.8	21.6	13.2	-
14	Specific conductance, micromhos at 25°C.	-	290·2	49.9	47.4	23.8
15	Calcium (Ca)	34.0	35.6	4.6	4.5	1.4
16	Magnesium (Mg)	7.3	7.8	1.1	1.1	1.0
17	Iron (Fe) Total	0.4	-	-	-	-
18	Dissolved	-	0.04	0.26	0.33	-
19	Manganese (Mn)	-	0.0	0.01	0.02	-
20	Aluminum (Al)	0.0	0.10	0.17	0.09	-
21	Copper (Cu)	-	0.0	0.04	0.01	-
22	Zinc (Zn)	-	0.05	-	-	-
23	Sodium (Na)	-	9.2	2.3	1.8	0.6
24	Potassium (K)	-	1.3	0.6	0.6	0.3
25	Ammonium (NH_4)	0.2	0.0	-	-	0.05
26	Carbonate (CO_3)	0.0	0.0	0.0	0.0	0.0
27	Bicarbonate (HCO_3)	110	108	16.8	17.3	3.8
28	Sulphate (SO_4)	20.3	22.8	5.5	5.0	3.1
29	Chloride (Cl)	24.3	21.5	1.7	1.4	1.0
30	Fluoride (F)	-	0.05	0.0	Trace	-
31	Nitrate (NO_3)	-	0.2	1.0	1.2	1.2
32	Silica (SiO_2), colorimetric	1.8	2.4	5.0	11	4.7
33	Carbonate hardness as $CaCO_3$	90.0	88.4	13.8	14.2	3.1
34	Non-carbonate hardness as $CaCO_3$	25.0	32.5	2.2	1.6	4.5
35	Total hardness as $CaCO_3$	115	121	16.0	15.8	7.6
36	Sum of constituents	-	154	30.6	35.8	15.2
37	Per cent sodium	-	14.0	21.5	18.1	14.0
38	Saturation index at test temperature	-0.5	+0.1	-2.3	-2.5	-4.6
39	Stability index at test temperature	8.4	7.9	11.9	12.0	15.3
	Remarks:	† Analysis by Alchem Limited		*See* also W.S.R. No. 13 * Composite Sample (4)		

TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

QUEBEC (Cont'd)

QUEBEC CITY and ENVIRONS (Concl'd)							ST. BRUNO			NO.
Citadel, Quebec City (Concl'd)				PMQ Area, Ste. Foy,			St. Bruno Camp			
Municipal Supply - St. Charles River (Concl'd)				Ste. Foy Municipal Supply - Wells			Wells			
Finished Water (Concl'd)				Raw and Finished Water			Raw and Finished Water			
At Citadel Tap				At Tap, Jean Lebarge St.		At Tap, Pierre Martin St.	At Pump		At Caretaker's Residence	
May 25/55	Apr.18/56	Aug.23/56	Jan.16/57	Feb.5/57	Apr.2/57	Apr.2/57	July 16/56	Dec.28/56	Dec.28/56	1
12:33	54:77	19:22	12:139	51:126	7:80	7:80	8:24	31:152	31:152	2
14.4	4.4	17.8	4.4	-	-	-	7.2	4.4	7.2	3
25.1	24.0	20.0	23.7	25.6	24.4	23.6	23.8	23.8	23.6	4
-	12	-	11	1.4	2.9	-	9.9	-	-	5
2.7	2.5	3.6	3.2	1.9	2.5	2.5	1.2	1.3	2.2	6
6.5	6.6	6.6	6.9	8.2	8.1	8.1	8.7	8.7	8.6	7
40	30	30	20	5	10	5	15	120	40	8
6	15	4	1	0	10	3.	25	17	0	9
-	11.4	-	-	-	13.1	2.8	24	9.4	-	10
-	9.5	-	-	-	7.9	0.7	15	5.2	-	11
-	49.6	-	68.4	250	260	242	380	388	470	12
-	25.6	-	37.2	33.6	32.4	87.2	23.2	31.2	36.4	13
28.1	35.70	39.02	49.62	384.1	380.0	382.2	605.9	620.5	762.0	14
3.2	3.5	4.6	4.9	61.0	61.8	62.7	3.7	4.2	6.9	15
0.4	0.7	0.3	1.0	6.7	5.9	5.3	0.1	0.3	5.5	16
-	-	-	-	-	-	-	0.37	2.5	-	17
-	0.27	-	0.28	0.0	Trace	0.01	0.08	-	0.02	18
-	0.0	-	0.01	0 02	0.0	0.0	0.0	0.0	0.0	19
-	0.0	-	0·22	0.37	0.51	0.26	0.73	0.0	0.19	20
-	0.0	-	Trace	Trace	0.0	0.0	0.02	Trace	0.0	21
-	0.05	-	0.05	0.0	0.0	0.0	0.0	0.02	0.0	22
0.9	1.1	1.4	2.2	9.3	8.8	8.7	146	152	177	23
0.5	0.9	0.5	0.6	1.3	1.3	1.3	3.0	3.1	7.0	24
0.2	0.2	0.1	0.2	0.0	0.0	0.0	0.1	-	-	25
0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.6	15.4	13.9	26
5.4	6.1	8.4	16.5	203	198	199	366	387	489	27
3.0	5.6	6.0	5.3	29.9	27.7	27.4	0.4	2.0	2.2	28
1.5	2.1	2.4	2.4	6.4	7.2	7.1	2.4	1.8	0.7	29
-	0.0	-	0.0	0.0	0.0	0.0	0.3	0.0	0.0	30
1.2	2.8	2.4	1.6	0. 2	0.4	0.2	8.0	0.4	1.6	31
4.6	5.6	6.7	10	11	9.1	9.9	11	9.1	12	32
4.4	5.0	6.9	13.5	167	162	163	9.6	11.7	39.8	33
5.2	6.6	5.8	2.8	13.0	16.4	14.8	0.0	0.0	0.0	34
9.6	11.6	12.7	16.3	180	178	178	9.6	11.7	39.8	35
17.9	25.6	28.4	37.3	226	220	221	370	380	467	36
16.0	14.8	18.6	19.7	9.9	9.5	9.4	94.6	94.3	88.5	37
-3.7	-3.5	-3.3	-2.6	+0.8	+0.6	+0.7	+0.3	+0.4	+0.6	38
13.9	13.6	13.2	12.1	6.6	6.9	6.7	8.1	7.9	7.4	39

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TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

PROVINCE QUEBEC (Cont'd)

NO.					
	Camp or Establishment	VALCARTIER, QUEBEC			
		Camp Valcartier			
	Source (s)	Deep Wells			
		Well No.1			
		Raw and Finished Water			
	Sampling Point	At Pump			
1	Date of sampling	May 1/56	Sept.11/56	Jan.22/57	Apr.24/57
2	Storage period (days)	49:83	35:42	8:142	5:83
3	Sampling temperature,°C.	7.2	8.3	7.2	7.2
4	Test temperature,°C.	23.0	24.8	22.1	23.3
5	Oxygen consumed by $KMnO_4$	8.3	-	-	2.2
6	Carbon dioxide (CO_2), (calculated)	2.6	2.6	2.2	2.2
7	pH	6.9	6.9	7.0	7.0
8	Colour	0	5	5	0
9	Turbidity	0	0	0	3
10	Suspended matter, dried at 105°C.	-	-	-	-
11	Suspended matter, ignited at 550°C.	-	-	-	-
12	Residue on evaporation, dried at 105°C.	37.2	-	65.6	42.4
13	Ignition loss at 550°C.	14.8	-	17.6	15.2
14	Specific conductance, micromhos at 25°C.	36.58	36.29	37.91	39.26
15	Calcium (Ca)	3.9	2.8	3.1	3.5
16	Magnesium (Mg)	0.7	1.3	1.2	1.1
17	Iron (Fe) Total	-	-	-	-
18	Dissolved	Trace	-	0.0	0.01
19	Manganese (Mn)	0.0	-	0.0	0.0
20	Aluminum (Al)	0.03	-	0.2	0.0
21	Copper (Cu)	0.0	-	0.0	Trace
22	Zinc (Zn)	0.05	-	0.05	0.02
23	Sodium (Na)	1.6	1.6	1.8	1.5
24	Potassium (K)	0.4	0.5	0.5	0.5
25	Ammonium (NH_4)	0.0	0.0	0.0	0.0
26	Carbonate (CO_3)	0.0	0.0	0.0	0.0
27	Bicarbonate (HCO_3)	13.3	12.9	14.3	14.1
28	Sulphate (SO_4)	2.8	3.4	2.9	2.7
29	Chloride (Cl)	0.2	0.9	1.1	0.9
30	Fluoride (F)	0.0	-	0.0	0.0
31	Nitrate (NO_3)	4.0	2.0	1.6	2.5
32	Silica (SiO_2), colorimetric	15	15	15	14
33	Carbonate hardness as $CaCO_3$	10.9	10.6	11.7	11.6
34	Non-carbonate hardness as $CaCO_3$	1.7	1.7	1.0	1.7
35	Total hardness as $CaCO_3$	12.6	12.3	12.7	13.3
36	Sum of constituents	35.2	33.6	34.3	33.7
37	Per cent sodium	20.7	21.2	21.3	18.9
38	Saturation index at test temperature	-2.8	-2.4	-2.8	-2.7
39	Stability index at test temperature	12.5	11.7	12.6	12.4
	Remarks:				

TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

QUEBEC (Cont'd)

VALCARTIER, QUEBEC (Cont'd)							
Camp Valcartier (Cont'd)							
Deep Wells							
Well No.3				Well No.5			NO.
Raw and Finished Water							
At Pump				At Pump			
May 1/56	Sept.11/56	Jan.22/57	Apr.24/57	May 1/56	Sept.11/56	Jan22/57	1
49:83	41:44	8:142	5:83	49:87	41:44	8:142	2
7.2	7.2	7.2	7.2	7.2	7.2	-	3
23.0	24.2	22.2	23.2	23.0	24.4	22.2	4
8.2	-	-	2.2	8.7	-	-	5
3.7	2.5	6.6	5.2	1.3	2.5	4.8	6
6.7	6.9	6.5	6.6	7.1	6.8	6.6	7
0	5	5	0	0	0	5	8
0	0	0	4	0	0	0	9
-	-	-	0.5	-	-	-	10
-	-	-	0.0	-	-	-	11
42.4	-	64.0	49.2	38.8	-	57.2	12
14.8	-	23.6	18.4	13.6	-	18.8	13
41.19	37.52	41.30	41.70	37.42	38.90	31.91	14
4.1	3.4	3.9	3.5	3.6	3.1	3.1	15
0.8	0.8	0.9	1.1	0.7	0.8	0.6	16
-	-	-	-	-	-	-	17
0.02	-	Trace	0.0	0.01	-	0.02	18
0.01	-	0.01	0.0	0.04	-	0.01	19
0.04	-	0.07	0.0	0.0	-	0.19	20
0.0	Trace	0.0	0.0	0.0	Trace	0.0	21
0.0	0.0	0.05	0.0	0.0	0.05	0.05	22
1.6	1.6	2.1	1.7	1.7	1.4	1.8	23
0.8	0.8	0.8	0.8	0.8	0.7	0.7	24
0.0	0.05	0.0	0.0	0.0	0.05	0.0	25
0.0	0.0	0.0	0.0	0.0	0.0	0.0	26
11.6	12.1	12.7	13.3	9.6	9.9	11.2	27
2.8	3.8	3.9	3.8	2.8	3.9	2.9	28
0.5	0.8	1.1	1.0	0.8	1.2	0.7	29
0.0	-	0.0	0.0	0.0	0.0	0.0	30
6.8	3.2	3.2	2.5	8.0	3.2	2.4	31
13	13	13	12	11	11	12	32
9.5	9.9	10.4	10.9	7.9	8.1	9.2	33
4.0	1.9	3.0	2.4	4.0	2.9	1.0	34
13.5	11.8	13.4	13.3	11.9	11.0	10.2	35
36.3	33.3	35.1	32.8	33.8	30.3	30.0	36
19.0	21.4	23.4	20.6	22.2	20.3	24.2	37
-3.1	-2.9	-3.3	-3.2	-2.8	-3.1	-3.3	38
12.9	12.7	13.1	13.0	12.7	13.0	13.2	39

TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

PROVINCE QUEBEC (Cont'd)

NO.		VALCARTIER, (Cont'd)				
	Camp or Establishment	Camp Valcartier, (Cont'd)				
	Source(s)	Well No.5	Mixed Wells			
		Raw and Finished Water				
	Sampling Point	At Pump	At Bldg. No. 5 (Central Heating Plant) Tap			
1	Date of sampling	Apr.24/57	Feb.10/55	Mar.16/55	Apr.18/55	May 16/55
2	Storage period (days)	5:83	19:35	15:43	15:18	16:24
3	Sampling temperature, °C.	7.2	7.8	7.2	-	-
4	Test temperature, °C	23.2	21.6	25.1	24.3	22.6
5	Oxygen consumed by $KMnO_4$	2.0	1.3	-	-	1.1
6	Carbon dioxide (CO_2), (calculated)	3.9	1.8	1.8	1.1	1.8
7	pH	6.6	7.1	7.1	7.3	7.1
8	Colour	0	5	5	0	0
9	Turbidity	3	0	0	0	0
10	Suspended matter, dried at 105°C	0.8	-	-	-	-
11	Suspended matter, ignited at 550°C	0.0	-	-	-	-
12	Residue on evaporation, dried at 105°C.	43.2	43.6	-	-	46.0
13	Ignition loss at 550°C	15.2	21.0	-	-	11.6
14	Specific conductance, micromhos at 25°C	31.60	38.9	38.8	38.3	39.2
15	Calcium (Ca)	2.8	3.2	3.4	3.8	3.8
16	Magnesium (Mg)	0.7	1.1	1.0	0.8	1.0
17	Iron (Fe) Total	-	-	-	-	-
18	Dissolved	0.0	0.01	-	-	0.0
19	Manganese (Mn)	0.01	Trace	-	-	0.0
20	Aluminum (Al)	0.0	0.35	-	-	0.42
21	Copper (Cu)	0.01	0.0	-	-	0.0
22	Zinc (Zn)	0.0	-	-	-	-
23	Sodium (Na)	1.4	1.9	1.4	1.4	1.4
24	Potassium (K)	0.7	0.5	0.5	0.5	0.5
25	Ammonium (NH_4)	0.0	-	-	-	0.0
26	Carbonate (CO_3)	0.0	0.0	0.0	0.0	0.0
27	Bicarbonate (HCO_3)	10.0	14.7	15.2	15.6	13.4
28	Sulphate (SO_4)	3.1	3.7	2.8	1.8	3.1
29	Chloride (Cl)	0.5	0.8	0.0	0.4	1.7
30	Fluoride (F)	0.0	0.0	-	-	0.05
31	Nitrate (NO_3)	3.0	2.4	2.0	1.2	3.2
32	Silica (SiO_2), colorimetric	11	10	17	18	14
33	Carbonate hardness as $CaCO_3$	8.2	12.1	12.5	12.8	10.6
34	Non-carbonate hardness as $CaCO_3$	1.7	0.4	0.1	0.0	2.6
35	Total hardness as $CaCO_3$	9.9	12.5	12.6	12.8	13.2
37	Sum of constituents	27.8	31.3	35.6	35.4	36.1
37	Per cent sodium	22.0	21.5	18.7	18.5	15.5
38	Saturation index at test temperature	-3.4	-2.7	-2.6	-2.3	-2.7
39	Stability index at test temperature	13.4	12.5	12.3	11.9	12.5
	Remarks:					

TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

QUEBEC (Concl'd)

VALCARTIER, (Concl'd)							
Camp Valcartier, (Concl'd)							
Mixed Wells							
Raw and Finished Water							NO.
At Bldg. No. 5 (Central Heating Plant) Tap			At Tap in Bldg. L 59				
Aug.1/55	Jan.4/56	Apr.3/56	May 1/56	Sept.11/56	Jan.22/57	Apr.24/57	1
14:29	13:14	20:28	49:83	41:44	8:142	5:83	2
-	6.7	7.2	7.2	14.4	8.3	9.4	3
27.5	24.1	23.2	23.0	24.4	22.0	23.2	4
-	-	-	8.3	-	-	1.9	5
1.0	2.1	3.3	1.8	1.9	3.6	2.3	6
7.5	7.0	6.8	7.3	7.1	6.8	7.2	7
10	5	0	0	5	5	0	8
0	0	0	0	0	0	4	9
-	-	-	-	-	-	1.0	10
-	-	-	-	-	-	0.0	11
-	-	-	44.0	-	64.0	50.0	12
-	-	-	18.0	-	32.0	14.0	13
49.7	36.50	37.41	51.96	43.34	42.48	54.36	14
3.9	3.5	3.6	4.8	3.8	4.1	3.8	15
1.0	0.9	0.9	1.2	0.9	0.7	2.4	16
-	-	-	-	-	-	-	17
-	-	-	0.02	-	0.01	0.0	18
-	-	-	0.0	-	0.0	0.01	19
-	-	-	-	-	0.08	0.42	20
-	-	-	0.0	Trace	0.0	Trace	21
-	-	-	1.0	0.5	1.5	0.8	22
1.8	1.5	1.4	1.8	1.6	1.7	1.5	23
0.6	0.5	0.4	0.6	0.6	0.6	0.7	24
0.0	0.3	0.0	0.1	0.0	0.0	0.0	25
0.0	0.0	0.0	0.0	0.0	0.0	0.0	26
20.0	13.4	14.5	22.4	16.2	15.7	23.5	27
2.9	2.8	3.6	2.8	3.4	3.4	3.8	28
0.2	0.6	0.4	0.3	0.8	1.0	1.2	29
-	-	-	0.0	0.0	0.0	0.0	30
0.8	4.0	3.2	4.0	3.2	2.4	2.5	31
14	14	14	13	14	14	11	32
13.8	11.0	11.9	16.9	13.2	12.9	19.3	33
0.0	1.4	0.8	0.0	0.0	0.2	0.1	34
13.8	12.4	12.7	16.9	13.2	13.1	19.4	35
34.7	34.5	34.4	39.9	37.0	36.8	40.0	36
21.1	20.0	18.8	16.7	19.1	18.2	12.0	37
-2.0	-2.7	-2.9	-2.0	-2.5	-2.9	-2.3	38
11.5	12.4	12.6	11.3	12.1	12.6	11.8	39

TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

PROVINCE ONTARIO

NO.		BARRIEFIELD, ONT.					
	Camp or Establishment	Camp Barriefield					
	Source(s)	St. Lawrence River (Lake Ontario)					
		Raw Water †			Finished Water		
	Sampling Point	At Vimy Pumphouse			At Vimy Pumphouse		
1	Date of sampling	Apr.24/56	Aug.16/56	Dec.4/56	Apr.24/56	Aug.16/56	Dec.4/56
2	Storage period (days)	51:77	15:20	34:39	51:77	15:20	34:39
3	Sampling temperature, °C.	5.0	16.1	1.1	5.0	16.1	1.1
4	Test temperature, °C.	25.8	21.4	22.2	25.6	21.5	22.3
5	Oxygen consumed by $KMnO_4$	8.0	-	11	7.9	-	10
6	Carbon dioxide (CO_2), calculated	1.4	1.5	1.2	1.1	1.5	1.3
7	pH	8.1	8.1	8.2	8.2	8.1	8.2
8	Colour	0	0	5	0	5	10
9	Turbidity	5	0	0	5	0	0
10	Suspended matter, dried at 105°C.	3.1	-	-	1.9	-	-
11	Suspended matter, ignited at 550°C.	1.6	-	-	1.6	-	-
12	Residue on evaporation, dried at 105°C.	189	-	187	192	-	190
13	Ignition loss at 550°C.	40.4	-	32.4	30.4	-	37.2
14	Specific conductance, micromhos at 25°C.	289.7	298	305.7	293.7	295.9	304.1
15	Calcium (Ca)	37.9	39.3	39.3	38.5	39.8	39.1
16	Magnesium (Mg)	6.9	6.8	7.6	7.0	6.5	7.5
17	Iron (Fe) Total	-	-	-	-	-	-
18	Dissolved	0.03	0.01	Trace	0.03	0.01	Trace
19	Manganese (Mn)	0.0	-	0.0	0.0	-	0.0
20	Aluminum (Al)	0.0	-	0.03	0.03	-	0.03
21	Copper (Cu)	0.0	-	Trace	0.0	-	Trace
22	Zinc (Zn)	0.0	-	0.0	0.0	-	0.0
23	Sodium (Na)	8.5	9.2	9.0	8.6	9.2	9.3
24	Potassium (K)	1.4	1.2	1.3	1.3	1.2	1.4
25	Ammonium (NH_4)	0.1	0.1	0.2	0.1	0.1	0.2
26	Carbonate (CO_3)	0	0	0	0	0	0
27	Bicarbonate (HCO_3)	112	112	117	112	112	115
28	Sulphate (SO_4)	22.2	23.6	24.4	22.3	23.1	23.7
29	Chloride (Cl)	19.2	20.2	21.8	19.9	22.6	22.6
30	Fluoride (F)	0.2	-	0.0	0.15	-	0.0
31	Nitrate (NO_3)	3.2	2.4	0.6	8.0	2.4	0.6
32	Silica (SiO_2), colorimetric	1.7	0.8	1.7	1.8	1.6	2.2
33	Carbonate hardness as $CaCO_3$	92.0	91.6	95.9	92.0	91.8	94.5
34	Non-carbonate hardness as $CaCO_3$	30.9	34.4	33.4	32.8	34.2	33.9
35	Total hardness as $CaCO_3$	123	126	129	125	126	128
36	Sum of constituents	157	160	163	163	162	163
37	Per cent sodium	12.9	13.6	12.9	12.9	13.6	13.4
38	Saturation index at test temperature	+0.2	+0.2	+0.3	+0.3	+0.1	+0.3
39	Stability index at test temperature	7.7	7.7	7.6	7.6	7.9	7.6
	Remarks:	† *See* also W.S.R. No. 3					

TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

ONTARIO (Cont'd)

BARRIEFIELD, ONT. (Concl'd)					CAMP BORDEN and ENVIRONS			NO.
Camp Barriefield (Concl'd)					Blackdown Park Camp			
St. Lawrence River (Lake Ontario)				Kingston Municipal Supply - St. Lawrence River Water, Treated.	Small Creek			
Finished Water (Concl'd)				Finished Water	Raw and Finished Water			
At R.C.E.M.E. Central Heating Plant Tap				At Town Tap	At Pump			
Feb.11/55	Apr.11/55	May 11/55	Feb.1/56	Sept.6/57	Apr.17/56	Aug.20/56	Dec.19/56	1
13:26	20:25	19:29	12:19	6:7	52:78	44:57	36:159	2
2.8	4.4	8.3	2.2	22.2	4.4	11.7	7.2	3
20.9	24.4	24.0	26.0	24.6	23.6	24.2	21.4	4
2.5	-	3.4	-	2	12	11	-	5
2.4	3.6	1.5	1.2	2.6	1.9	1.6	2.2	6
7.9	7.7	8.1	8.2	7.8	8.2	8.3	8.3	7
10	5	5	10	0	30	10	30	8
0	1	3	1	1	0	0.8	0.9	9
-	-	-	-	-	-	-	-	10
-	-	-	-	-	-	-	-	11
185	-	191	-	205	205	-	295	12
38.4	-	51.2	-	48.0	26.4	-	70.8	13
313.1	299.6	292.4	301.0	308.4	318.2	389.2	417.6	14
38.3	39.0	39.6	38.5	37.8	58.0	69.3	75.0	15
7.5	6.5	6.3	8.5	8.2	5.9	7.3	8.6	16
-	-	-	-	-	-	-	-	17
0.0	-	0.0	-	0.05	0.04	-	0.0	18
0.0	-	0.0	-	0.01	0.0	-	0.0	19
0.07	-	0.0	-	0.04	0.03	-	0.16	20
0.0	-	0.0	-	0.0	0.0	0.0	0.0	21
-	-	-	-	0.1	0.0	0.0	0.0	22
8.4	7.3	6.9	9.2	8.9	2.0	2.5	2.7	23
1.2	1.2	1.3	1.3	1.2	1.1	1.0	1.0	24
-	-	-	0.0	0.0	0.0	0.1	0.1	25
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26
115	113	112	114	100	184	222	251	27
23.9	22.8	21.4	24.4	30.7	19.5	25.5	22.3	28
20.4	19.5	18.0	22.1	22.6	1.9	3.0	2.3	29
0.2	-	0.05	-	0.0	0.0	-	0.0	30
0.8	1.2	1.2	1.6	0.3	1.2	0.8	0.8	31
1.0	2.3	5.2	1.7	0.7	6.0	10	14	32
93.9	92.7	92.2	93.2	82.1	151	182	206	33
32.5	34.1	32.5	37.8	45.9	18.0	20.6	16.5	34
126	127	125	131	128	169	203	223	35
158	156	155	163	160	187	229	250	36
12.5	11.0	10.6	13.1	13.0	2.5	2.6	2.5	37
-0.1	-0.4	+0.2	+0.4	-0.1	+0.7	+1.0	+1.0	38
8.1	8.5	7.7	7.4	8.0	6.8	6.3	6.3	39
					Flow is slightly above normal	Low flow		

TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

NO.	PROVINCE	ONTARIO (Cont'd)					
		CAMP BORDEN and ENVIRONS (Cont'd)					
	Camp or Establishment	Camp Borden					
	Source(s)	Deep Wells					
		Well No. 1			Well No. 2		
		Raw and Finished Water					
	Sampling Point	At Pump			At Pump		
1	Date of sampling	Aug.20/56	Dec.19/56	Apr.4/57	Aug.20/56	Dec.19/56	Apr.4/57
2	Storage period (days)	31:44	36:159	5:79	31:57	36:159	7:78
3	Sampling temperature, °C.	11.1	12.8	10.0	11.1	12.2	10.0
4	Test temperature, °C.	22.5	21.6	24.8	22.8	21.6	24.7
5	Oxygen consumed by $KMnO_4$	8.9	-	-	9.5	-	-
6	Carbon dioxide (CO_2), (calculated)	1.3	1.4	4.5	1.2	1.5	3.7
7	pH	8.4	8.3	7.9	8.5	8.4	8.0
8	Colour	5	5	10	0	5	5
9	Turbidity	2	0	3	2	5	4
10	Suspended matter, dried at 105°C.	-	-	8.6	-	-	5.3
11	Suspended matter, ignited at 550°C.	-	-	4.3	-	-	1.6
12	Residue on evaporation, dried at 105°C.	-	200	294	253	-	302
13	Ignition loss at 550°C.	-	50.8	89.2	41.2	-	63.0
14	Specific conductance, micromhos at 25°C.	394.6	275.0	377.5	455.7	446	467.3
15	Calcium (Ca)	48.1	17.5	44.6	59.4	58.6	59.0
16	Magnesium (Mg)	14.8	11.2	15.0	14.9	14.6	16.5
17	Iron (Fe) Total	-	-	-	0.62	-	-
18	Dissolved	0.34	0.0	Trace	0.03	0.05	0.09
19	Manganese (Mn)	-	0.0	0.0	0.0	Trace	0.01
20	Aluminum (Al)	-	0.11	0.32	0.13	0.19	0.36
21	Copper (Cu)	Trace	0.0	0.0	0.0	0.0	0.0
22	Zinc (Zn)	0.0	0.05	0.0	0.0	0.0	0.0
23	Sodium (Na)	11.1	26.5	12.2	12.2	10.5	11.3
24	Potassium (K)	1.6	1.5	1.4	1.6	1.5	1.5
25	Ammonium (NH_4)	0.1	0.1	0.0	0.1	0.0	0.0
26	Carbonate (CO_3)	5.8	0.0	0.0	7.4	2.5	0.0
27	Bicarbonate (HCO_3)	210	172	211	216	228	238
28	Sulphate (SO_4)	6.7	1.0	6.9	8.7	9.1	10.0
29	Chloride (Cl)	13.5	7.1	14.1	28.5	26.2	30.9
30	Fluoride (F)	-	0.0	0.0	0.0	0.0	0.0
31	Nitrate (NO_3)	0.4	0.8	0.4	0.4	0.2	0.2
32	Silica (SiO_2), colorimetric	17	18	16	17	17	15
33	Carbonate hardness as $CaCO_3$	181	89.7	173	189	191	195
34	Non-carbonate hardness as $CaCO_3$	0.0	0.0	0.0	20.2	16.3	20.2
35	Total hardness as $CaCO_3$	181	89.7	173	209	207	215
36	Sum of constituents	222	167	220	256	252	262
37	Per cent sodium	11.7	38.3	13.1	11.1	9.8	10.1
38	Saturation index at test temperature	+0.9	+0.2	+0.4	+1.1	+0.9	+0.6
39	Stability index at test temperature	6.6	7.9	7.1	6.3	6.6	6.8
	Remarks:						

TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

ONTARIO (Cont'd)

CAMP BORDEN and ENVIRONS (Concl'd)				COBOURG					
Camp Borden									
Deep Wells				Cobourg Municipal Supply - Lake Ontario, Treated.*					
Well No.3									
Raw and Finished Water				Finished Water					NO.
At Pump				At Tap In Central Heating Plant					
Apr.17/56	July 20/56	Dec.19/56	Apr.4/57	Feb.9/55	Mar.30/55	Apr.25/55	May 17/56	May 29/57	1
55:78	44:57	36:161	7:78	20:28	16:29	15:23	41:76	13:54	2
8.9	11.1	12.8	10.0	4.4	15.6	4.4	12.2	-	3
22.4	24.2	21.5	24.4	21.6	23.0	22.3	24.4	23.4	4
7.2	8.9	-	-	2.6	-	-	7.5	2.6	5
2.9	1.6	1.8	3.7	1.9	8.0	2.4	1.5	2.4	6
8.1	8.3	8.3	8.0	8.0	7.4	7.9	8.1	7.9	7
0	5	5	5	5	0	0	0	0	8
3	2	1	5	0	1	6	5	5	9
-	-	-	8.1	-	-	-	5.1	-	10
-	-	-	6.4	-	-	-	1.7	-	11
197	198	207	216	198	-	-	216	177	12
20.0	19.6	40.4	33.6	44.0	-	-	102	53.2	13
352.0	356.2	350.4	360.2	316.0	313.1	313.6	307.0	310.9	14
50.9	50.1	48.2	50.5	39.8	40.1	40.0	39.0	39.6	15
12.8	13.2	12.9	14.1	7.8	7.5	7.4	8.3	8.1	16
-	0.33	-	-	-	-	-	-		17
0.04	0.03	0.0	0.13	Trace	-	-	0.02	0.0	18
0.0	0.01	Trace	0.0	0.0	-	-	0.0	0.0	19
0.03	0.07	0.16	0.47	0.11	-	-	0.09	0.09	20
0.0	0.0	0.0	0.0	Trace	-	-	0.0	0.0	21
0.0	0.0	0.0	0.0	-	-	-	0.0	0.0	22
6.0	6.0	7.5	4.8	9.0	8.6	8.2	9.1	9.4	23
1.4	1.4	1.2	1.3	1.2	1.3	1.3	1.3	1.2	24
0.0	0.0	0.0	0.0	-	-	0.05	0.1	0.0	25
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26
220	230	228	235	120	122	118	115	120	27
6.1	6.4	6.9	7.4	26.9	24.2	21.3	24.4	26.3	28
2.0	2.4	1.6	1.5	22.1	20.9	21.4	21.5	22.6	29
0.0	0.0	0.0	0.0	0.05	-	-	0.0	0.0	30
0.8	0.4	0.2	0.15	1.0	1.0	1.6	3.2	0.8	31
17	17	15	16	0.8	0.6	0.5	1.9	1.1	32
180	180	173	184	98.6	99.8	96.5	94.0	98.3	33
0.0	0.0	0.0	0.0	32.8	31.1	33.7	37.4	33.8	34
180	180	173	184	131	131	130	131	132	35
206	210	206	213	169	164	160	165	169	36
6.7	6.8	8.5	5.3	12.8	12.4	11.9	12.9	13.2	37
+0.6	+0.8	+0.7	+0.6	+0.1	-0.5	0.0	+0.2	0.0	38
6.9	6.7	6.9	6.8	7.8	8.4	7.9	7.7	7.9	39

* *See* also W.S.R. No. 3

TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

PROVINCE — ONTARIO (Cont'd)

NO.		HAGERSVILLE				
	Camp or Establishment	Camp Hagersville				
	Source (s)	Lake Erie				
		Raw Water	Finished Water			
	Sampling Point	At Pump	At Tap or From Tank, in Bldg. 21			
1	Date of sampling	Apr.2/56	Apr.3/56	Oct.11/56	Feb.11/57	Apr.10/57
2	Storage period (days)	84:121	84:120	28:89	56:122	7:79
3	Sampling temperature, °C.	7.2	10.0	17.8	11.7	12.8
4	Test temperature, °C.	23.4	23.8	25.2	24.1	23.8
5	Oxygen consumed by $KMnO_4$	7.9	8.6	-	3.6	3.4
6	Carbon dioxide (CO_2), (calculated)	1.9	1.5	1.9	1.6	3.0
7	pH	8.1	8.1	8.0	8.1	7.8
8	Colour	0	10	10	5	15
9	Turbidity	25	40	5	4	40
10	Suspended matter, dried at 105°C.	19.8	24.8	-	-	18.4
11	Suspended matter, ignited at 550°C	17.4	22.8	-	-	6.3
12	Residue on evaporation, dried at 105°C.	199	242	-	-	226.4
13	Ignition loss at 550°C.	51.6	92.0	-	-	54.4
14	Specific conductance, micromhos at 25°C.	296.5	291.5	303.1	316.4	314.2
15	Calcium (Ca)	39.2	38.8	39.7	39.3	40.9
16	Magnesium (Mg)	7.1	7.2	7.7	8.1	8.0
17	Iron (Fe) Total	-	-	-	-	-
18	Dissolved	0.01	0.04	-	0.0	0.02
19	Manganese (Mn)	0.0	0.0	-	0.0	Trace
20	Aluminum (Al)	0.10	0.08	-	0.44	0.07
21	Copper (Cu)	0.0	0.0	Trace	Trace	Trace
22	Zinc (Zn)	0.0	0.0	0.05	0.4	0.2
23	Sodium (Na)	7.9	7.7	9.1	8.5	8.0
24	Potassium (K)	1.2	1.4	1.3	1.2	1.3
25	Ammonium (NH_4)	0.1	0.1	0.0	0.0	0.0
26	Carbonate (CO_3)	0.0	0.0	0.0	0.0	0.0
27	Bicarbonate (HCO_3)	119	115	120	123	118
28	Sulphate (SO_4)	16.7	22.1	21.8	22.5	24.9
29	Chloride (Cl)	19.1	19.9	22.9	23.5	22.5
30	Fluoride (F)	0.1	0.05	-	0.1	0.0
31	Nitrate (NO_3)	1.2	0.4	0.4	0.4	0.8
32	Silica (SiO_2), colorimetric	1.1	2.4	-	2.7	1.6
33	Carbonate hardness as $CaCO_3$	97.6	94.4	98.7	101	96.8
34	Non-carbonate hardness as $CaCO_3$	29.4	32.0	32.0	30.7	38.1
35	Total hardness as $CaCO_3$	127	126	131	131	135
36	Sum of constituents	152	157	-	168	167
37	Per cent sodium	11.7	11.5	13.1	12.0	11.2
38	Saturation index at test temperature	+0.2	+0.2	+0.2	+0.3	+0.1
39	Stability index at test temperature	7.7	7.7	7.6	7.5	8.0
	Remarks:	*See* also W.S.R. No. 3				

TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

ONTARIO (Cont'd)

HAGERSVILLE (Concl'd)			IPPERWASH			NO.
Camp Hagersville			Camp Ipperwash			
Wells (Standby Supply)			Lake Huron			
Raw and Finished Water			Raw and Finished Water			
At Pump			At Intake Pump	At Tap in Bldg. 18		
Oct.12/56	Feb.11/57†	Apr.10/57†	Apr.10/56	Aug.27/56	Dec.3/56	1
27:103	56:122	7:79	58:78	42:62	50:170	2
15.6	-	10.0	4.3	18.9	6.7	3
25.1	24.0	23.8	22.2	24.2	26.3	4
-	-	2.9	7.5	9.5	10	5
15	2.2	4.2	1.4	0.9	0.9	6
7.3	8.3	8.0	8.1	8.2	8.2	7
10	5	10	5	15	5	8
30	20	40	35	20	3	9
58.0	26.1	28.6	43.2	-	-	10
48.1	17.4	13.7	39.7	-	-	11
1198	586	563	136	-	127	12
93.6	56.0	67.2	21.2	-	21.6	13
1459	824.6	807.6	213.4	210.3	196.3	14
208	89.0	85.4	29.9	28.6	27.0	15
64.3	27.4	28.3	6.6	6.1	6.2	16
-	-	-	-	-	-	17
0.04	0.06	0.10	0.02	-	0.0	18
0.0	0.0	0.0	0.0	-	0.0	19
0.28	0.60	0.14	0.05	-	0.05	20
0.0	0.0	0.0	0.0	0.0	0.0	21
0.1	0.0	0.0	0.0	0.02	0.0	22
43.1	47.6	49.6	2.7	2.9	3.9	23
4.6	2.2	2.3	1.0	1.0	0.8	24
-	0.05	0.2	0.0	0.0	0.1	25
0.0	0.0	0.0	0.0	0.0	0.0	26
208	271	274	101	97.0	97.3	27
667	213	210	14.3	14.0	12.3	28
9.3	3.4	3.6	4.6	7.6	5.3	29
1.6	0.53	0.4	0.0	-	0.0	30
0.4	0.6	1.6	8.0	1.2	0.8	31
10	7.1	6.2	4.1	3.2	6.5	32
171	223	224	83.2	79.6	79.8	33
613	112	105	18.5	16.8	13.1	34
784	335	329	102	96.4	92.9	35
1112	525	522	121	112	111	36
10.6	23.3	24.4	5.4	6.1	8.2	37
+0.3	+1.1	+0.8	0.0	+0.1	+0.2	38
6.7	6.1	6.4	8.1	8.0	7.8	39
	† No.3 well		Normal lake level			

TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

PROVINCE ONTARIO (Cont'd)

NO.								
	Camp or Establishment	LAKEVIEW						
	Source (s)	Toronto Township and Lakeview Municipal Supply - Lake Ontario, Treated						
		Finished Water						
	Sampling Point	At Tap in Central Heating Plant						
1	Date of sampling	Mar.18/55	Apr.28/55	Feb.2/56	Mar.8/56	Apr.4/56	May 5/56	June 4/56
2	Storage period (days)	13:38	19:27	25:32	8:26	15:21	11:20	29:64
3	Sampling temperature, °C.	-	-	11.1	-	-	6.7	11.1
4	Test temperature, °C.	25.1	22.1	22.4	22.1	22.4	23.0	23.3
5	Oxygen consumed by $KMnO_4$	2.3	-	-	3.2	-	-	4.0
6	Carbon dioxide (CO_2), (calculated)	4.9	4.0	1.2	2.6	1.8	4.1	1.2
7	pH	7.6	7.8	8.2	7.7	8.0	7.6	8.2
8	Colour	5	5	5	0	5	0	5
9	Turbidity	0.3	3	0.3	0	3	0	1
10	Suspended matter, dried at 105°C.	-	-	-	-	-	-	-
11	Suspended matter, ignited at 550°C.	-	-	-	-	-	-	-
12	Residue on evaporation, dried at 105°C.	199	-	-	-	-	-	210
13	Ignition loss at 550°C.	38.4	-	-	-	-	-	46.0
14	Specific conductance, micromhos at 25°C.	327.3	337.1	312.8	326.1	309.9	328.8	311.6
15	Calcium (Ca)	42.2	42.9	40.3	41.3	40.1	42.9	39.9
16	Magnesium (Mg)	8.2	8.3	7.7	7.6	7.4	7.5	8.6
17	Iron (Fe) Total	-	-	-	-	-	-	-
18	Dissolved	Trace	-	-	-	-	-	0.01
19	Manganese (Mn)	Trace	-	-	-	-	-	0.0
20	Aluminum (Al)	0.15	-	-	-	-	-	0.15
21	Copper (Cu)	Trace	-	-	Trace	-	-	0.0
22	Zinc (Zn)	-	-	-	0.0	-	-	0.0
23	Sodium (Na)	8.3	9.3	9.7	9.6	9.5	9.1	9.3
24	Potassium (K)	1.4	1.7	1.3	1.6	1.4	1.5	1.3
25	Ammonium (NH_4)	-	0.0	0.0	0.0	-	0.0	0.05
26	Carbonate (CO_3)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
27	Bicarbonate (HCO_3)	119	131	114	78.0	113	102	116
28	Sulphate (SO_4)	35.0	24.7	25.4	55.7	25.2	42.8	24.2
29	Chloride (Cl)	19.1	20.8	21.8	23.6	23.9	21.2	22.4
30	Fluoride (F)	0.1	-	-	-	-	-	0.0
31	Nitrate (NO_3)	1.2	1.6	2.4	1.2	2.0	4.0	4.0
32	Silica (SiO_2), colorimetric	1.2	1.5	2.5	1.3	1.1	1.4	2.0
33	Carbonate hardness as $CaCO_3$	98.0	107.4	93.8	64.0	92.6	84.0	95.2
34	Non-carbonate hardness as $CaCO_3$	41.0	31.3	38.4	70.3	37.9	53.9	39.7
35	Total hardness as $CaCO_3$	139	139	132	134	131	138	135
36	Sum of constituents	176	175	168	180	166	181	169
37	Per cent sodium	11.3	12.5	13.6	13.3	13.5	12.4	12.8
38	Saturation index at test temperature	-0.2	0.0	+0.3	-0.4	+0.1	-0.3	+0.3
39	Stability index at test temperature	8.0	7.8	7.6	8.5	7.8	8.2	7.6
	Remarks:	*See* also W.S.R. No. 3						

TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

ONTARIO (Cont'd)

LAKEVIEW (Concl'd)				LEITRIM							
				Leitrim Station							
Toronto Township and Lakeview Municipal Supply - Lake Ontario, Treated (Concl'd)				Wells							
				Shallow Well		Deep Well (Goth Farm)		Deep Well			
Finished Water				Raw and Finished Water							NO.
At Tap in Central Heating Plant				At Pump		At Pump		At Pump			
Oct.9/56	Nov.1/56	Jan.22/57	Apr.24/57	Apr.10/56	Dec.4/56	Aug.29/56	June 14/57	Aug.28/56	Dec.4/56	Mar.7/58	1
7:14	28:57	13:21	7:83	56:65	23:77	15:26	6:7	14:27	43:77	3:5	2
10.0	11.1	-	-	6.7	10.0	10.0	12.8	14.4	10.0	15.5	3
24.9	23.6	24.8	23.9	21.8	22.5	22.8	27.4	22.6	17.0	22.9	4
-	-	-	3.4	7.4	-	-	2.6	-	-	-	5
1.2	1.5	-	2.5	5.2	1.9	2.7	1.5	3.6	1.6	4.0	6
8.2	8.1	8.0	7.9	8.0	8.3	7.8	8.0	8.2	8.6	8.2	7
5	10	-	0	5	5	0	5	0	0	-	8
4	0	-	6	1	-	4	80 *	1	-	Clear	9
-	-	-	0.7	-	-	-	79.8	-	-	-	10
-	-	-	0.0	-	-	-	75.6	-	-	-	11
-	-	-	210	510	-	-	258	-	-	-	12
-	-	-	82.8	60.0	-	-	44.4	-	-	-	13
308.3	309.7	316.4	320.4	745.7	508.9†	359.1	355.3	662.7	611.8	792.3	14
39.5	39.4	-	41.3	94.6	45.5†	49.2	45.9	65.6	35.6	-	15
7.5	7.7	-	8.2	30.2	27.1	8.4	9.1	16.2	19.5	-	16
-	-	-	-	-	-	-	4.1	-	-	-	17
-	-	-	0.04	0.05	Trace	-	0.17	-	0.02	-	18
-	-	-	0.0	-	0.0	-	0.02	-	0.02	-	19
-	-	-	0.11	-	0.16	-	0.06	-	0.49	-	20
-	-	-	0.04	0.0	Trace	-	0.0	-	0.0	-	21
-	-	-	0.0	0.3	0.05	-	0.0	-	0.3	-	22
9.7	10.3	9.4	9.4	22.2	21.2	7.4	9.5	57.0	77.0	70.5	23
1.3	1.3	1.3	1.4	4.5	4.0	2.0	2.1	3.8	4.4	3.9	24
0.1	0.05	0.0	0.0	-	-	0.2	0.0	0.2	0.0	-	25
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.3	0.0	26
118	114	122	121	334	242†	101	104	370	346	404	27
24.5	26.1	24.9	24.4	120	71.4 †	79.6	79.6	49.2	22.3	41.7	28
23.0	23.1	22.5	22.1	3.1	3.2	8.1	7.7	8.3	10.8	13.0	29
-	-	-	0.0	0.20	0.1	-	0.07	-	1.2	-	30
1.2	0.8	0.8	1.2	2.4	1.2	Trace	0.0	0.4	4.0	0.0	31
1.5	1.6	2.7	0.9	22	22	11	17	22	15	21	32
96.8	93.8	99.7	99.2	274	198	83.1	85.3	230	169	231	33
32.6	36.2	36.3	37.8	86.2	26.6	74.2	66.6	0.0	0.0	0	34
129	130	136	137	360	225†	157	152	230	169	231	35
166	167	-	169	465	316†	216	222	405	375	-	36
13.9	14.5	12.9	12.8	11.6	16.6	9.1	11.7	34.5	48.5	39.4	37
+0.3	+0.2	-	+0.1	+0.9	+0.7	-0.1	+0.2	+1.0	+1.1	-	38
7.6	7.7	-	7.7	6.2	6.9	8.0	7.6	6.2	6.4	-	39

† May have lost $CaCO_3$ during storage; note however decrease in SO_4 ion also.

* Mostly precipitated iron oxides

H_2S Present

TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

PROVINCE ONTARIO (Cont'd)

NO.		LONDON and ENVIRONS				
	Camp or Establishment	Cedar Springs Rifle Range			Wolsely Barracks, London	
	Source (s)	Well			London Municipal Supply - Wells, Treated	
		Raw and Finished Water			Finished Water	
	Sampling Point	At Pump			At Central Heating Plant Tap.	
1	Date of sampling	Apr.5/56	Aug.12/56	Dec.5/56	Feb.8/55	Mar.23/55
2	Storage period (days)	57:67	41:54	51:173	13:31	14:36
3	Sampling temperature, °C.	8.9	13.9	7.8	10.0	15.6
4	Test temperature, °C.	24.2	22.5	22.0	22.3	25.3
5	Oxygen consumed by $KMnO_4$	-	9.9	-	2.1	-
6	Carbon dioxide (CO_2), (calculated)	1.6	1.6	2.3	2.6	5.8
7	pH	8.5	8.4	8.3	8.2	7.8
8	Colour	0	0	5	10	5
9	Turbidity	3	3	1	0	0
10	Suspended matter, dried at 105°C.	-	-	-	-	-
11	Suspended matter, ignited at 550°C.	-	-	-	-	-
12	Residue on evaporation, dried at 105°C.	-	-	808	322	-
13	Ignition loss at 550°C.	-	-	52.4	43.2	-
14	Specific conductance, micromhos at 25°C.	1737	1488	1484	544.3	484.8
15	Calcium (Ca)	25.8	29.4	30.0	76.7	72.8
16	Magnesium (Mg)	10.5	10.8	10.1	22.1	16.0
17	Iron (Fe) Total	-	-	-	-	-
18	Dissolved	0.01	0.04	Trace	0.0	-
19	Manganese (Mn)	0.0	-	0.0	0.1	-
20	Aluminum (Al)	0.09	-	0.05	0.02	-
21	Copper (Cu)	0.0	0.0	0.0	0.06	-
22	Zinc (Zn)	0.0	0.03	0.02	-	-
23	Sodium (Na)	272	280	268	4.9	4.1
24	Potassium (K)	3.9	3.8	4.0	2.0	1.7
25	Ammonium (NH_4)	0.5	0.5	0.0	-	-
26	Carbonate (CO_3)	7.2	6.7	0.0	0.0	0.0
27	Bicarbonate (HCO_3)	293	313	329	251	240
28	Sulphate (SO_4)	0.5	20.5	4.9	61.3	49.5
29	Chloride (Cl)	304	311	312	6.2	6.2
30	Fluoride (F)	1.6	-	1.0	0.2	-
31	Nitrate (NO_3)	1.6	0.4	0.8	6.4	5.6
32	Silica (SiO_2), colorimetric	9.6	9.7	11	4.0	5.8
33	Carbonate hardness as $CaCO_3$	108	118	116	206	197
34	Non-carbonate hardness as $CaCO_3$	0.0	0.0	0.0	68.2	50.6
35	Total hardness as $CaCO_3$	108	118	116	274	247
36	Sum of constituents	781	827	804	306	280
37	Per cent sodium	84.0	83.3	82.7	3.7	3.4
38	Saturation index at test temperature	+0.8	+0.8	+0.7	+0.9	+0.5
39	Stability index at test temperature	6.9	6.8	6.9	6.4	6.8
	Remarks:				*See* also W.S.R. No.3	

TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

ONTARIO (Cont'd)

LONDON and ENVIRONS (Concl'd)						MEAFORD			NO.
Wolsely Barracks, London (Concl'd)						Rifle Range			
London Municipal Supply - Wells, Treated (Concl'd)						Georgian Bay (Lake Huron)			
Finished Water						Raw and Finished Water			
At Central Heating Plant Tap						At Pumps			
May 4/55	July 14/55	Feb.7/56	Feb.29/56	Dec.6/56	Apr.2/58	Apr.17/56	Aug.21/56	Dec.18/56	1
15:28	11:26	20:27	6:20	50:172	12:20	52:78	43:56	37:160	2
21.1	-	-	7.8	12.2	10.0	3.3	20.0	7.2	3
22.9	26.9	22.3	22.0	22.0	26.7	23.6	24.1	21.6	4
-	10	-	3.8	9.7	3.0	7.7	9.2	-	5
3.8	1.6	1.9	3.1	3.1	3.1	1.8	Trace	0.9	6
8.0	8.4	8.3	8.1	8.1	8.1	7.9	8.3	8.2	7
5	5	5	5	5	5	5	5	5	8
0	0	0	0	1	0.4	0.8	0	2	9
-	-	-	-	-	-	-	-	-	10
-	-	-	-	-	-	-	-	-	11
-	291	-	-	318	336	126	-	145	12
-	38.8	-	-	47.2	52.4	44.0	-	51.2	13
475.9	471.6	548.8	547.7	548.1	532.7	181.0	182.5	180.5	14
71.9	73.3	80.2	82.3	70.0	80.8	24.2	23.9	24.4	15
15.3	14.8	19.2	17.5	22.2	18.2	6.0	6.3	6.0	16
-	-	-	-	-	-	-	-	-	17
-	0.04	-	-	0.0	0.02	0.03	-	0.0	18
-	0.01	-	-	0.01	0.01	0.0	-	0.0	19
-	0.40	-	-	0.21	0.02	0.07	-	0.24	20
-	0.8	-	High	Trace	0.37	0.0	0.0	0.0	21
-	-	-	0.05	0.0	0.1	0.05	0.0	0.0	22
3.6	3.3	5.8	6.5	12.3	4.9	2.3	2.3	2.3	23
1.9	1.5	2.0	1.9	1.6	1.8	0.9	0.7	0.8	24
0.0	0.0	0.0	0.1	0.0	-	0.0	0.0	0.1	25
0.0	4.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26
238	239	242	244	256	261	86.8	90.7	90.7	27
43.4	38.0	68.0	65.8	75.0	54.8	12.2	12.5	13.2	28
4.8	5.4	8.6	9.4	6.4	8.4	4.7	4.2	3.9	29
-	0.05	-	-	0.5	0.0	0.0	-	0.0	30
6.0	12	12	6.0	3.2	4.0	0.6	0.4	0.8	31
5.4	8.1	5.9	6.3	13	5.2	2.8	2.8	3.9	32
195	204	199	200	210	214	71.2	74.4	74.4	33
47.5	39.6	80.5	77.3	56.0	62.3	13.9	11.1	11.2	34
243	244	279	277	266	276	85.1	85.5	85.6	35
270	285	321	316	330	307	97.4	97.5	100	36
3.1	2.8	4.3	4.8	9.1	3.7	5.5	5.5	5.4	37
+0.7	+1.2	+1.0	+0.8	+0.7	+0.9	-0.3	+0.1	0.0	38
6.6	6.0	6.3	6.5	6.7	6.3	8.5	8.1	8.2	39

TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

NO.	PROVINCE	ONTARIO (Cont'd)				
		ORLEANS AREA				
	Camp or Establishment	Army Station, Orleans			V.E. Proving Establishment, Montreal Road	
	Source(s)	Deep Well *			Deep Wells *	
					Well, Bldg. No. 26	
		Raw and Finished Water			Raw and Finished Water	
	Sampling Point	At Station Tap			At Tap	
1	Date of sampling	Apr.10/56	Aug.26/56	Dec.4/56	Apr.10/56	Aug.28/56
2	Storage period (days)	56:65	16:19	43:77	56:65	14:17
3	Sampling temperature, °C.	10.0	15.6	15.6	5.6	10.0
4	Test temperature, °C.	21.8	20.8	19.2	21.9	20.1
5	Oxygen consumed by $KMnO_4$	21	-	-	13	-
6	Carbon dioxide (CO_2), (calculated)	5.0	3.0	2.0	7.0	2.0
7	pH	8.4	8.4	8.9	8.0	8.3
8	Colour	70	140	110	20	20
9	Turbidity	10	25	0	35 †	25 †
10	Suspended matter, dried at 105°C	4.9	-	-	30.0	-
11	Suspended matter, ignited at 550°C.	2.1	-	-	12.0	-
12	Residue on evaporation, dried at 105°C.	2368	-	-	5069	-
13	Ignition loss at 550°C.	150	-	-	226	-
14	Specific conductance, micromhos at 25°C.	3944	3919	3945	8506	9015
15	Calcium (Ca)	16.4	15.9	14.1	71.1	68.5
16	Magnesium (Mg)	24.0	25.0	26.8	88.3	97.5
17	Iron (Fe) Total	-	-	-	9.5	Very High
18	Dissolved	0.16	0.15	0.03	0.05	0.05
19	Manganese (Mn)	0.0	-	0.0	Trace	-
20	Aluminum (Al)	0.59	-	0.37	0.37	-
21	Copper (Cu)	Trace	-	0.0	Trace	-
22	Zinc (Zn)	0.4	-	0.5	0.0	-
23	Sodium (Na)	850	856.0	865	1670	1830
24	Potassium (K)	22.0	19.0	17.4	36.0	42.0
25	Ammonium (NH_4)	-	-	-	-	-
26	Carbonate (CO_3)	31.4	19.9	118	0.0	0.0
27	Bicarbonate (HCO_3)	1060	1105	917	604	620
28	Sulphate (SO_4)	104	105	113	394	369
29	Chloride (Cl)	682	723	713	2345	2583
30	Fluoride (F)	1.0	-	0.75	2.0	-
31	Nitrate (NO_3)	4.0	5.0	1.6	32	-
32	Silica (SiO_2), colorimetric	17	17	15	12	13
33	Carbonate hardness as $CaCO_3$	140	143	145	496	509
34	Non-carbonate hardness as $CaCO_3$	0.0	0.0	0.0	44.7	63.0
35	Total hardness as $CaCO_3$	140	143	145	541	572
36	Sum of constituents	2275	2330	2338	5013	5309
37	Per cent sodium	91.6	91.7	91.7	86.0	86.4
38	Saturation index at test temperature	+1.0	+0.9	+1.4	+0.9	+1.1
39	Stability index at test temperature	6.4	6.6	6.1	6.2	6.1
	Remarks:	*Not used for drinking			† Iron oxides mostly	

TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

ONTARIO (Cont'd)

ORLEANS AREA (Concl'd)				OSHAWA				
V.E. Proving Establishment, Montreal Road				Army Station				
Deep Wells *			Ottawa Municipal Supply-Ottawa River, Treated	Oshawa Municipal Supply - Lake Ontario, Treated				
Well, Bldg. No. 26 (Concl'd)		Test Hole Well No.1						
Raw and Finished Water			Finished Water	Finished Water				NO.
At Tap		At Well	At No. 1 Hangar Rockcliffe Airport **	At Tap Boiler Room	At Tap P.M.Q. No. 9	At Kitchen Tap		
Dec.4/56	Mar.7/58	Sept.16/56	Apr.17/56	Nov.26/56	Apr.3/57	Nov.26/56	Apr.3/57	1
34:39	3:5	2:10	51:58	42:80	6:86	42:80	6:86	2
10.0	10.0	-	15.5	-	-	-	-	3
22.4	23.0	20.5	22.2	22.2	23.1	22.3	23.2	4
-	-	-	-	11	2.4	11	3.2	5
1.0	8.5	19	0.8	2.9	4.7	1.9	2.9	6
8.7	8.0	7.4	7.8	7.8	7.6	8.0	7.8	7
20	-	5	0	5	20	5	10	8
-		-	7 †	0	5	0	5	9
-	-	-	4.9 †	-	2.9	-	2.6	10
-	-	-	2.1 †	-	1.0	-	0.7	11
-	-	-	-	185	236	194	270	12
-	-	-	-	12.8	89.2	35.6	86.0	13
8390	9624	858.3	113.4	317.4	317.3	318.7	314.6	14
69.7	-	103	15.2	41.3	38.7	40.7	38.5	15
89.2	-	40.2	2.0	7.1	8.4	7.5	8.1	16
-	High	-	1.0 †	-	-	-	-	17
0.01	-	0.01	0.13	0.13	0.18	0.12	0.06	18
0.01	-	0.04	0.01	0.0	0.02	0.02	0.02	19
0.58	-	-	0.06	0.17	0.05	0.79	0.02	20
Trace	-	-	-	Trace	Trace	Trace	Trace	21
1.0	-	-	-	0.5	3.0	2.0	1.4	22
1660	1920	16.7	1.6	9.6	9.7	9.8	9.5	23
45.0	41.8	7.7	0.7	1.3	1.3	1.3	1.3	24
0.0	-	-	-	0.1	0.0	0.1	0.0	25
49.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26
532	659	327	29.4	111	113	112	110	27
390	396	123	21.7	30.5	29.9	30.8	28.4	28
2303	2747	32.4	2.0	22.0	22.5	22.1	22.5	29
1.6	-	-	0.10	1.1	0.1	1.1	0.1	30
4.0	Trace	4.8	1.6	1.2	0.6	1.2	0.9	31
11	13	9.4	2.8	2.0	3.0	2.8	2.7	32
519	540	269	24.1	91.1	92.5	91.6	90.6	33
22.1	101	154	22.1	41.1	38.6	40.8	38.8	34
541	641	423	46.2	132	131	132	129	35
4885	-	499	65.6	172	173	175	168	36
85.7	85.8	7.7	6.8	13.3	13.3	13.4	13.4	37
+1.6	-	+0.3	-1.1	-0.1	-0.3	+0.1	-0.1	38
5.5	-	6.8	10.0	8.0	8.2	7.8	8.0	39

** Drinking water

† From tank used to transport water to V.E.P.E.

68664-5

TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

PROVINCE — ONTARIO (Cont'd)

NO.		OTTAWA and ENVIRONS					
	Camp or Establishment	Headquarters			Connaught Rifle Range		
	Source (s)	Ottawa Municipal Supply - Ottawa River, Treated			Wells		
					Shallow Well, Target Shed, Bldg. No. 83		
		Finished Water			Raw and Finished Water		
	Sampling Point	At Tap, Mines Branch, 40 Lydia St.			At Tap		
1	Date of sampling	Sept.24/46	Sept.26/57	Nov. 25 - Dec. 6/57*	Apr.11/56	Aug.28/56	Dec.4/56
2	Storage period (days)	-	8:12	-	51:64	14:17	34:77
3	Sampling temperature, °C	-	72.0	-	5.6	10.0	10.0
4	Test temperature, °C.	Room	21.8	21.2	23.9	20.1	22.6
5	Oxygen consumed by $KMnO_4$	-	5	-	-	-	-
6	Carbon dioxide (CO_2), calculated)	-	1.3	1.1	1.3	2.5	1.3
7	pH	8.8	7.6	7.6	8.5	8.2	8.5
8	Colour	-	10	5	0	5	5
9	Turbidity	-	0.3	Clear	40	4	-
10	Suspended matter, dried at 105°C.	-	-	-	31.3	-	-
11	Suspended matter, ignited at 550°C.	-	-	-	22.2	-	-
12	Residue on evaporation, dried at 105°C.	-	70.3	76.4	287	-	-
13	Ignition loss at 550°C.	-	19.6	14.8	98.4	-	-
14	Specific conductance, micromhos at 25°C	-	107.0	111.2	462.1	476.8	471.8
15	Calcium (Ca)	19.0	14.2	15.0	47.4	46.6	48.5
16	Magnesium (Mg)	3.5	2.2	2.3	19.0	20.1	19.5
17	Iron (Fe) Total	0.05	-	-	-	-	-
18	Dissolved	-	0.08	Trace	0.10	-	0.4
19	Manganese (Mn)	-	0.0	0.0	Trace	-	Trace
20	Aluminum (Al)	0.14	0.15	0.14	0.17	-	0.11
21	Copper (Cu)	-	Trace	-	0.0	-	Trace
22	Zinc (Zn)	-	0.0	-	0.4	-	0.2
23	Sodium (Na)	2.9	1.1	1.4	21.2	22.8	22.3
24	Potassium (K)		0.7	0.8	5.7	6.0	6.2
25	Ammonium (NH_4)	-	0.0	0.0	0.0	0.1	-
26	Carbonate (CO_3)	8.4	0.0	0.0	7.2	0.0	10.9
27	Bicarbonate (HCO_3)	41.4	24.5	24.5	232	257.0	229
28	Sulphate (SO_4)	29.6	23.5	25.2	29.1	31.2	35.3
29	Chloride (Cl)	1.3	3.0	2.6	9.4	10.3	10.0
30	Fluoride (F)	-	0.0	0.15	1.5	-	0.5
31	Nitrate (NO_3)	0.56	0.4	0.3	3.2	1.6	1.2
32	Silica (SiO_2), colorimetric	1.0 (Gravimetric)	3.8	4.1	10	11	12
33	Carbonate hardness as $CaCO_3$	34.0	20.1	20.1	196	199	201
34	Non-carbonate hardness as $CaCO_3$	27.9	24.4	26.8	0.0	0.0	0.0
35	Total hardness as $CaCO_3$	61.9	44.5	46.9	196	199	201
36	Sum of constituents	-	61.2	64.1	268	276	280
37	Per cent sodium	9.2	4.9	5.9	18.4	19.3	18.7
38	Saturation index at test temperature	+0.27	-1.4	-1.4	+1.0	+0.8	+1.0
39	Stability index at test temperature	-	10.4	10.4	6.5	6.6	9.5
	Remarks:	*See* also Under V.E.P.E.		* Composite of 10 daily samples			

TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

ONTARIO (Cont'd)

OTTAWA and ENVIRONS (Concl'd)											
Connaught Rifle Range (Concl'd)											
Wells											
Well at Bldg. No. 1			Well at D.A.D. Bldg. No.29			West Side Well		East Side Well	Carp Road Well		
Raw and Finished Water											NO.
At Tap In Caretaker's Residence			At Tap			At Tap In Bldg. No.86		At Tap In Bldg.No.26	At Tap In Kidd House		
Apr.11/56	Aug.28/56	Dec.4/56	Apr.11/56	Apr.28/56	Dec.4/56	May 1/56	Aug.28/56	Aug.28/56	Apr.11/56	Sept.28/56	1
55:64	14:27	43:77	55:64	14:27	43:77	48:83	14:27	59:85	51:61	16:57	2
10.0	15.6	12.8	10.0	15.6	12.8	10.0	10.0	10.0	5.6	10.0	3
21.8	20.0	19.4	21.8	20.0	19.2	23.4	20.0	23.5	24.0	22.8	4
3.8	-	-	7.3	-	-	7.2	-	11	-	-	5
4.5	2.4	1.4	2.7	2.6	0.9	1.8	2.7	6.5	1.4	3.5	6
8.0	8.3	8.6	8.2	8.2	8.7	8.3	8.2	7.8	8.4	8.0	7
5	5	0	0	5	0	0	5	20	0	10	8
2	2	-	8	3	-	0	5	0.3	20 †	30 †	9
-	-	-	2.5	-	-	-	-	-	-	-	10
-	-	-	1.1	-	-	-	-	-	-	-	11
340	-	-	317	-	-	278.6	-	391	-	-	12
47.2	-	-	57.2	-	-	74.8	-	28.0	-	-	13
563.8	579.0	557.2	507.8	508.5	492.1	459.1	500.9	616.0	454.4	478.5	14
52.0	54.5	52.1	63.8	65.4	62.2	64.5	67.4	75.1	65.0	68.5	15
29.8	30.2	32.3	22.9	22.0	24.6	15.6	17.9	26.3	15.3	15.2	16
-	-	-	-	-	-	-	-	0.30	>6 †	High	17
0.08	-	0.8	0.07	-	Trace	0.02	-	-	0.03	-	18
Trace	-	0.0	0.02	-	0.02	0.0	-	0.02	Trace	-	19
-	-	0.19	-	-	0.16	0.08	-	0.48	0.19	-	20
0.0	-	0.0	0.0	-	0.0	0.0	-	Trace	0.0	-	21
0.3	-	0.15	0.3	-	0.25	0.0	-	0.05	0.3	-	22
21.6	21.6	22.3	8.9	9.2	9.7	8.6	10.8	15.8	6.1	6.6	23
6.0	6.4	6.3	3.4	3.4	3.5	2.0	2.1	2.7	3.7	4.0	24
-	0.1	0.05	-	0.1	0.0	-	0.1	0.1	0.1	0.1	25
0.0	0.0	14.9	0.0	0.0	6.7	0.0	0.0	0.0	3.6	0.0	26
292	309	281	266	271	260	241	264	288	219	247	27
47.0	47.9	47.8	41.4	43.5	38.8	33.8	37.1	72.9	36.2	37.8	28
10.4	10.0	10.7	9.6	8.2	8.4	7.6	10.8	12.9	6.1	7.4	29
1.0	-	0.5	0.30	-	0.1	0.15	-	0.25	0.1	-	30
2.4	0.8	1.2	3.2	0.6	0.8	2.4	0.4	0.8	12	8.0	31
12	13	14	11	11	12	10	11	8.9	15	15	32
240	253	255.4	218	222.4	224	198	217	236	186	203	33
12.5	6.9	7.4	35.3	31.2	31.8	27.5	25.2	59.2	39.1	30.6	34
252	260	263	253	254	256	225	242	295	225	233	35
327	337	341	296	297	295	264	287	358	271	284	36
15.2	14.8	15.1	6.8	7.2	7.4	7.6	8.8	10.2	5.4	5.7	37
+0.6	+0.9	+1.2	+0.8	+0.8	+1.3	+0.9	+0.8	+0.5	+1.0	+0.6	38
6.8	9.2	6.2	6.6	9.0	6.1	6.5	6.6	6.8	6.4	6.8	39

†Iron oxides mostly

68664-5½

TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

	PROVINCE	ONTARIO (Cont'd)					
		NEAR PETAWAWA					
	Camp or Establishment	Camp Petawawa					
	Source (s)	Ottawa River and Spring					
		Ottawa River *			Spring		
NO.		Raw Water			Raw Water		
	Sampling Point	At Intake Pump			At Storage Tank		
1	Date of sampling	Aug.8/56	Jan.31/57	May 15/57	Aug.8/56	Jan.31/57	May 15/57
2	Storage period (days)	23:49	56:133	19:37	20:49	56:133	19:37
3	Sampling temperature, °C.	24.4	0.6	3.3	14.4	5.6	1.7
4	Test temperature, °C.	21.6	25.6	23.5	23.0	25.5	23.3
5	Oxygen consumed by $KMnO_4$	18	11	11.2	9.3	0.9	2.0
6	Carbon dioxide (CO_2), (calculated)	3.0	1.9	2.8	0	1.6	3.0
7	pH	7.0	7.2	6.9	8.7	7.4	7.1
8	Colour	30	45	40	10	0	0
9	Turbidity	0.3	3	8	0.2	0	4
10	Suspended matter, dried at 105°C	-	-	6.6	-	-	-
11	Suspended matter, ignited at 550°C	-	-	0.0	-	-	-
12	Residue on evaporation, dried at 105°C	-	81.2	66.0	-	159	132
13	Ignition loss at 550°C	-	44.0	37.2	-	78.8	66.0
14	Specific conductance, micromhos at 25°C	61.83	67.21	50.80	134.9	186.8	158.6
15	Calcium (Ca)	7.2	6.9	5.5	13.9	12.9	11.9
16	Magnesium (Mg)	1.8	2.4	1.5	1.7	8.6	6.5
17	Iron (Fe) Total	-	-	-	-	-	-
18	Dissolved	-	0.05	0.08	0.19	0.0	0.0
19	Manganese (Mn)	-	0.0	0.0	Trace	0.0	0.0
20	Aluminum (Al)	-	0.06	0.01	0.08	0.17	0.02
21	Copper (Cu)	0.0	Trace	0.0	0.0	0.0	0.0
22	Zinc (Zn)	0.0	0.0	0.0	0.0	0.0	0.0
23	Sodium (Na)	1.2	1.8	1.4	7.4	5.3	4.8
24	Potassium (K)	0.6	0.7	0.7	4.3	1.4	1.2
25	Ammonium (NH_4)	0.1	0.1	0.05	0.1	0.0	0.0
26	Carbonate (CO_3)	0.0	0.0	0.0	2.9	0.0	0.0
27	Bicarbonate (HCO_3)	18.9	21.3	13.8	46.8	27.1	23.8
28	Sulphate (SO_4)	9.4	11.3	10.3	6.8	20.1	18.0
29	Chloride (Cl)	0.8	1.4	0.8	5.8	19.5	16.0
30	Fluoride (F)	-	0.0	0.0	-	0.0	0.0
31	Nitrate (NO_3)	0.6	0.6	0.6	4.0	12.0	8.0
32	Silica (SiO_2), colorimetric	4.1	5.2	8.0	12	15	14
33	Carbonate hardness as $CaCO_3$	15.5	17.5	11.3	41.7	22.2	19.5
34	Non-carbonate hardness as $CaCO_3$	9.9	9.6	8.6	0.0	45.4	36.4
35	Total hardness as $CaCO_3$	25.4	27.1	19.9	41.7	67.6	55.9
36	Sum of constituents	34.7	41.0	35.8	81.9	108	92.6
37	Per cent sodium	9.1	12.0	12.6	25.1	14.1	15.2
38	Saturation index at test temperature	-2.4	-2.0	-2.6	0.0	-1.5	-1.9
39	Stability index at test temperature	11.8	11.2	12.1	8.7	10.4	10.9
	Remarks:	* *See* also W.S.R. No.2					

TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

ONTARIO (Cont'd)

NEAR PETAWAWA							
Camp Petawawa (Concl'd)							
Ottawa River and Spring							
Mixed Supply. (Ottawa River and Spring)							
Finished Water							NO.
At Tap in Bldg. C 5			At Tap C.H. Plant, Bldg. P 49				
Aug.9/56	Jan.31/57	May 15/57	Feb.9/55	Apr.25/55	May 12/55	May 4/56	1
22:48	56:133	19:37	12:28	8:11	5:23	14:21	2
17.8 •	-	35.0	4.4	-	-	5.6	3
21.6	25.5	23.5	22.3	24.4	21.8	22.9	4
-	7.8	9.2	6.2	-	-	14	5
4.6	3.1	3.0	5.0	3.4	3.4	5.8	6
6.8	7.0	7.0	6.8	6.8	6.7	6.6	7
30	35	35	35	30	30	40	8
0	0.9	12	0.3	4	3	1	9
-	-	5.3	-	-	-	-	10
-	-	0.6	-	-	-	-	11
-	94.4	75.2	79.2	-	-	77.6	12
-	37.6	30.4	31.6	-	-	28.0	13
75.73	96.60	78.87	93.8	99.3	82.6	60.70	14
8.1	8.6	7.2	8.3	8.0	7.2	7.1	15
2.3	3.7	2.8	3.2	3.6	2.8	1.3	16
-	-	-	-	-	-	-	17
-	0.09	0.13	0.18	-	-	0.09	18
-	0.0	0.0	0.1	-	-	0.0	19
-	0.02	0.0	0.07	-	-	0.0	20
0.0	Trace	0.0	0.07	-	-	0.0	21
0.05	0.0	0.07	-	-	-	0.0	22
1.6	2.5	2.4	2.2	2.2	2.1	1.4	23
0.7	0.9	0.8	0.9	0.9	0.8	0.7	24
-	0.05	0.05	-	-	-	0.1	25
0.0	0.0	0.0	0.0	0.0	0.0	0.0	26
17.9	20.6	18.3	20.2	13.3	10.2	14.0	27
10.9	14.7	12.0	10.6	11.4	10.4	11.1	28
3.7	6.0	4.8	6.3	7.7	6.9	1.2	29
-	0.0	0.0	0.4	-	-	0.0	30
1.6	2.4	2.0	3.6	8.0	3.2	2.4	31
5.0	8.1	6.6	5.9	8.4	8.2	4.5	32
14.7	16.9	15.0	15.6	10.9	8.4	11.5	33
15.0	19.8	14.5	17.3	23.9	17.0	11.6	34
29.7	36.7	29.5	33.9	34.8	25.4	23.1	35
42.4	57.2	47.9	51.8	56.8	46.6	36.7	36
10.2	12.4	14.4	11.8	11.8	14.7	11.2	37
-2.5	-2.2	-2.3	-2.5	-2.6	-2.9	-2.9	38
11.8	11.4	11.6	11.8	13.0	12.5	12.4	39

TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

PROVINCE — ONTARIO (Cont'd)

NO.		PICTON and ENVIRONS		
	Camp or Establishment	Camp Picton		
	Source (s)	Picton Municipal Supply -Lake Ontario (Bay of Quinte), Treated		
		Finished Water		
	Sampling Point	At Tap, C.H. Plant		
1	Date of sampling	Feb.14/55	Mar.28/55	Apr.25/55
2	Storage period (days)	13:23	18:31	15:23
3	Sampling temperature, °C	-	-	-
4	Test temperature, °C.	21.6	22.5	22.3
5	Oxygen consumed by $KMnO_4$	7.4	-	-
6	Carbon dioxide (CO_2), (calculated)	2.6	5.4	4.1
7	pH	7.9	7.5	7.6
8	Colour	30	15	15
9	Turbidity	3	3	6
10	Suspended matter, dried at 105°C.	-	-	-
11	Suspended matter, ignited at 550°C.	-	-	-
12	Residue on evaporation, dried at 105°C. ..	174	-	-
13	Ignition loss at 550°C.	36.0	-	-
14	Specific conductance, micromhos at 25°C .	261.6	256.6	232.4
15	Calcium (Ca)	43.5	41.1	36.5
16	Magnesium (Mg)	4.3	3.9	3.9
17	Iron (Fe) Total	-	-	-
18	Dissolved	0.07	-	-
19	Manganese (Mn)	0.0	-	-
20	Aluminum (Al)	0.33	-	-
21	Copper (Cu)	Trace	-	-
22	Zinc (Zu)	-	-	-
23	Sodium (Na)	2.6	2.4	2.1
24	Potassium (K)	1.2	1.3	1.2
25	Ammonium (NH_4)	-	-	0.15
26	Carbonate (CO_3)	0.0	0.0	0.0
27	Bicarbonate (HCO_3)	129	105	99.6
28	Sulphate (SO_4)	21.2	29.3	21.3
29	Chloride (Cl)	5.3	4.4	5.1
30	Fluoride (F)	0.4	-	-
31	Nitrate (NO_3)	0.8	1.4	1.6
32	Silica (SiO_2), colorimetric	2.2	4.8	3.8
33	Carbouate hardness as $CaCO_3$	106	86.2	81.7
34	Nou-carbonate hardness as $CaCO_3$	20.2	32.4	25.4
35	Total hardness as $CaCO_3$	126	119	107
36	Sum of constituents	146	140	125
37	Per cent sodium	4.0	4.2	4.0
38	Saturation index at test temperature	+0.1	-0.4	-0.4
39	Stability index at test temperature	7.7	8.3	8.4
	Remarks:			

TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

ONTARIO (Concl'd)

PICTON and ENVIRONS (Concl'd)						
Camp Picton (Concl'd)			Point Petrie			
Picton Municipal Supply - Lake Ontario (Bay of Quinte), Treated			Lake Ontario			
Finished Water			Raw and Finished Water			NO
At Pumphouse Tap or Direct from Reservoir			At Area Tap			
May 16/56	Oct.17/56	Feb. 6/57	May 16/56	Oct.17/56	Feb.6/57	1
42:77	12:25	50:127	42:77	12:20	51:126	2
12.2	-	-	6.1	-	-	3
24.3	24.4	25.5	24.6	24.4	25.5	4
11	-	3.8	7.8	-	2.1	5
3.3	2.9	1.9	1.5	0.5	2.1	6
7.7	7.8	8.0	8.1	8.5	7.9	7
20	10	10	10	10	5	8
5	0.3	0	4	0	0	9
4.0	-	-	2.5	-	-	10
1.8	-	-	1.1	-	-	11
147	-	175	209	-	201	12
67.2	-	50.8	106	-	64.0	13
215.6	262.2	264.2	298.1	293.3	313.3	14
36.5	38.5	40.2	39.7	35.4	38.0	15
3.3	5.2	6.0	7.1	8.4	8.8	16
-	-	-	-	-	-	17
0.05	-	0.0	0.01	-	0.0	18
0.0	-	0.0	0.0	-	0.0	19
0.43	-	0.30	0.09	-	0.2	20
0.0	-	Trace	0.0	-	Trace	21
0.0	-	0.0	0.0	-	0.0	22
2.2	5.1	4.1	8.7	9.3	9.6	23
1.3	1.3	1.2	1.2	1.2	1.5	24
0.1	0.1	0.0	0.1	0.1	0.0	25
0.0	0.0	0.0	0.0	2.3	0.0	26
100	112	131	113	108	115	27
17.6	22.1	19.1	23.0	23.7	30.0	28
5.8	11.5	7.3	20.2	21.6	21.5	29
0.0	-	0.1	0.0	-	0.05	30
1.2	1.2	1.2	2.4	0.4	1.6	31
2.4	1.7	1.2	1.5	1.5	2.7	32
82.0	92.0	97.2	93.0	92.0	94.1	33
22.6	25.4	17.8	35.2	30.9	36.8	34
105	117	125	128	123	131	35
120	142	145	160	157	171	36
4.2	8.5	6.5	12.7	14.0	13.5	37
-0.3	-0.1	+0.2	+0.2	+0.6	0.0	38
8.3	8.0	7.6	7.7	7.3	7.9	39

TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

NO.	PROVINCE	MANITOBA			
		Near CLEAR LAKE	FORT CHURCHILL		
	Camp or Establishment	Clear Lake Camp			
	Source(s)	Clear Lake	Lake Isabelle		
		Raw and Finished Water	Raw Water		
	Sampling Point	From Lake Near Wasagaming	At Suction Well At Plant		
1	Date of sampling	July 3/53	May 29/56 †	Mar.14/57	Nov.27/57
2	Storage period (days)	7:381	31:49	26:99	8:19
3	Sampling temperature, °C.	15.6	1.7	0.6	3.3
4	Test temperature, °C	22.3	22.3	25.0	24.9
5	Oxygen consumed by $KMnO_4$	-	6.3	-	-
6	Carbon dioxide (CO_2), (calculated)	1.6	12	9.5	2.0
7	pH	8.4	7.2	7.8	8.1
8	Colour	10	20	20	10
9	Turbidity	5	2	4	0.4
10	Suspended matter, dried at 105°C.	15.5	-	12.4	-
11	Suspended matter, ignited at 550°C.	10.1	-	6.8	-
12	Residue on evaporation, dried at 105°C.	273	196	667	263
13	Ignition loss at 550°C.	48.2	41.6	120	45.2
14	Specific conductance, micromhos at 25°C.	425.2	311.7	1101	435.4
15	Calcium (Ca)	34.5	27.2	112	42.2
16	Magnesium (Mg)	30.7	8.0	27.4	11.3
17	Iron (Fe) Total	0.28	-	-	-
18	Dissolved	0.03	0.01	0.01	Trace
19	Manganese (Mn)	-	0.0	0.0	0.0
20	Aluminum (Al)	-	0.0	0.38	0.07
21	Copper (Cu)	-	0.0	Trace	0.0
22	Zinc (Zn)	-	0.0	0.05	0.0
23	Sodium (Na)	11.6	25.2	77.4	28.6
24	Potassium (K)	5.4	2.5	5.0	1.9
25	Ammonium (NH_4)	-	0.05	0.05	0.05
26	Carbonate (CO_3)	3.6	0.0	0.0	0.0
27	Bicarbonate (HCO_3)	230	114	414	162
28	Sulphate (SO_4)	43.9	12.0	27.9	9.2
29	Chloride (Cl)	2.5	34.4	146	55.1
30	Fluoride (F)	0.1	0.2	0.0	0.0
31	Nitrate (NO_3)	1.2	8.0	3.0	0.1
32	Silica (SiO_2), colorimetric	22	2.0	4.1	0.7
33	Carbonate hardness as $CaCO_3$	194	93.6	340.6	133
34	Non-carbonate hardness as $CaCO_3$	17.8	7.2	52.3	19.1
35	Total hardness as $CaCO_3$	212	101	392	152
36	Sum of constituents	269	176	607	229
37	Per sodium	10.3	34.5	29.6	28.7
38	Saturation index at test temperature	+0.7	-0.9	+0.9	+0.4
39	Stability index at test temperature	7.0	9.0	6.0	7.3
	Remarks:		† Heavy run-off	Low level	

TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

MANITOBA (Cont'd)

FORT CHURCHILL (Concl'd)			WINNIPEG and ENVIRONS					
			Fort Osborne			Fort Whyte		
Lake Isabelle			Winnipeg Municipal Supply - Shoal Lake*			Winnipeg Municipal Supply- Shoal Lake	Well *	
Finished Water			Raw and Finished Water			Raw and Finished Water		NO.
At Clear Well At Plant			At Tap At Fort Osborne Barracks					
May 29/56	Mar.14/57	Nov.27/57	Apr.25/55	July 27/55	Feb.27/58		Aug.8/56	1
31:49	26:99	8:19	8:11	-	14:20		16:21	2
13.3	13.3	14.4	9.4	-	-		-	3
22.3	23.8	24.9	24.4	26.8	24.6		21.7	4
4.8	-	-	-		-	*See*	10	5
1.3	0	0.2			3.2	Fort	16	6
7.6	8.9	8.2	8.0	7.9	8.0	Osborne	7.3	7
10	5	5	5	5	5		0	8
0.3	2	0.4	0.9	Trace	-		5.0	9
-	-	-			-		15.9	10
-	-	-			-		11.6	11
272	404	208		112	-		4734	12
80.8	53.6	32.8		26.8	-		365	13
351.5	686.1	333.4	178.5	171	209		6609	14
17.9	17.3	21.9	24.0	24.1	29.3		312	15
11.7	9.0	5.6	6.5	5.8	7.5		204	16
-	-	-			-		-	17
Trace	0.02	0.01		0.04	0.02		0.09	18
0.0	0.0	0.0		0.0	-		0.02	19
0.15	0.41	1.7		0.08	-		1.5	20
0.0	Trace	-		0.02	-		0.0	21
0.0	0.0	0.0		0.0	-		0.5	22
27.6	94.4	30.1	1.4	1.4	2.3		892	23
2.5	5.2	1.8	1.3	1.4	1.5		28.8	24
0.0	0.5	0.05		0.3	0.0		-	25
0.0	3.8	0.0	0.0	0.0	0.0		0.0	26
30.7	20.5	35.7	105	101	123		264	27
74.7	58.8	38.4	2.6	3.4	5.0		1246	28
36.4	149	57.0	1.1	1.5	1.6		1495	29
0.2	0.2	0.0	-	0.0	-		0.0	30
4.8	0.1	0.1	0.8	0.6	1.0		3.0	31
3.4	6.5	1.8	2.5	2.6	4.0		12.4	32
25.2	23.2	29.3	86.5	83.0	101		216	33
67.6	57.0	48.4	0.0	1.0	3.4		1401	34
92.8	80.2	77.7	86.5	84.0	104		1617	35
195	355	176	92.2	90.9	113		4325	36
38.3	69.4	42.8	3.3	3.4	4.5		53.8	37
-1.2	0.0	-0.6	-0.1	-0.2	+0.1		+0.5	38
10.0	8.9	9.0	8.2	8.3	7.8		6.3	39
			* See Also W.S.R. No. 10 High water in Lake			* Not used as drinking water-		

TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

PROVINCE — MANITOBA (Cont'd)

NO.		SHILO					
	Camp or Establishment	Camp Shilo					
	Source (s)	Wells					
		Well No. 1, 45' Deep				Well No. 2 43'Deep	
		Raw Water		Finished Water		Raw Water	
	Sampling Point	At Pump		At Tap		At Pump	
1	Date of sampling	Apr.16/56	Dec.3/56	Aug.17/56	Apr.5/57	Apr.16/56	Aug.17/56
2	Storage period (days)	52:79	49:91	19:19	4:77	52:73	19:19
3	Sampling temperature, °C.	6.7	6.7	6.7	5.6	6.7	6.7
4	Test temperature, °C.	22.0	27.0	24.1	25.0	22.0	24.2
5	Oxygen consumed by $KMnO_4$	7.2	-	-	-	7.1	-
6	Carbon dioxide (CO_2), (calculated)	1.9	5.3	5.0	5.1	2.3	5.2
7	pH	8.3	7.9	8.0	8.0	8.2	7.9
8	Colour	0	5	10	5	5	5
9	Turbidity	0.2	4	0	3	2	2
10	Suspended matter, dried at 105°C.						
11	Suspended matter, ignited at 550°C.						
12	Residue on evaporation, dried at 105°C.	254	288		348	220	
13	Ignition loss at 550°C.	21.6	20.0		66.0	7.2	
14	Specific conductance, micromhos at 25°C.	389.9	431.9	524.5	542.8	406.5	473.8
15	Calcium (Ca)	63.6	72.2	15.7	22.5	62.5	75.6
16	Magnesium (Mg)	12.8	13.4	4.7	8.0	14.1	15.2
17	Iron (Fe) Total	-	-	0.18	-	-	0.50
18	Dissolved	Trace	0.32	0.14	0.0	0.08	0.24
19	Manganese (Mn)	0.04	0.26	-	Trace	0.01	-
20	Aluminum (Al)	0.13	0.05	-	0.21	0.09	-
21	Copper (Cu)	0.01	0.0	-	0.0	0.0	-
22	Zinc (Zn)	0.3	0.05	-	0.2	0.0	-
23	Sodium (Na)	1.7	1.4	105	94.5	2.1	2.3
24	Potassium (K)	1.4	1.2	1.1	1.7	1.3	1.2
25	Ammonium (NH_4)	0.0	0.2	0.1	0.0	0.0	0.1
26	Carbonate (CO_3)	0.0	0.0	0.0	0.0	0.0	0.0
27	Bicarbonate (HCO_3)	239	271	318	335	228	280
28	Sulphate (SO_4)	13.6	18.5	18.4	20.1	21.9	19.8
29	Chloride (Cl)	2.7	1.4	4.5	4.7	1.0	5.0
30	Fluoride (F)	0.1	0.0	-	0.0	0.6	-
31	Nitrate (NO_3)	0.6	2.0	4.0	2.4	8.0	3.2
32	Silica (SiO_2), colorimetric	24	25	25	25	25	25
33	Carbonate hardness as $CaCO_3$	196	222	58.5	89.0	187	229
34	Non-carbonate hardness as $CaCO_3$	14.9	13.1	0.0	0.0	26.9	21.8
35	Total hardness as $CaCO_3$	211	235	58.5	89.0	214	251
36	Sum of constituents	239	270	335	345	249	289
37	Per cent sodium	1.7	1.3	79.1	68.9	2.1	1.9
38	Saturation index at test temperature	+0.9	+0.7	+0.1	+0.3	+0.8	+0.7
39	Stability index at test temperature	6.5	6.5	7.8	7.4	6.6	6.5
	Remarks:						

TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

MANITOBA (Cont'd)

SHILO (Cont'd)									
Camp Shilo (Cont'd)									
Wells									
Well No. 2, 43' Deep		Well No. 3, 42' Deep				Well No. 4, 42' Deep			NO.
Raw Water		Raw Water				Raw Water			
At Pump		At Pump				At Pump			
Dec.3/56	Apr.5/57	Apr.16/57	Aug.17/56	Dec.3/56	Apr.5/57	Aug.17/56	Dec.3/56	Apr.5/56	1
49:91	7:77	52:79	19:19	49:91	7:77	19:40	49:95	7:77	2
6.7	5.6	6.7	6.7	6.7	5.6	6.7	6.7	5.6	3
26.8	24.0	22.0	24.2	26.8	22.5	24.2	26.8	22.6	4
-	-	7.3	-	-	-	9.5	-	-	5
3.8	4.9	3.5	7.0	5.3	6.2	5.0	2.6	7.1	6
8.1	8.0	8.1	7.9	8.0	8.0	8.0	8.2	7.9	7
5	5	5	5	5	5	5	5 *	10	8
2	4	25 *	30 *	25 *	15 *	10 *	15 *	15 *	9
	2.8	-		5.6	-	-	3.9	3.6	10
	1.1	-		2.8	-	-	1.8	1.4	11
329	346	234		336	241	-	300	365	12
36.4	146	26.8		30.8	82.8	-	48.8	110	13
498.6	516.1	424.9	540.1	542.8	552.2	543.0	457.3	546.7	14
80.8	82.7	62.9	86.8	91.0	91.8	87.2	68.9	88.7	15
15.5	15.9	17.2	18.9	17.4	17.6	17.0	16.5	16.9	16
-	-	High	2.0	-	-	0.87	-	-	17
0.12	0.25	2.7	0.04	0.48	0.09	-	0.28	0.27	18
0.05	0.29	0.0	-	0.03	0.0	0.04	Trace	0.35	19
0.10	0.05	0.25	-	0.0	0.43	0.40	0.0	0.35	20
Trace	Trace	0.0	-	0.0	0.0	0.0	0.0	0.0	21
0.1	0.1	0.0	-	0.05	0.0	0.0	0.05	0.0	22
3.4	3.0	1.7	1.8	1.7	1.9	3.7	4.1	3.8	23
1.4	1.3	1.6	1.5	1.5	1.6	1.7	1.9	1.8	24
0.1	0.0	0.0	0.1	0.1	0.0	0.1	0.1	0.05	25
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26
304	307	270	351	355	372	334	277	346	27
23.0	23.0	7.3	11.3	16.3	7.4	17.0	19.0	18.4	28
4.2	4.0	1.0	1.0	0.6	0.5	4.1	3.9	3.6	29
0.0	0.0	0.2	-	0.0	0.0	-	0.0	0.0	30
2.4	2.0	2.5	2.0	0.4	0.2	0.8	0.8	1.0	31
26	24	26	25	27	31	24	27	25	32
249.7	252	222	288	291	301	274	228	284	33
15.6	20.1	6.1	6.2	7.5	0.0	13.7	12.2	7.1	34
265	272	228	294	299	301	288	240	291	35
307	308	256	321	331	336	321	279	331	36
2.7	2.3	1.5	1.3	1.2	1.3	2.7	3.5	2.7	37
+1.0	+0.8	+0.7	+0.8	+1.0	+0.9	+0.9	+1.0	+0.8	38
6.1	8.8	6.7	6.3	6.0	6.2	6.2	6.2	6.3	39

* Colloidal iron

TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

PROVINCE MANITOBA (Cont'd)

NO.								
	Camp or Establishment	SHILO (Cont'd)						
		Camp Shilo (Cont'd)						
	Source (s)	Wells						
		Disposal Plant Well No. 5, 16' Deep				Rifle Range Well No. 6, About 16' Deep		
		Raw Water				Raw Water		
	Sampling Point	At Pump				At Pump		
1	Date of sampling	Apr.16/56	Aug.17/56	Dec.3/56	Apr.5/57	Aug.8/56	Dec.3/56	Apr.5/57
2	Storage period (days)	52:79	19:28	49:95	4:77	19:40	49:95	4:77
3	Sampling temperature, °C	8.9	8.9	8.9	6.7	7.8	7.8	7.8
4	Test temperature, °C.	22.2	24.2	26.6	23.9	24.2	26.5	24.4
5	Oxygen consumed by $KMnO_4$	6.8	-	-	-	9.0	-	-
6	Carbon dioxide (CO_2) (calculated)	1.7	2.6	1.3	4.2	2.0	1.8	3.4
7	pH	8.3	8.1	8.4	7.9	8.2	8.3	8.0
8	Colour	0	5	5	5	0	5	5
9	Turbidity	0.2	0	0	3	0	0	3
10	Suspended matter, dried at 105°C.	-						5.1
11	Suspended matter, ignited at 550°C.	-						4.1
12	Residue on evaporation, dried at 105°C.	229		237	228	-	260	159
13	Ignition loss at 550°C.	24.4		25.6	79.2		36.4	25.6
14	Specific conductance, micromhos at 25°C.	350.8	358.9	351.9	353.4	332.4	386.2	359.1
15	Calcium (Ca)	56.0	55.7	55.8	54.7	49.2	63.2	56.0
16	Magnesium (Mg)	11.2	12.1	11.7	12.5	12.4	11.9	12.2
17	Iron (Fe) Total	-	-			-		
18	Dissolved	0.0	0.15	0.0	0.01	0.04	0.0	0.0
19	Manganese (Mn)	0.04	-	0.04	0.05	0.0	Trace	0.0
20	Aluminum (Al)	0.22	0.34	0.0	0.51	0.17	0.0	0.03
21	Copper (Cu)	0.0	-	0.0	0.0	0.0	0.0	0.0
22	Zinc (Zn)	0.0	-	0.1	0.1	0.1	0.2	0.6
23	Sodium (Na)	0.9	1.0	1.1	0.9	1.0	1.2	0.7
24	Potassium (K)	0.8	0.9	1.0	0.9	0.7	0.8	0.5
25	Ammonium (NH_4)	0.0	0.1	0.1	0.0	0.1	0.1	0.0
26	Carbonate (CO_3)	0.0	0.0	2.5	0.0	0.0	0.0	0.0
27	Bicarbonate (HCO_3)	210	215	210	216	194	228	220
28	Sulphate (SO_4)	12.5	12.7	12.8	12.2	9.4	9.6	8.8
29	Chloride (Cl)	1.1	0.4	0.7	0.4	0.6	0.7	0.4
30	Fluoride (F)	0.0	-	0.0	0.0	-	0.0	0.0
31	Nitrate (NO_3)	4.0	4.0	3.6	3.2	8.0	16	8.0
32	Silica (SiO_2), colorimetric	25	23	23	21	22	24	21
33	Carbonate hardness as $CaCO_3$	172	177	176.5	177	160	187	180
34	Non-carbonate hardness as $CaCO_3$	13.8	12.2	10.8	10.7	14.2	19.8	9.6
35	Total hardness as $CaCO_3$	186	189	187	188	174	207	190
36	Sum of constituents	215	216	213	213	200	240	216
37	Per cent sodium	1.0	1.1	1.2	1.0	1.2	1.2	0.8
38	Saturation index at test temperature	+0.8	+0.6	+1.0	+0.4	+0.6	+1.0	+0.6
39	Stability index at test temperature	6.7	6.9	6.4	7.1	7.0	6.3	6.8
	Remarks:							

TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

MANITOBA (Concl'd)

SHILO (Concl'd)

Camp Shilo (Concl'd)

Wells

Mixed Wells, - General Camp Supply

Finished (Softened) Water											NO.
At Central Heating Plant Tap							At Camp Tap				
Feb.11/55	Mar.14/55	Apr.15/55	May 18/55	Sept.21/55	Feb.1/56	Aug.10/56	Apr.10/56	Aug.17/56	Dec.3/56	May 5/57	1
14:34	8:23	10:13	12:40	6:14	12:19	14:19	52:73	14:19	49:95	4:77	2
11.1	3.3	8.3	7.2	4.4	12.8	7.8	6.7	8.9	7.8	-	3
20.9	20.6	24.2	23.8	22.5	25.9	21.7	22.2	21.4	26.6	24.4	4
2.1	-	-	2.4	-	-	-	7.9	-	-	-	5
8.1	8.0	4.4	5.1	8.0	2.0	3.2	2.7	5.0	2.1	11	6
7.8	7.8	8.0	8.0	7.8	8.4	8.2	8.3	8.0	8.4	7.7	7
10	3	5	0	5	5	5	0	5	5	5	8
0	0	2	0	0	0	0.3	0	0	0	2	9
-											10
-											11
338			350		341		357		337	347	12
51.2			77.6		36.0		26.4		40.0	123	13
531.2	551	556.0	552.2	589.7	536.9	547.2	551.9	546.5	543.9	536.3	14
17.4	14.1	14.3	27.1	16.3	28.0	29.6	15.5	23.8	21.2	17.3	15
3.6	2.9	3.0	9.3	3.1	8.8	7.9	5.1	7.8	6.3	5.7	16
-						-			-	-	17
Trace			0.04		Trace	-	0.04	0.04	0.0	0.01	18
-			0.0		0.03	-	0.04	-	0.02	0.0	19
0.02			0.19		0.05	-	0.11	-	0.0	0.57	20
Trace			0.0		Trace	Trace	0.0	-	0.0	0.0	21
-			-		0.0	0.0	0.1	-	0.0	0.2	22
103	114	115	82.0	120	84.8	88.0	110	94.0	99.8	102	23
1.9	1.0	1.0	3.6	1.2	1.2	2.2	1.7	1.9	1.7	1.3	24
-	-	-	0.0	0	0.0	0.0	0.0	-	0.1	0.0	25
0.0	0.0	0.0	0.0	0.0	6.7	0.0	0.0	0.0	2.5	0.0	26
315	333	333	331	341	320	319	332	333	332	330	27
18.8	17.4	19.7	18.3	18.3	18.4	18.2	17.5	17.5	18.5	20.3	28
2.7	3.3	3.2	2.9	12.7	3.0	6.5	8.0	5.1	4.7	4.0	29
0.0	-	-	0.0	-	0.0	-	0.0	-	0.0	0.0	30
2.0	1.0	0.8	0.8	0.8	1.6	1.2	5.4	4.0	0.6	1.6	31
13	20	29	27	24	25	-	25	26	26	25	32
58.2	47.1	48.0	106	53.4	106	106	59.6	91.5	78.8	66.6	33
0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	34
58.2	47.1	48.0	106	53.4	106	106	59.6	91.5	78.8	66.6	35
317	338	351	334	364	335	-	352	344	345	341	36
78.7	83.7	83.6	61.5	82.5	63.1	63.7	79.3	68.5	72.7	75.6	37
-0.1	-0.2	+0.3	+0.4	0.0	+0.8	+0.6	+0.4	+0.3	+0.7	-0.1	38
8.0	8.2	7.4	7.2	7.8	6.8	7.0	7.5	7.4	7.0	7.9	39
				Li - 0.0							

TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

NO.	PROVINCE	SASKATCHEWAN							
		DUNDURN							
	Camp or Establishment	Camp Dundurn							
	Source (s)	Two Wells							
		North Well				West Well			
		Raw and Finished Water							
	Sampling Point	At Pump				At Pump			
1	Date of sampling	May 11/56	Sept.28/56	Jan.17/57	Apr.15/57	May 11/56	Sept.28/56	Jan. 17/57	Apr.15/57
2	Storage period (days)	42:77	18:25	42:132	8:99	42:77	23:27	42:132	8:98
3	Sampling temperature, °C.	6.1	7.2	-	4.4	6.1	6.7	6.7	5.6
4	Test temperature, °C.	23.8	24.5	23.8	25.8	23.8	24.0	23.8	25.8
5	Oxygen consumed by $KMnO_4$	8.5	-	-	4.0	7.9	-	-	2.6
6	Carbon dioxide (CO_2), (calculated)	4.0	12	4.9	1.9	2.6	3.2	3.2	4.5
7	pH	8.3	7.8	8.2	7.7	8.3	8.2	8.2	8.1
8	Colour	10	10	10	20	0	5	5	5
9	Turbidity	40 *	60 *	50 *	55 *	20 *	40 *	15 *	30 *
10	Suspended matter, dried at 105°C.	12.4	-	16.4	12.8	2.5	-	7.2	
11	Suspended matter, ignited at 550°C.	7.6	-	11.0	7.5	1.1	-	2.2	
12	Residue on evaporation, dried at 105°C.	722	-	609	614	366	-	407	385
13	Ignition loss at 550°C.	108	-	91.6	92.4	39.6	-	44.8	88.8
14	Specific conductance, micromhos at 25°C.	1082	946.1	951.7	992.4	609.1	658.3	658.0	659.8
15	Calcium (Ca)	87.3	92.4	91.6	87.9	97.9	101	102	100
16	Magnesium (Mg)	41.4	48.4	47.6	44.8	21.7	23.2	21.7	24.9
17	Iron (Fe) Total	4.4	Very High		2.2	-	High		
18	Dissolved	0.1		0.78	-	0.86	-	0.46	0.71
19	Manganese (Mn)	0.04		0.29	0.04	0.08	-	Trace	0.01
20	Aluminum (Al)	0.27		0.0	0.0	0.0	-	0.30	0.0
21	Copper (Cu)	0.0		0.0	0.0	0.0	Trace	0.0	0.0
22	Zinc (Zn)	0.0		0.0	0.0	0.0	0.1	0.0	0.0
23	Sodium (Na)	104	48.0	49.3	71.8	6.2	6.7	6.7	6.5
24	Potassium (K)	6.1	4.6	4.8	5.5	2.4	2.4	2.3	2.4
25	Ammonium (NH_4)	0.0	-	0.0	-	0.0	0.1	-	-
26	Carbonate (CO_3)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
27	Bicarbonate (HCO_3)	534	493	506	506	332	347	341	352
28	Sulphate (SO_4)	158	124	127	154	64.9	77.2	80.5	84.3
29	Chloride (Cl)	8.1	6.4	5.1	6.4	2.0	2.9	2.3	2.8
30	Fluoride (F)	0.13	-	0.0	0.0	0.08	-	0.0	0.0
31	Nitrate (NO_3)	6.0	1.6	1.4	2.0	4.0	0.4	0.4	0.4
32	Silica (SiO_2), colorimetric	21	20	22	22	17	17	21	16
33	Carbonate hardness as $CaCO_3$	388	404	415	404	272	284.3	280	289
34	Non-carbonate hardness as $CaCO_3$	0.0	25.5	8.9	0.0	61.1	63.3	63.3	63.3
35	Total hardness as $CaCO_3$	388	430	424	404	333	348	343	352
36	Sum of constituents	695	589	600	640	380	402	405	412
37	Per cent sodium	36.2	19.3	19.9	27.4	3.8	4.0	4.0	3.8
38	Saturation index at test temperature	+1.4	+0.9	+1.2	+0.8	+1.2	+1.2	+1.1	+1.1
39	Stability index at test temperature	5.5	6.0	5.7	6.1	5.9	5.8	6.0	5.9
	Remarks:					*Iron oxides			

TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

SASKATCHEWAN (Concl'd)

GRENFELL			LLOYDMINSTER				REGINA				
			Wells *				Regina Municipal Supply - Wells and Buffalo Pound Lake *				
Well			Well No.1	Well No.2	Well No.4	Mixed Well					
Raw and Finished Water			Raw Water			Finished Water	Finished Water				NO.
At Tap			At Well Pumps			At Armoury Tap		At D.N.D. Tap			
May 1/56	Sept.26/56	Jan.29/57	July 12/57	July 12/57	July 12/57	July 12/57	Oct.26/56†	Dec.18/56	Feb.25/58	Mar.18/58	1
52:87	32:40	42:135	13:18	13:18	13:18	13:18	7	41:162	16:22	7:13	2
7.2	-	12.2	-	-	-	-		10.0	-	-	3
23.8	25.4	25.4	25.2	25.2	25.2	25.1		23.6	24.0	24.0	4
10	-	5.2	3.4	2.8	2.5	3.3		11	-	-	5
15	Trace	Slight	10	9.0	7.0	10		9.0	5.0	6.8	6
7.7	8.4	8.3	7.8	7.9	8.0	7.8	8.1	7.9	8.1	8.0	7
5	5	10	5	5	5	5	20	10	7	10	8
2	3	0	7	4	0.9	3	2	2	-	-	9
			9.7	12.2	-	10.4	Trace	-	-	-	10
			8.3	9.1	-	6.8	-	-	-	-	11
1886		2528	472	1409	1188	1409	-	924	-	-	12
391		536	170	126	148	134	1000	135	-	-	13
2155	2580	2628	2077	2045	1729	2023	-	1363	1388	1432	14
236	326	350	109	103	99.8	103	128.0	141	122	137	15
168	188	188	50.4	49.5	55.4	51.1	68.0	74.8	61.6	69.0	16
			-	0.56	-	-	1.2	-	-	-	17
0.02	0.01	Trace	0.13	0.12	0.04	0.34	-	0.0	0.08	-	18
0.31	0.96	0.47	0.06	0.06	0.04	0.04	-	0.0	-	-	19
0.91	-	0.50	0.41	0.18	0.21	0.08	-	0.45	-	-	20
0.06	0.04	0.04	Slight	0.0	0.0	Slight	0.0	0.0	-	-	21
0.7	1.5	2.0		0.05	0.01			0.0	-	-	22
56.0	52.8	55.0	310	310	240	303		63.0	105	91.0	23
7.1	7.8	6.5	5.0	5.1	5.1	5.1		7.4	10.8	9.5	24
-	-	-	-	-	-	-	0.3	-	-	-	25
0.0	17.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26
563	505	560	518	562	581	546	439	505	467	505	27
800	1105	1140	632	578	442	584	365	377	365	384	28
37.5	45.8	47.3	60.8	67.2	42.0	62.2	24.3	11.4	32.4	25.1	29
0.2	-	0.2	0.0	0.0	0.0	0.0	-	0.0	-	-	30
40	48.0	64	6.0	2.8	0.8	6.0	-	0.6	1.5	2.0	31
23	23	26	15	15	14	14	23	25	20	23	32
462	443	460	425	460	477	448	360	414	383	414	33
816	1141	1185	54.1	0.0	0.2	19.3	240	245	175	211	34
1278	1584	1645	479	460	477	467	600	659	558	625	35
1647	2064	2156	1444	1407	1186	1398	-	949	948	989	36
8.6	6.7	6.5	58.0	59.0	51.8	58.1	-	16.9	28.4	23.7	37
+1.1	+1.9	+1.8	+0.9	+1.1	+1.1	+0.9		+1.2	+1.2	+1.2	38
5.5	4.6	4.7	6.0	5.7	5.8	6.0		5.5	5.7	5.6	39

* *See* also W.S.R. No. 7

* *See* also W.S.R. No. 10

† Analysis by Alchem Ltd. Burlington, Ont.

TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

	PROVINCE	ALBERTA					
		BANFF			CALGARY and ENVIRONS		
	Camp or Establishment	Cadet Camp			Currie Barracks		
	Source(s)	Spring on Cascade Mountain			Calgary Municipal Supply - Elbow River, Treated *		
NO.		Raw and Finished Water			Finished Water		
	Sampling Point	At Spring			At Barracks Tap		
1	Date of sampling	June 5/56	Nov.1/56	May 27/57	May 9/56	Sept.25/56	Jan.22/57
2	Storage period (days)	28:63	10:56	11:56	47:84	30:35	44:142
3	Sampling temperature, °C.	4.4	3.9	4.4	5.6	8.9	3.3
4	Test temperature, °C.	23.6	20.2	21.4	23.3	21.2	24.0
5	Oxygen consumed by $KMnO_4$	5.1	-	2.6	8.0	-	0.9
6	Carbon dioxide (CO_2), (calculated)	1.6	1.8	-	1.6	1.4	1.1
7	pH	8.0	8.1	8.1	8.2	8.3	8.3
8	Colour	5	5	0	0	5	0
9	Turbidity	0.3	0	6	6	3	0
10	Suspended matter, dried at 105°C.	-	-	-	2.7	-	-
11	Suspended matter, ignited at 550°C	-	-	-	1.7	-	-
12	Residue on evaporation, dried at 105°C.	108	-	116	238	-	200
13	Ignition loss at 550°C.	10.0	-	32.0	24.0	-	26.0
14	Specific conductance, micromhos at 25°C.	187.2	376.2	179.6	372.5	348.6	340.6
15	Calcium (Ca)	26.0	54.8	24.7	52.7	50.3	41.3
16	Magnesium (Mg)	9.2	14.3	7.8	14.2	13.3	15.9
17	Iron (Fe) Total	-	-	-	-	-	-
18	Dissolved	Trace	-	0.0	0.05	-	0.01
19	Manganese (Mn)	Trace	-	0.0	0.0	-	0.0
20	Aluminum (Al)	0.0	-	0.06	0.12	-	0.25
21	Copper (Cu)	0.0	-	0.0	0.0	-	0.0
22	Zinc (Zn)	0.0	-	0.0	0.05	-	0.0
23	Sodium (Na)	0.3	1.1	0.4	2.8	1.9	2.5
24	Potassium (K)	0.3	0.5	0.3	1.0	0.7	0.7
25	Ammonium (NH_4)	0.05	-	0.0	0.0	0.0	0.0
26	Carbonate (CO_3)	0.0	0.0	0.0	0.0	0.0	0.0
27	Bicarbonate (HCO_3)	101	151	98.9	162	175	143
28	Sulphate (SO_4)	11.3	71.8	13.4	56.4	41.5	57.3
29	Chloride (Cl)	0.3	0.5	0.6	1.5	0.6	0.5
30	Fluoride (F)	0.05	-	0.2	0.2	-	0.15
31	Nitrate (NO_3)	1.2	1.2	0.4	1.6	0.4	0.2
32	Silica (SiO_2), colorimetric	3.2	6.9	2.9	4.9	5.7	5.8
33	Carbonate hardness as $CaCO_3$	83.3	124	81.1	133	144	117
34	Non-carbonate hardness as $CaCO_3$	19.7	72.0	12.6	57.3	36.3	51.4
35	Total hardness as $CaCO_3$	103	196	93.7	190	180	168
36	Sum of constituents	102	225	99.5	215	201	195
37	Per cent sodium	0.6	1.2	9.1	3.1	2.2	3.1
38	Saturation index at test temperature	-0.1	+0.4	-0.1	+0.6	+0.6	+0.5
39	Stability index at test temperature	8.2	7.3	8.3	7.0	7.1	7.3
	Remarks:				* *See* also W.S.R. No. 7		

TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

ALBERTA (Concl'd)

CALGARY and ENVIRONS (Concl'd)					EDMONTON and ENVIRONS				NO.
Sarcee Camp					Griesbach Barracks				
Deep Wells					Edmonton Municipal Supply - North Saskatchewan River, * Treated				
Well, 250' Deep at Tank Hangar		Well, 200' Deep at Caretaker's Residence							
Raw and Finished Water					Finished Water				
At Tap		At Tap			At C.H.P. Tap				
May 9/56	Sept.24/56	May 9/56	Sept.24/56	Jan.22/57	Feb.18/55	Apr.1/55	Jan.25/56 †	Apr.18/56 †	1
47:84	31:36	47:49	31:36	8:136	21:33	19:27	5:5	5:5	2
8.9	5.6	7.3	7.8	4.4	15.6	15.6	-	-	3
23.4	21.2	23.3	21.2	22.0	20.5	24.7	-	-	4
7.5	-	7.9	-	-	2.0	-	-	-	5
1.2	1.5	1.9	1.4	1.8	0.0	-	-	-	6
8.5	8.3	8.2	8.3	8.2	9.0	7.3	9.8	9.1	7
0	0	0	5	5	10	5	0	15	8
12	12	8	7	0.9	0	0	2	2	9
1.7	-	2.6	-	-	-		Trace	Trace	10
1.0	-	1.0	-	-	-			-	11
681	-	835	-	853	144		250	200	12
26.0	-	30.0	-	26.8	37.6		-	-	13
1032	1059	1243	1277	1267	236.5	252.2	-	-	14
18.2	17.8	17.1	19.6	19.2	12.7	19.9	32.0	32.8	15
3.9	4.7	3.5	5.0	3.9	5.0	3.6	7.8	1.5	16
-	-	-	-	-	-		0.4	0.2	17
0.08	-	0.08	-	0.01	Trace	-	-	-	18
0.02	-	0.04	-	0.01	0.0	-	-	-	19
0.05	-	0.02	-	0.0	0.07	-	0.0	1.9	20
0.0	-	0.0	-	0.0	0.03	-	-	-	21
0.05	-	0.4	-	0.1	-	-	-	-	22
210	220	252	257	253	21.3	18.6	-	-	23
2.3	2.2	2.1	2.4	2.4	1.0	3.2	-	-	24
0.1	0.0	0.1	0.0	-	-	-	0.2	0.7	25
6.0	0.0	0.0	0.0	0.0	3.0	0.0	19.2	9.6	26
253	273	190	187	187	19.5	24.5	2.4	31.7	27
292	289	414	453	432	74.1	78.5	94.6	60.8	28
3.8	3.6	4.2	4.4	3.6	2.2	3.7	6.1	7.3	29
0.4	-	0.5	-	0.8	0.0	-	-	-	30
3.2	0.4	10	0.4	2.4	0.4	0.6	-	-	31
8.7	7.9	6.1	0.7	7.6	3.4	7.6	5.3	3.7	32
61.4	63.7	57.1	69.5	63.9	21.1	20.1	34	42	33
0.0	0.0	0.0	0.0	0.0	31.8	44.4	46	40	34
61.4	63.7	57.1	69.5	63.9	52.9	64.5	80	82	35
673	680	804	842	817	133	148	-	-	36
87.6	87.8	89.9	88.5	91.2	45.9	-	-	-	37
+0.6	+0.3	+0.1	+0.2	+0.1	-0.1	-1.5	+1.3	+0.8	38
7.3	7.7	8.0	7.9	8.0	9.2	10.3	7.2	7.5	39

† Analyses by Alchem Ltd., Burlington.
* *See* also W.S.R. No. 7

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TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

NO.	PROVINCE	ALBERTA (Cont'd)			
		EDMONTON and ENVIRONS (Cont'd)			
	Camp or Establishment	Griesbach Barracks s			
	Source (s)	Edmonton Municipal Supply - North Saskatchewan River, * Treated			
		Finished Water			
	Sampling Point	At Firehall Tap		At C.H. Plant Tap	
1	Date of sampling	May 4/56	June 25/56†	Sept. 24/56	Oct.31/56†
2	Storage period (days)	49:84	4:4	31:36	6:6
3	Sampling temperature, °C.	5.6	-	11.1	-
4	Test temperature, °C.	24.0	-	21.2	-
5	Oxygen consumed by $KMnO_4$	-	-	-	-
6	Carbon dioxide (CO_2), (calculated)	0.8	0	0	0
7	pH	7.9	9.2	9.2	9.5
8	Colour	0	15	5	12
9	Turbidity	3	2	4	2
10	Suspended matter, dried at 105°C.	3.8	Trace	-	Trace
11	Suspended matter, ignited at 550°C.	1.3	-	-	-
12	Residue on evaporation, dried at 105°C.	124	140	-	200
13	Ignition loss at 550°C.	15.2	-	-	-
14	Specific conductance, micromhos at 25°C.	200.9	-	153.8	-
15	Calcium (Ca)	25.3	21.6	12.8	23.2
16	Magnesium (Mg)	3.7	4.4	7.6	2.9
17	Iron (Fe) Total	-	0.0	-	0.0
18	Dissolved	0.05	-	-	-
19	Manganese (Mn)	0.01	-	-	-
20	Aluminum (Al)	0.0	0.1	-	Trace
21	Copper (Cu)	0.0	-	-	-
22	Zinc (Zn)	0.0	-	-	-
23	Sodium (Na)	6.7	-	2.7	-
24	Potassium (K)	1.8	-	0.7	-
25	Ammonium (NH_4)	0.1	0.4	0.1	0.4
26	Carbonate (CO_3)	0.0	12	5.6	24.0
27	Bicarbonate (HCO_3)	42.4	9.7	23.6	0.0
28	Sulphate (SO_4)	51.2	39.2	38.3	60.8
29	Chloride (Cl)	3.1	3.6	1.6	3.6
30	Fluoride (F)	0.15	-	-	-
31	Nitrate (NO_3)	3.2	-	0.8	-
32	Silica (SiO_2), colorimetric	5.0	3.6	6.0	6.6
33	Carbonate hardness as $CaCO_3$	34.8	28.0	28.8	40.0
34	Non-carbonate hardness as $CaCO_3$	43.5	44.0	34.4	30.0
35	Total hardness as $CaCO_3$	78.3	72.0	63.2	70.0
36	Sum of constituents	121	-	86.1	-
37	Per cent sodium	15.3	-	8.4	-
38	Saturation index at test temperature	-0.6	+0.6	+0.3	+1.0
39	Stability index at test temperature	9.1	8.0	8.6	7.5
	Remarks:	† Analyses by Alchem Ltd., Burlington, Ont.			

TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

ALBERTA (Cont'd)

EDMONTON and ENVIRONS (Concl'd)								
Griesbach Barracks (Concl'd)		Bissell Station			Winterburn Rifle Range			
Edmonton Municipal Supply - North Saskatchewan River,* Treated (Concl'd)		Well			Well			
Finished Water		Finished Water			Raw and Finished Water			NO.
At C.H. Plant Tap		At Station Tap			At Pump			
Jan.22/57	Apr.2/57	May 4/56	Sept.24/56	Jan.22/57	May 4/56	Sept.24/56	Jan.22/57	1
44:142	9:13	49:84	35:43	44:142	49:84	31:36	44:142	2
3.3	-	12.8	10.0	10.0	4.4	4.4	5.6	3
24.4	25.4	23.8	24.6	24.2	23.8	21.2	24.4	4
1.1	-	9.9	-	3.8	10	-	4.2	5
Trace	0	7.0	1.1	4.2	10.0	5.0	6.0	6
8.7	8.8	8.2	8.9	8.4	7.8	8.1	8.0	7
0	5	5	20	5	10	10	15	8
0	4	4	3	6	85 *	35 *	15 *	9
-	1.2	11.1	-	12.6	34.9	-	21.7	10
-	0.0	2.8	-	6.2	28.1	-	12.1	11
194	194	713	-	746	562	-	503	12
29.4	33.6	37.6	-	51.2	47.2	-	45.6	13
262.6	252.6	1116	1161	1130	838.4	1137	724.2	14
16.9	24.3	0.0	0.0	1.9	131	223	114	15
8.6	4.8	0.0	0.0	0.0	37.0	22.0	26.7	16
-	-	-	-	-	9.4	High	-	17
0.05	0.0	0.06	-	0.05	0.25	0.1	0.09	18
0.0	0.0	0.0	-	0.0	0.52	0.1	0.0	19
0.38	0.33	0.0	-	0.32	0.0	-	0.46	20
0.0	Slight	0.0	-	0.0	0.0	-	0.0	21
0.0	0.0	0.0	-	0.05	0.1	-	0.25	22
20.1	13.8	292	310	306	10.0	12.3	8.4	23
1.0	3.7	0.8	2.6	0.8	2.2	2.7	2.0	24
0.0	0.1	0.0	0.5	0.05	0.1	-	0.0	25
1.8	2.9	0.0	49.4	19.6	0.0	0.0	0.0	26
40.0	31.8	748	677	737	417	461	404	27
81.8	76.2	1.0	1.8	1.0	130	292	79.9	28
1.8	4.3	10.4	14.3	11.0	0.8	0.9	1.0	29
0.15	0.0	1.8	-	2.0	0.7	-	0.4	30
0.2	1.2	3.6	0.4	0.4	2.4	0.8	0.4	31
6.2	4.6	8.3	9.1	10	15	19	18	32
35.8	30.9	0.0	0.0	4.7	342	379	332	33
41.7	49.5	0.0	0.0	0.0	137	269	63.3	34
77.5	80.4	0.0	0.0	4.7	479	648	395	35
159	152	687	721	706	533	800	451	36
35.0	25.6	99.8	99.5	99.1	4.3	3.9	4.4	37
0.0	+0.3	-0.5	+0.2	0.0	+0.9	+1.4	+1.1	38
8.7	8.2	9.2	9.5	8.4	6.0	5.3	5.8	39

* Iron oxides mostly

68664-6½

TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

PROVINCE ALBERTA (Cont'd)

NO.		FORT CHIPEWAYAN					
	Camp or Establishment						
	Source (s)	Wells					
		Well No. 1			Well No. 2		
		Raw and Finished Water					
	Sampling Point	At Pump, PMQ No. 9			At Pump, PMQ No. 2		
1	Date of sampling	Aug.17/56	Dec.13/56	May 15/57	Aug.17/56	Dec.13/56	May 15/57
2	Storage period (days)	34:60	29:48	35:68	34:53	29:48	35:68
3	Sampling temperature, °C.	7.2	4.4	-	7.2	4.4	-
4	Test temperature, °C.	23.6	21.0	27.4	22.4	20.6	27.4
5	Oxygen consumed by $KMnO_4$	19	-	-	16	-	9.7
6	Carbon dioxide (CO_2) (calculated)	11	14	15	11	26	9
7	pH	6.9	6.9	6.7	7.5	7.3	7.5
8	Colour	-	120	55	20	40	25
9	Turbidity	12	20	17	13	5	6
10	Suspended matter, dried at 105°C.	6.6	-	0.3	12.2	-	4.4
11	Suspended matter, ignited at 550°C.	3.1	-	0.0	2.4	-	0.8
12	Residue on evaporation, dried at 105°C.	142	-	108	326	-	286
13	Ignition loss at 550°C	56.4	-	46.0	110	-	82.8
14	Specific conductance, micromhos at 25°C	171.3	167.9	130.4	473.4	571.3	436.1
15	Calcium (Ca)	16.2	15.6	12.8	42.8	54.2	39.0
16	Magnesium (Mg)	6.9	5.8	4.7	25.6	32.0	23.2
17	Iron (Fe) Total	1.4	-	-	-	-	-
18	Dissolved	1.1	1.7	1.1	0.15	0.51	0.26
19	Manganese (Mn)	0.02	-	Trace	0.04	-	0.04
20	Aluminum (Al)	-	-	0.01	-	-	0.06
21	Copper (Cu)	0.0	-	Trace	Trace	-	0.03
22	Zinc (Zn)	> 1	-	0.2	>1	-	0.3
23	Sodium (Na)	3.4 †	2.8 †	2.4 †	12.0	14.8	9.6
24	Potassium (K)	5.2	5.5	5.2	4.6	5.5	4.8
25	Ammonium (NH_4)	0.1	-	0.1	0.2	0.2	0.05
26	Carbonate (CO_3)	0.0	0.0	0.0	0.0	0.0	0.0
27	Bicarbonate (HCO_3)	59.2	69.2	51.6	214	317	200
28	Sulphate (SO_4)	8.0	7.6	7.1	13.1	11.4	10.6
29	Chloride (Cl)	7.2	6.4	5.1	16.6	14.9	8.9
30	Fluoride (F)	- †	- †	0.0 †	0.0 †	- †	0.0 †
31	Nitrate (NO_3)	24	7.2	6.0	48	24	48
32	Silica (SiO_2) colorimetric	7.5	7.8	7.3	12	14	12
33	Carbonate hardness as $CaCO_3$	48.6	56.8	42.3	176	260	164
34	Non-carbonate hardness as $CaCO_3$	20.2	6.0	9.0	36.5	7.2	28.8
35	Total hardness as $CaCO_3$	68.8	62.8	51.3	212	267	193
36	Sum of constituents	110	94.5	72.2	282	327	255
37	Per cent sodium	8.6	7.7	7.9	10.5	10.5	9.4
38	Saturation index at test temperature	-1.7	-1.6	-1.9	-0.1	-0.1	0.0
39	Stability index at test temperature	10.3	10.1	10.5	7.7	7.5	7.5
	Remarks:	† Note higher nitrates and potassium: sodium ratios					

TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

ALBERTA (Cont'd)

FORT CHIPEWAYAN (Concl'd)			McMURRAY			STRATHMORE			NO.
						Drill Hall			
Wells			Clearwater River			Well			
Well No. 3									
Raw and Finished Water			Raw and Finished Water			Raw and Finished Water			
At Pump, PMQ No. 3			At PMQ's Tap			At Tap			
Aug.17/56	Dec.13/56	May 15/57	June 11/56	Dec.19/56	July 15/57	May 2/56	Sept.6/56	Jan.29/57 *	1
34:60	29:48	35:68	28:59	23:29	25:43	51:86	33:40	42:29	2
7.2	4.4	-	16.7	15.0	12.8	18.9	17.8	15.6	3
22.5	20.0	27.4	23.3	21.0	26.5	23.9	20.6	25.5	4
19	-	13	14	-	15	8.3	-	2.0	5
12	24	12	1.8	1.8	2.4	4.4	11	2.6	6
6.9	6.6	7.0	7.9	8.0	7.9	8.2	7.8	8.5	7
-	60	40	70	60	100	0	5	5	8
30	2	8	10	-	13	5	12	0	9
8.9	-	0.8	2.8	-	5.8	6.5	-	-	10
5.2	-	0.0	1.7	-	4.8	2.0	-	-	11
122	-	168	166	-	170	867	-	893	12
38.8	-	69.6	43.2	-	41.2	44.0	-	48.0	13
147.7	154.7	203.3	238.6	307.5	223.0	1310	1320	1382	14
13.8	14.8	22.2	19.3	22.6	25.5	33.4	37.9	2.4	15
5.1	5.1	6.0	5.6	7.1	7.2	9.2	8.4	0.2	16
2.5	-	-	-	-	0.23	-	-	-	17
1.7	-	0.16	0.15	-	0.0	0.17	-	0.0	18
0.02	-	0.16	0.0	-	0.0	0.26	-	0.02	19
-	-	0.06	-	-	0.0	0.22	-	0.08	20
0.0	-	Trace	0.0	-	0.0	0.31	-	0.07	21
>1	-	0.3	1.0	-	0.6	0.05	-	0.1	22
3.7 †	3.6 †	4.1 †	22.0	28.5	12.0	260	274	330	23
6.8	6.7	6.9	1.7	1.9	2.0	1.6	1.6	2.4	24
0.1	0.1	0.1	0.3	0.1	0.1	0.0	0.1	0.05	25
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.7	26
55.7	56.6	76.3	91.4	107	118	507	523	510	27
6.6	7.2	8.0	8.2	10.5	17.0	254	269	284	28
5.2	5.0	6.5	27.0	36.6	6.5	2.8	3.2	2.7	29
- †	- †	0.0 †	0.0	-	0.0	0.0	0.0	0.2	30
24	16	24	4.0	1.2	0.6	8.0	2.4	3.2	31
8.2	9.4	9.0	6.7	12	5.0	9.1	11	12	32
47.2	46.4	62.6	70.8	85.6	93.2	121	129	6.8	33
8.2	11.5	17.5	0.0	0.0	0.0	0.0	0.0	0.0	34
55.4	57.9	80.1	70.8	85.6	93.2	121	129	6.8	35
105	95.7	125	141	173	135	829	865	888	36
10.5	10.5	9.0	38.8	41.3	21.2	81.8	82.0	98.5	37
-1.8	-2.1	-1.0	-0.4	-0.2	+0.1	+0.8	+0.4	0.0	38
10.5	10.8	9.4	8.7	8.4	8.1	6.6	7.0	8.5	39

* Sample apparently softened

TABLE II - (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

PROVINCE — ALBERTA (Cont'd)

NO.		WAINWRIGHT					
	Camp or Establishment	Camp Wainwright					
	Source(s)	Battle River, Betty Lake and Standby Wells *					
		Battle River				Betty Lake	
		Raw Water				Raw Water	
	Sampling Point	At Plant Intake				At Plant Intake	
1	Date of sampling	May 22/56	Oct.22/56	Feb.6/57	May 1/57	May 11/55	May 22/56
2	Storage period (days)	38:77	11:67	47:70	13:16	8:29	38:77
3	Sampling temperature, °C.	15.8	7.2	2.8	13.0	-	15.9
4	Test temperature, °C.	24.4	21.8	24.3	24.1	22.9	22.0
5	Oxygen consumed by $KMnO_4$	11	-	5.1	13	11	10
6	Carbon dioxide (CO_2), (calculated)	6.2	1.7	2.8	6.0	1.3	2.1
7	pH	7.7	8.5	8.5	7.7	8.7	8.5
8	Colour	50	40	25	-	20	20
9	Turbidity	100	25	2	269	0.4	0
10	Suspended matter, dried at 105°C.	299	-	-	197	-	-
11	Suspended matter, ignited at 550°C.	273	-	-	165	-	-
12	Residue on evaporation, dried at 105°C.	284	-	879	279	425	422
13	Ignition loss at 550°C.	46.8	-	69.2	55.6	145	128
14	Specific conductance, micromhos at 25°C.	416.1	729	1433	403.5	658.0	649.9
15	Calcium (Ca)	40.1	61.5	48.1	32.6	26.1	24.6
16	Magnesium (Mg)	12.2	24.5	25.4	12.0	44.3	46.6
17	Iron (Fe) Total	4.5	-	-	-	-	-
18	Dissolved	0.03	-	0.0	0.0	Trace	Trace
19	Manganese (Mn)	0.0	-	0.0	0.0	0.0	0.0
20	Aluminum (Al)	0.04	-	0.08	0.02	0.14	0.27
21	Copper (Cu)	0.0	-	0.0	Slight	0.0	0.0
22	Zinc (Zn)	0.0	-	0.0	0.0	-	0.0
23	Sodium (Na)	27.0	69.3	267	33.5	52.0	53.0
24	Potassium (K)	7.3	5.7	7.0	8.6	10.6	10.0
25	Ammonium (NH_4)	0.0	-	0.1	0.0	0.0	-
26	Carbonate (CO_3)	0.0	9.1	32.3	0.0	22.7	11.8
27	Bicarbonate (HCO_3)	190	367	705	192	357	389
28	Sulphate (SO_4)	53.1	83.2	166	50.1	34.7	25.9
29	Chloride (Cl)	2.7	7.2	2.8	4.1	5.7	6.0
30	Fluoride (F)	0.0	-	0.3	0.0	0.15	0.0
31	Nitrate (NO_3)	3.2	1.6	4.8	2.4	0.4	2.8
32	Silica (SiO_2), colorimetric	7.2	14	18	7.2	1.6	2.9
33	Carbonate hardness as $CaCO_3$	150	254	225	131	247	253
34	Non-carbonate hardness as $CaCO_3$	0.0	0.0	0.0	0.0	0.0	0.0
35	Total hardness as $CaCO_3$	150	254	225	131	247	253
36	Sum of constituents	247	457	919	245	374	376
37	Per cent sodium	26.9	36.6	71.2	33.9	30.2	30.1
38	Saturation index at test temperature	+0.1	+1.2	+1.4	-0.1	+1.1	+0.9
39	Stability index at test temperature	7.5	6.1	5.7	7.9	6.5	6.7
	Remarks:						

TABLE II - (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

ALBERTA (Concl'd)

WAINWRIGHT (Concl'd)										
Camp Wainwright (Concl'd)										
Battle River, Betty Lake and Standby Wells *										
Betty Lake			Mixed River and Lake - Camp Supply						Wells *	
Raw Water			Finished Water						Finished Water	NO.
At Plant Intake			At Tap in Bldg. 184						Town Tap	
Oct.22/56	Feb.6/57	May 1/57	May 11/55	July28/55	May 22/56	Oct.20/56	Feb.6/57	May 1/57	Oct.11/51	1
11:67	47:70	13:16	8:29	6:18	36:77	11:20	47:70	13:16	11:30	2
7.0	3.0	13.0	-	-	11.1	12.0	8.9	-	9.4	3
21.8	24.0	24.1	23.0	29.4	24.4	21.8	24.3	24.1	22.6	4
-	12	12	5.8	-	11	-	5.7	7.9	-	5
0	2.2	1.6	0	0	0.0	0.0	-	0.0	4.0	6
9.3	8.6	8.6	9.4	10.2	10.0	9.8	9.1	9.2	8.4 (8.5)	7
30	35	25	5	5	10	10	5	0	2 (15)	8
7	0	15	0	-	4	5	0	4	0.6 (Clear)	9
-	-	8.4	-	-	3.1	-	-	-	-	10
-	-	2.8	-	-	1.7	-	-	-	-	11
-	562	397	272	-	325	-	290	369	936	12
-	188	119	44.8	-	37.6	-	36.0	96.0	31.0	13
573.7	869.2	610.0	450.0	428.9	522.5	427.6	512.0	568.2	1411	14
13.8	20.0	19.0	4.6	4.5	15.6	8.9	10.6	7.9	5.2	15
48.8	70.5	47.4	3.7	7.3	6.6	8.8	5.6	12.2	1.4	16
-	-	-	-	-	-	-	-	-	-	17
-	0.0	0.0	0.03	0.0	0.0	-	0.0	0.0	0.07	18
-	-	0.0	0.0	-	0.0	-	0.0	0.0	-	19
-	0.24	0.05	0.07	0.02	0.0	-	0.05	0.03	-	20
-	-	0.0	0.0	0.0	0.0	-	0.0	Slight	-	21
-	-	0.0	-	-	0.0	-	0.0	0.0	-	22
53.8	74.8	48.0	69.4	59.6	60.0	53.0	72.5	74.3	340	23
10.1	15.0	9.9	12.8	11.6	14.0	10.0	14.4	14.9	7.0	24
-	-	0.0	Trace	0.1	0.3	0.1	0.4	0.15	-	25
69.5	24.7	19.6	22.9	60.0	25.2 †	23.3	12.4	13.6	5.5 (21.6)	26
268	539	373	70.0	30.0	0.0	31.3	46.9	76.9	667(616)	27
20.4	28.0	18.9	83.7	58.0	32.4	25.5	33.9	36.0	199	28
5.5	10.0	6.0	7.7	2.0	99.5	68.4	90.6	91.7	4.8 (6.0)	29
-	0.0	0.0	0.15	0.15	0.1	-	0.05	0.0	0.2	30
1.2	3.2	1.2	0.6	0.0	0.2	0.8	0.2	0.6	0.5	31
4.2	4.3	4.8	6.2	6.9	17	5.7	21	4.8	11	32
234	340	242	26.7	41.3	45.4	58.4	49.5	69.9	18.7	33
0.0	0.0	0.0	0.0	0.0	20.7	0.0	0.0	0.0	0.0	34
234	340	242	26.7	41.3	66.1	58.4	49.5	69.9	18.7	35
359	516	358	246	239	271	220	285	294	900	36
32.2	33.7	29.0	77.6	69.8	60.6	61.8	69.5	64.3	96.4	37
+1.4	+1.1	+0.9	+0.6	+1.6	+1.4	+1.0	+0.4	+0.5	+0.3	38
6.5	6.4	6.8	8.2	7.0	7.2	7.8	8.3	8.2	7.8	39

† OH = 1.2

* Municipal water

TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

	PROVINCE	BRITISH COLUMBIA					
	Camp or Establishment	CHILLIWACK					
		Camp Chilliwack					
	Source (s)	Vedder River and Well					
		Well at Wet Bridging Area		Vedder River at Bridging Area		Vedder River	
NO.		Raw and Finished Water				Raw and Finished Water	
	Sampling Point	At Tap		At Well		At Tap, Central Central Heating Plant	
1	Date of sampling	Apr.25/56	Aug.27/56	Mar.1/57	Apr.9/57	Feb.16-17/55	May 1/55
2	Storage period (days)	54:89	17:36	39:112	8:38	13:21	18:47
3	Sampling temperature, °C.	7.2	15.6	8.9	8.9	4.4 - 10.0	4.4
4	Test temperature, °C.	23.5	23.3	24.0	24.1	21.6	22.0
5	Oxygen consumed by $KMnO_4$	8.8	-	3.5	-	1.8	1.5
6	Carbon dioxide (CO_2), (calculated)	2.3	5.1	1.8	1.8	3.1	2.0
7	pH	7.9	7.5	7.6	7.7	7.4	7.6
8	Colour	0	-	10	15	10	5
9	Turbidity	2	15	7	10	0	0
10	Suspended matter, dried at 105°C.	-	-	8.4	-	-	
11	Suspended matter, ignited at 550°C.	-	-	7.6	-		
12	Residue on evaporation, dried at 105°C.	138	-	92.0	-	57.6	63.6
13	Ignition loss at 550°C.	30.0	-	29.2	-	14.4	29.6
14	Specific conductance, micromhos at 25°C	201.2	195.3	91.01	107.9	107.2	106.8
15	Calcium (Ca)	30.6	29.7	13.2	16.3	16.1	16.0
16	Magnesium (Mg)	5.0	5.2	1.9	2.2	1.4	1.5
17	Iron (Fe) Total	-	High	-	-	-	-
18	Dissolved	0.15	-	0.27	-	0.02	Trace
19	Manganese (Mn)	0.25	-	0.0	-	Trace	0.0
20	Aluminum (Al)	0.17	-	0.07	-	0.28	0.21
21	Copper (Cu)	0.0	-	0.0	-	0.11	0.04
22	Zinc (Zn)	1.0	-	0.0	-	-	-
23	Sodium (Na)	2.5	1.8	1.7	1.8	1.2	1.3
24	Potassium (K)	0.9	0.9	0.8	0.8	0.6	0.7
25	Ammonium (NH_4)	0.1	0.0	0.0	0.05	-	0.0
26	Carbonate (CO_3)	0.0	0.0	0.0	0.0	0.0	0.0
27	Bicarbonate (HCO_3)	117	108	43.5	56.0	46.7	47.8
28	Sulphate (SO_4)	0.4	19	8.6	6.8	10.5	9.6
29	Chloride (Cl)	6.0	6.3	0.9	0.7	1.0	1.2
30	Fluoride (F)	0.0	-	0.0	-	0.05	0.0
31	Nitrate (NO_3)	0.6	0.2	1.5	1.2	0.4	0.6
32	Silica (SiO_2), colorimetric	20	18	9.6	9.2	4.2	6.6
33	Carbonate hardness as $CaCO_3$	96.0	88.2	35.7	45.9	38.3	39.2
34	Non-carbonate hardness as $CaCO_3$)	0.9	7.4	5.0	3.8	7.6	6.9
35	Total hardness as $CaCO_3$	96.9	95.6	40.7	49.7	45.9	46.1
36	Sum of constituents	125	11/	60.1	66.6	59.8	61.4
37	Per cent sodium	5.1	4.1	8.0	7.1	5.1	5.5
38	Saturation index at test temperature	-0.1	-0.6	-1.1	-0.8	-1.2	-1.0
39	Stability index at test temperature	8.1	8.7	9.8	9.3	9.8	9.6
	Remarks:			River rising	River low		

TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

BRITISH COLUMBIA (Cont'd)

CHILLIWACK (Concl'd)							COURTENAY		
Camp Chilliwack (Concl'd)									
Vedder River and Well							Spring	Courtenay Municipal Supply -Brown's River	
Vedder River									
Raw and Finished Water							Raw and Finished Water		NO.
At Tap, Central Heating Plant				At Tap in Bldg. 1016			At Tap	Town Tap	
Nov.29/55	Feb.13/56	Aug.7/56	Apr.25/56	Aug.27/56	Mar.1/57	Apr.9/57	Apr.24/57	Aug.16/49	1
15:36	14:21	17:22	54: 89	43:56	52:110	8:38	15:83	-:63	2
10.0	10.0	-	10.0	15.6	8.9	4.4	2.8	14.5	3
24.4	22.2	21.6	23.5	20.8	25.6	24.0	26.0	22.0	4
1.9	-	8.2	7.8	-	2.7	-	2.8	-	5
1.3	1.2	3.4	2.0	1.6	2.7	2.1	4.2	- (1.0)	6
7.7	7.9	7.2	7.5	7.6	7.4	7.5	7.3	7.4 (7.7)	7
0	5	0	0	10	5	0	5	5(7)	8
0	0	0	0	0	0	5	0.8	0.2	9
		-	-					-	10
		-	-					-	11
56.4		-	-		68.8		93.6	33.0	12
20.0		-	-		14.3		27.6	6.4	13
85.26	113.3	70.89	90.13	77.06	90.43	86.61	119.1	46.4	14
13.1	17.8	11.0	13.5	11.7	13.6	12.9	11.3	6.0	15
1.2	1.6	0.8	1.4	1.2	1.6	1.4	4.5	1.2	16
-		-	-		-		-	-	17
		-	0.03		0.04		0.07	0.03	18
0.02		-	0.0		0.0		0.0	-	19
0.23		-	0.0		0.23		0.01	-	20
0.04		0.0	0.0		Trace		Trace	-	21
0.09		0.5	0.3		0.4		0.5	-	22
1.0	1.4	0.9	1.4	1.0	1.3	1.3	5.1	1.4	23
0.6	0.7	0.6	0.6	0.6	0.5	0.5	0.2	0	24
-	-	0.1	0.1	0.1	0.0	0.0	0.0	-	25
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0 (0)	26
39.1	53.3	32.1	41.6	36.0	43.0	40.7	55.3	25.4 (19.5)	27
7.0	8.1	5.9	5.9	5.9	7.4	6.7	2.5	3.3	28
1.0	0.8	1.1	1.3	1.5	1.1	0.4	7.0	0	29
0.0	-	-	0.0	-	0.0	-	0.0	0.5	30
1.2	1.6	2.4	2.8	0.4	0.6	0.6	1.0	0.6	31
6.0	6.6	25	6.4	6.4	6.1	6.6	16	5.2	32
32.1	43.8	26.3	34.1	29.5	35.3	33.4	45.4	19.9 (16.0)	33
5.5	7.2	4.4	5.3	4.6	5.2	4.5	1.3	10	34
37.6	51.0	30.7	39.4	34.1	40.5	37.9	46.7	19.9	35
50.7	64.9	64.4	54.2	46.4	54.1	50.4	75.3	30.2	36
5.2	5.5	5.7	6.9	5.9	6.1	6.8	18.8		37
-1.0	-0.7	-1.8	-1.3	-0.9	-1.3	-1.3	-1.4	-1.9	38
9.7	9.3	10.8	10.1	9.4	10.0	10.1	10.1		39
	River very low					River low	High surface run-off		

TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

PROVINCE — BRITISH COLUMBIA (Cont'd)

No.									
	Camp or Establishment	FORT NELSON and ENVIRONS							
		Fort Nelson - Mile 295, Alaska Highway							
	Source (s)	Well							
		Raw Water							
	Sampling Point	At Pump or Before Treatment							
1	Date of sampling	Jan.12/56	Mar.6/56	May 15/56	Dec.5/56	Apr.9/57	June 10/57	Feb.20/58	Mar.6/58
2	Storage period (days)	25:29	7:14	9:15	48:76	14:22	11:18	19:19	5:5
3	Sampling temperature, °C.	0.6	-	-	4.4	5.0	5.0	5.0	10.0
4	Test temperature, °C.	24.1	23.7	21.5	26.3	25.6	26.6	24.6	24.4
5	Oxygen consumed by $KMnO_4$	2.6	5.2	-	-	4.6	4.2		
6	Carbon dioxide (CO_2), (calculated)	43	42	6.3	7	14	11		
7	pH	7.3	7.3	8.1	8.0	7.8	7.9		7.3
8	Colour	5	5	30	5	15	5		
9	Turbidity	High *	-	High *	-	Very High *	425 *		
10	Suspended matter, dried at 105°C.	140	-						
11	Suspended matter, ignited at 550°C.	115	-						
12	Residue on evaporation, dried at 105°C	1295	1280		1522	1608			
13	Ignition loss at 550°C.	86.4	38.0		115	131			
14	Specific conductance, micromhos at 25°C.	1640	1639	1477	1856	1938	1508	1881	1859
15	Calcium (Ca)	332	327	292	380	390	289	378	375
16	Magnesium (Mg)	50.4	54.0	45.7	53.6	65.5	51.3	67.2	66.8
17	Iron (Fe) Total	93.	36.5	Very High	Very High	-	77	78	79
18	Dissolved	0.09	-	Trace	0.26	0.28	2.8		
19	Manganese (Mn)	1.1	0.8	High	0.72	High	0.77		
20	Aluminum (Al)	0.0	-	-	0.44	0.36	0.0		
21	Copper (Cu)	0.0	0.0	-	0.0	Trace	Slight		
22	Zinc (Zn)	0.0	0.0	-	0.0	0.0	0.0		
23	Sodium (Na)	8.3	8.2	7.0	8.5	8.5	7.1		
24	Potassium (K)	3.0	2.9	2.7	3.2	3.3	2.7		
25	Ammonium (NH_4)	-	0.0	-	-	-	-		
26	Carbonate (CO_3)	0.0	0.0	0.0	0.0	0.0	0.0		
27	Bicarbonate (HCO_3)	684	683	592	725	762	581		
28	Sulphate (SO_4)	472	-	390	553	626	458		
29	Chloride (Cl)	0.7	0.7	0.8	0.8	1.9	1.3		
30	Fluoride (F)	0.0	0.5	-	0.0	0.0	0.4		
31	Nitrate (NO_3)	1.2	0.4	2.8	6.0	3.2	0.8		
32	Silica (SiO_2), colorimetric	11	13	13	11	11	9.8		
33	Carbonate hardness as $CaCO_3$	561	560	486	595	625	476	615	606
34	Non-carbonate hardness as $CaCO_3$	643	478	430	575	617	454	605	605
35	Total hardness as $CaCO_3$	1204	1038	916	1170	1242	931	1220	1211
36	Sum of constituents	1217	1220	1045	1375	1485	1508		
37	Per cent sodium	1.7	1.7	1.6	1.5	1.5	1.6		
38	Saturation index at test temperature	+1.0	+0.8	+1.1	+1.7	+1.4	+0.9		
39	Stability index at test temperature	4.3	5.7	6.1	4.6	5.0	6.1		
	Remarks:	* Iron oxides							

TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

BRITISH COLUMBIA (Cont'd)

FORT NELSON and ENVIRONS (Cont'd)													
Fort Nelson - Mile 295, - Alaska Highway (Concl'd)													
Well													
Finished Water													NO
At Tap in Central Heating Plant													
Sept.22/55	Nov.28/55	Jan.12/56	Mar.6/56	Mar.13/56	Mar.27/56	Apr.12/56	Apr.25/56	May 15/56	June 4/56	Dec.5/56	Apr.9/57	June 10/57	1
11:54	11:17	25:29	7:14	8:21	23:29	14:19	9:15	9:15	29:64	48:76	14:22	11:18	2
-	-	15.6	-	-	-	-	-	-	16.7	22.8	20.0	22.1	3
22.3	21.8	24.2	23.7	24.4	22.5	23.5	24.1	21.5	23.3	26.3	25.6	26.6	4
9.1	-	2.9	5.1	-	-	-	-	-	4.1	-	4.2	4.0	5
1.3	1.6	1.7	2.7	2.5	2.6	3.7	2.1	1.5	2.0	2	7	2.5	6
8.2	8.3	8.1	8.1	8.1	8.0	8.0	8.3	8.2	8.0	8.3	7.9	8.2	7
5	10	5	10	10	10	10	10	0	5	10	10	5	8
-	-	0.9	-	-	-	-	-	-	0.9	10	35	15	9
-		-	-							5.7		14.2	10
-	-	-	-							4.2		2.0	11
-	-	819	933						754	1174	1300	933	12
-		65.6	82.4						80.8	119	126	123	13
1006	1142	1039	1183	1131	1029	1076	1119	1005	943.9	1400	1564	1170	14
184	194	164	197	176	153	171	180	158	132	242	275	180	15
22.1	40.6	41.0	49.3	51.4	46.9	47.1	51.2	40.8	40.5	56.9	65.3	51.4	16
-		0.08	1.8						0.26	-	-	-	17
0.05	-	0.08	-						0.18	0.10	0.02	0.02	18
0.02	-	0.05	0.12						0.04	0.12	0.06	0.04	19
0.03	-	0.28	-						0.25	0.29	0.26	0.31	20
Trace	0.0	0.0	0.0						0.0	0.0	Trace	Slight	21
0.0		0.0	0.0						0.0	0.0	0.0	0.0	22
7.3	8.3	8.3	8.2	7.9	7.5	7.5	7.0	7.1	7.0	8.6	8.5	7.8	23
3.0	3.2	3.0	3.0	3.0	3.0	2.8	2.9	2.7	2.7	4.4	3.4	2.8	24
-	-	-	-				-	-	-	-	-	-	25
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26
145	208	131	239	209	172	251	263	176	130	330	419	260	27
445	488	475	469	452	433	403	376	416	381	553	633	451	28
0.2	1.0	0.7	0.6	0.9	1.1	1.0	0.6	0.8	0.8	1.1	0.9	7.7	29
0.1		0.15	0.5	-					0.0	0.0	0.2	0.13	30
1.2	1.6	1.6	0.8	2.4	2.0	8.0	3.2	10	4.0	6.0	1.8	2.4	31
7.7	5.2	4.1	5.3	4.8	5.1	6.5	6.7	4.4	3.9	6.7	7.4	6.4	32
119	170	108	196	172	141	206	216	144	106	271	343	214	33
430	481	471	498	478	432	413	442	418	390	567	611	447	34
549	651	579	694	650	574	619	658	562	496	838	954	661	35
742	844	763	851	801	737	770	757	726	636	1042	1202	1170	36
2.8	2.7	3.9	2.5	2.6	2.7	2.6	5.3	2.7	2.9	2.2	1.9	2.5	37
+1.0	+1.3	+0.8	+1.2	+1.1	+0.8	+1.0	+1.4	+1.0	+0.6	+1.6	+1.3	+0.8	38
6.2	5.7	6.5	5.7	5.9	6.4	6.0	5.5	6.2	6.8	5.1	5.3	6.6	39

TABLE II (Cont'd)

CHEMICAL ANALYSES OR ARMY WATER SUPPLIES

(In parts per million)

PROVINCE BRITISH COLUMBIA (Cont'd)

NO.	Camp or Establishment	FORT NELSON and ENVIRONS (Concl'd)					
		Maintenance Camp, Mile 392, Alaska Highway	Maintenance Camp, Mile 456, Alaska Highway	Maintenance Camp - Mile 546, Alaska Highway		Watson Lake Maintenance Camp — Mile 635, Alaska Highway	
	Source (s)	Summit Lake	Well	Well alongside Coal River		Deep Well	
		Raw & Finished Water	Raw & Finished Water	Raw & Finished Water		Raw & Finished Water	
	Sampling Point	At Pump	At Pump	At Pump		At Pump	
1	Date of sampling	Oct.31/56	Oct.31/56	Aug.21/56	June, 1957	Aug.20/56	June 1957†
2	Storage period (days)	8:84	30:84	46:162	-	47:162	-
3	Sampling temperature, °C.	3.3	13.3	5.6	7.8	3.9	6.7
4	Test temperature, °C.	25.3	20.8	22.3	25.8	22.4	25.8
5	Oxygen consumed by $KMnO_4$	9.8	-	10.1	2.4	9.9	2.1
6	Carbon dioxide (CO_2), (calculated)	1.2	3.3	3	2.5	1.3	1.6
7	pH	8.3	7.9	8.3	8.1	8.4	8.1
8	Colour	5	10	10	0	5	5
9	Turbidity	0.3	0	6	-	2	-
10	Suspended matter, dried at 105°C.			7.8	-	-	-
11	Suspended matter, ignited at 550°C.			1.8	-	-	-
12	Residue on evaporation, dried at 105°C.	132	153	352	-	175	-
13	Ignition loss at 550°C.	20.0	26.8	32.0	-	29.2	-
14	Specific conductance, micromhos at 25°C.	237.1	264.2	666.3	460.71 †	318.8	231
15	Calcium (Ca)	30.0	36.6	88.0	33.2 †	51.5	28.7
16	Magnesium (Mg)	12.6	12.2	38.0	38.9	8.7	10.6
17	Iron (Fe) Total	-		-	-	-	-
18	Dissolved	0.01	0.0	0.05	0.08	0.04	3.1
19	Manganese (Mn)	0.0	Trace	0.0	-	0.0	0.0
20	Aluminum (Al)	0.14	0.16	0.20	0.35	0.06	0.0
21	Copper (Cu)	Trace	Trace	0.0	0.0	0.0	0.0
22	Zinc (Zn)	0.0	0.1	0.0	0.0	0.0	0.0
23	Sodium (Na)	0.9	0.6	1.5	2.9	2.9	5.2
24	Potassium (K)	0.3	0.4	1.7	1.7	1.0	1.0
25	Ammonium (NH_4)	0.0	0.05	-	0.0	0.05	0.05
26	Carbonate (CO_3)	0.0	0.0	0.0	0.0 †	1.3	0.0
27	Bicarbonate (HCO_3)	154	164	364	201 †	201	133
28	Sulphate (SO_4)	3.0	9.9	85.1	65.7	3.2	3.5
29	Chloride((Cl)	0.3	1.1	0.4	0.5	5.2	6.8
30	Fluoride (F)	0.0	0.0	0.0	-	0.0	-
31	Nitrate (NO_3)	0.4	0.4	0.4	0.2	Trace	1.2
32	Silica (SiO_2), colorimetric	3.8	5.3	9.1	12	16	20
33	Carbonate hardness as $CaCO_3$	127	135	298	165	164	109
34	Non-carbonate hardness as $CaCO_3$	0.2	6.5	73.4	77.6	0.0	6.3
35	Total hardness as $CaCO_3$	127	141	372	243 †	164	115
36	Sum of constituents	127	148	404	255	188	146
37	Per cent sodium	1.5	0.9	0.9	2.8	3.7	8.5
38	Saturation index at test temperature	+0.5	+0.1	+1.2	+0.4	+0.9	+0.2
39	Stability index at test temperature	7.3	7.9	5.9	7.3	6.6	7.7
	Remarks:			† May have lost $CaCO_3$			† This sample may be Watson Lake

TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

BRITISH COLUMBIA (Cont'd)

KAMLOOPS			LADNER	NANAIMO		RAYLEIGH							
			Boundary Bay	Camp Nanaimo									
South Thompson River			Delta Municipality Municipal Supply	Nanaimo Municipal-Supply - Nanaimo River		Wells and North Thompson River							
						Artesian Well*			Shallow Well*		North Thompson River		
Raw and Finished Water			Raw & Finished Water	Finished Water		Raw and Finished Water							NO.
At Pumphouse			At Tap	At Camp Tap		At Pump, Bldg. 43			At Pump		At Pump		
Apr.15/56	Aug 25/56	Jan.15/57	Jan.31/57	Nov.29/56	Dec.2/56	Apr.25/56	Aug.30/56	Jan.15/57	Jan.23/56	Jan. 15/57	Aug.30/56	Jan.15/57	1
54:89	61:140	13:140	40:133	39:77	54:171	54:89	37:146	13:134	37:146	13:134	37:146	13:134	2
3.3	15.0	0.6	5.0	3.9	3.3	6.7	10.0	8.9	10.0	9.4	14.4	-0.6	3
23.2	25.2	23.8	25.3	22.4	22.2	23.4	22.4	23.8	22.4	23.9	22.3	23.8	4
8.6	5.8	10	1.2	11	11	8.4	-	-	-	-	10	10	5
1.1	2.4	4.3	1.7	1.5	2.3	3.0	3.2	9.0	3.7	3.8	1.8	2.0	6
7.8	7.4	7.2	4.8	7.2	7.1	8.3	8.3	7.8	8.2	8.2	7.5	7.7	7
0	5	5	5	10	10	0	5	5	5	5	10	5	8
18	0.8	0	-	1	0	0	0	0	0	0	30	0.8	9
43.3	-	-	-	-	-	-	-	-	-	-	25.4	-	10
28.7	-	-	-	-	-	-	-	-	-	-	21.5	-	11
68.4	70.4	66.8	12.4	31.2	79.6	1183	1133	1164	1204	1190	64.4	48.4	12
25.2	16.8	24.8	40.0	8.8	12.0	182	123	188	118	173	14.4	19.2	13
104.8	80.43	85.45	136	35.89	38.73	1532	1476	1496	1546	1536	80.52	129.0	14
12.9	10.8	12.5	14.7	4.5	5.3	103	100	101	117	116	11.7	17.3	15
2.3	1.8	1.7	4.5	0.4	0.0	100	94.3	96.6	89.2	90.3	1.2	3.0	16
-	-	-	-	-	-	-	-	-	-	-	-	-	17
0.03	0.0	0.02	0.02	0.06	0.26	0.01	Trace	0.0	0.0	0.0	0.05	0.05	18
0.0	0.0	0.0	0.0	0.0	0.01	0.0	Trace	0.04	0.0	0.0	0.0	0.0	19
0.03	0.25	0.19	0.19	0.08	0.23	0.39	0.4	0.56	0.58	0.98	0.0	0.18	20
Trace	Slight	0.0	0.0	Slight	Trace	0.0	0.0	0.0	Slight	0.0	0.0	0.0	21
0.0	0.0	0.20	0.0	0.05	1.0	0.0	0.0	0.0	0.5	0.5	0.0	0.0	22
1.9	1.3	1.4	4.9	1.5	1.6	106	105	103	111	110	0.7	2.5	23
0.9	1.0	0.7	1.4	0.2	0.1	7.6	8.0	7.8	10.4	11.2	0.9	1.1	24
0.1	0.0	0.1	0.0	0.1	0.0	-	-	-	-	-	0.05	0.2	25
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26
43.9	36.9	42.8	72.3	14.6	17.7	407	411	410	442	440	36.1	61.2	27
8.9	6.7	6.9	4.9	0.2	1.0	545	523	534	525	533	7.4	10.8	28
0.1	0.3	0.6	2.3	2.7	1.9	4.1	4.7	3.4	8.9	8.5	0.4	0.0	29
0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.5	0.0	0.46	0.0	0.0	0.0	30
1.6	1.6	0.2	0.0	0.8	0.4	1.6	1.2	1.2	12	8.0	0.8	0.8	31
8.6	6.7	6.9	25.1	5.7	5.2	21	21	20	21	18	5.1	11	32
36.0	30.3	35.1	55.2	12.0	13.2	333	337	336	363	360	29.6	50.2	33
5.6	4.0	3.1	0.0	0.9	0.0	337	301	313	297	301	4.5	5.3	34
41.6	34.3	38.2	55.2	12.9	13.2	670	638	649	660	661	34.1	55.5	35
58.9	48.6	52.5	93.7	23.5	25.7	1089	956	978	1114	1114	46.1	76.7	36
8.7	7.1	7.0	15.6	19.4	17.3	25.2	26.0	25.3	26.4	25.9	4.1	8.5	37
-1.0	-1.4	-1.6	-0.7	-2.4	-2.4	+1.2	+1.3	+0.8	+1.2	+1.3	-1.4	-0.8	38
9.8	10.2	10.4	9.2	12.0	11.9	5.9	5.7	6.2	5.8	5.6	10.3	9.3	39
River 5' above low	Summer low	Low-river frozen	*See* also W.S.R. No. 6			*Drinking water supply					4' above low water	Winter low	

TABLE II - (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

	PROVINCE	BRITISH COLUMBIA (Cont'd)		
	Camp or Establishment	VANCOUVER		VERNON
		Jericho Beach		Camp Vernon
	Source (s)	Vancouver Municipal Supply -Rivers and Lakes †		Vernon Municipal Supply -Creek, Treated††
NO.		Raw and Finished Water		Finished
	Sampling Point	At Tap		At Tap in Bldg. K.156
1	Date of sampling	December 10, 1956	March 21, 1958	December 11, 1956
2	Storage period (days)	46:137	13:26	45:167
3	Sampling temperature, °C.	7.8	-	6.7
4	Test temperature, °C.	21.8	24.9	22.0
5	Oxygen consumed by $KMnO_4$	12	-	10
6	Carbon dioxide (CO_2), (calculated)	1.5	1.7	1.7
7	pH	6.6	6.6	8.2
8	Colour	15	15	5
9	Turbidity	2	-	0
10	Suspended matter, dried at 105°C.	-	-	-
11	Suspended matter, ignited at 550°C	-	-	-
12	Residue on evaporation, dried at 105°C.	16.8	-	240
13	Ignition loss at 550°C.	11.2	-	28.0
14	Specific conductance, micromhos at 25°C.	17.26	15.7	385.3
15	Calcium (Ca)	1.8	1.3	39.6
16	Magnesium (Mg)	0.0	0.3	16.3
17	Iron (Fe) Total	-	-	-
18	Dissolved	0.03	-	0.0
19	Manganese (Mn)	0.0	-	0.0
20	Aluminum (Al)	-	-	0.23
21	Copper (Cu)	0.0	-	0.0
22	Zinc (Zn)	0.15	-	0.02
23	Sodium (Na)	0.8	1.4	14.4
24	Potassium (K)	0.2	0.2	4.3
25	Ammonium (NH_4)	0.05	0.1	0.0
26	Carbonate (CO_3)	0.0	0.0	0.0
27	Bicarbonate (HCO_3)	3.8	4.1	181
28	Sulphate (SO_4)	2.5	2.6	53.4
29	Chloride (Cl)	1.1	1.0	1.7
30	Fluoride (F)	0.0	-	0.3
31	Nitrate (NO_3)	0.4	Trace	0.4
32	Silica (SiO_2), colorimetric	3.9	3.0	14
33	Carbonate hardness as $CaCO_3$	3.1	3.4	149
34	Non-carbonate hardness as $CaCO_3$	1.4	1.1	17.1
35	Total hardness as $CaCO_3$	4.5	4.5	166
36	Sum of constituents	10.7	11.9	234
37	Per cent sodium	22.0	37.9	15.0
38	Saturation index at test temperature	-4.0	-4.1	+0.5
39	Stability index at test temperature.	14.6	14.4	7.2
	Remarks:	† *See* also W.S.R. No. 6		†† *See* also W.S.R. No. 4

TABLE II - (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

BRITISH COLUMBIA (Concl'd)

VICTORIA and ENVIRONS					
Albert Head	Gordon Head	Mary Hill	Work Point	Heales Rifle Range	
Greater Victoria Water Board Municipal Supply - Sooke and Goldstream Lakes - *see* also W.S.R.No.5				Well	
Raw and Finished Water				Raw and Finished Water	NO
At Tap	At Tap	At Tap	At Tap	At Pump	
January 15, 1957	January 15, 1957	January 15, 1957	January 15, 1957	January 15, 1957	1
42:140	13:140	42:140	42:140	42:140	2
3.9	0.6	1.1	5.0	3.9	3
24.4	23.6	23.6	24.5	24.5	4
9.6	11	9.1	10	9.9	5
1.6	1.8	1.2	2.2	6.8	6
7.2	7.1	7.4	7.0	7.2	7
15	10	15 *	10	10	8
0	0	15 *	0	0	9
-	-	6.7	-	-	10
-	-	4.3	-	-	11
60.4	93.2	49.2	122	206	12
43.2	56.0	18.4	102	128	13
49.57	43.25	44.54	41.68	151.5	14
5.3	4.5	4.7	4.3	22.4	15
0.4	0.5	0.7	0.4	2.2	16
-	-	High	-	-	17
0.12	0.09	0.52	0.07	0.01	18
0.0	0.0	0.0	0.0	0.0	19
0.22	0.05	0.06	-	0.0	20
0.0	0.0	0.0	0.2	High	21
0.07	1.5	0.6	0.2	0.6	22
2.1	2.3	2.2	2.1	3.3	23
0.2	0.2	0.2	0.2	0.3	24
0.0	0.1	0.0	0.0	0.0	25
0.0	0.0	0.0	0.0	0.0	26
16.3	15.5	18.7	13.8	68.9	27
2.9	3.4	1.8	2.5	9.3	28
3.2	3.5	3.2	3.5	4.1	29
0.0	0.0	0.0	0.0	0.0	30
0.0	0.4	0.0	0.2	2.4	31
5.3	4.8	4.1	4.9	9.1	32
13.4	12.7	14.6	11.3	56.5	33
1.5	0.6	0.0	1.1	8.4	34
14.9	13.3	14.6	12.4	64.9	35
27.9	29.0	27.3	25.4	87.7	36
21.4	23.2	21.9	23.5	9.8	37
-2.3	-2.5	-2.1	-2.6	-1.1	38
11.8	12.1	11.6	12.2	9.4	39
		* Iron oxides probably from corrosion in pipes			

TABLE II - (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

	PROVINCE OR TERRITORY	YUKON TERRITORY					
	Camp or Establishment	MAYO					
	Sources (s)	Wells					
		Well No. 1			Well No. 2		
NO.		Raw Water		Finished Water	Finished Water		
	Sampling Point	At Tap in P.M.Q.s No. 1			At Tap in P.M.Q.s No. 2		
1	Date of sampling	May 16/56	Mar. 14/57	Nov. 6/56 *	May 16/56	Nov. 6/56	Mar. 14/57
2	Storage period (days)	42:83	29:55	23:52	42:83	23:52	29:55
3	Sampling temperature, °C.	4.4	4.4	4.4	4.4	4.4	-
4	Test temperature, °C.	24.4	22.0	23.5	24.6	23.5	22.6
5	Oxygen consumed by $KMnO_4$	7.8	-	-	7.7	-	-
6	Carbon dioxide (CO_2), (calculated)	3.1	6.0	3.3	2.0	5.5	7.0
7	pH	7.8	7.5	7.8	8.0	7.6	7.5
8	Colour	5	10	30	20	20	10
9	Turbidity	25	-	4	5	0	-
10	Suspended matter, dried at 105°C.	2.8	-	-	2.2	-	-
11	Suspended matter, ignited at 550°C.	0.9	-	-	1.2	-	-
12	Residue on evaporation, dried at 105° C	149	-	-	172	-	-
13	Ignition loss at 550°C.	36.8	-	-	20.8	-	-
14	Specific conductance, micromhos at 25°C.	254.6	234.1	255.3	242.9	294.1	256.0
15	Calcium (Ca)	6.4	14.9	0.0	0.0	0.2	0.0
16	Magnesium (Mg)	17.5	14.9	0.1	0.2	0.0	0.2
17	Iron (Fe) Total	1.8	-	-	-	-	-
18	Dissolved	0.31	0.06	-	0.31	-	0.07
19	Manganese (Mn)	3.47	1.2	-	0.02	-	-
20	Aluminum (Al)	0.0	0.51	-	0.0	-	0.42
21	Copper (Cu)	0.0	-	-	0.0	-	-
22	Zinc (Zn)	0.6	-	-	0.2	-	-
23	Sodium (Na)	10.0	7.6	62.0	55.0	69.8	62.2
24	Potassium (K)	5.0	2.0	0.2	0.3	0.2	0.1
25	Ammonium (NH_4)	-	0.05	0.05	0.1	0.1	0.0
26	Carbonate CO_3)	0.0	0.0	0.0	0.0	0.0	0.0
27	Bicarbonate(HCO_3)	120	125	139	123	152	137
28	Sulphate (SO_4)	20.2	21.5	18.0	20.2	17.9	19.0
29	Chloride (Cl)	5.2	0.7	1.4	0.9	6.9	3.2
30	Fluoride (F)	0.0	-	-	0.0	-	-
31	Nitrate (NO_3)	2.4	0.2	0.4	1.2	0.2	0.2
32	Silica (SiO_2), colorimetric	7.4	6.2	8.4	6.6	8.0	6.5
33	Carbonate hardness as $CaCO_3$	94.3	98.4	0.4	0.8	0.5	0.8
34	Non-carbonate hardness as $CaCO_3$	0.0	0.0	0.0	0.0	0.0	0.0
35	Total hardness as $CaCO_3$	94.3	98.4	0.4	0.8	0.5	0.8
36	Sum of constituents	137	131	159	146	178	159
37	Per cent sodium	17.6	13.5	99.5	98.1	99.5	97.5
38	Saturation index at test temperature	+0.8	-0.8	-1.6	-1.4	+1.7	-1.9
39	Stability index at test temperature	9.4	9.1	11.0	10.8	11.0	11.3
	Remarks:		* After softener				

TABLE II --(Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

YUKON TERRITORY (Cont'd)

MAYO (Concl'd)						ALASKA HIGHWAY		NO.
						Maintenance Camp - Mile 733		
Wells (Concl'd)								
Well No. 3A			Well No. 3B			Swift River		
Finished Water						Raw and Finished Water		
At Tap in P.M.Q.s No. 3A			At Tap in P.M.Q.s No. 3B			At Pump		
May 16/56	Nov. 6/56	Mar.14/57	May 16/56	Nov.6/56	Mar.14/57	Aug.30/56	Feb.15/57	1
44:83	23:52	29:64	44:83	23:52	29:64	47:163	52:124	2
4.4	4.4	-	4.4	4.4	4.4	1.7	6.7	3
22.4	23.6	23.3	22.3	23.6	22.8	22.2	25.7	4
5.5	-	-	5.7	-	-	10	2.3	5
18	18	11	6.6	4.5	5.8	1.4	1.1	6
7.3	7.4	7.6	7.7	7.9	7.8	7.7	7.7	7
10	300	180	10	20	55	10	0	8
5	8 *	-	4	2	-	0	-	9
2.5	-	-	1.5	-	-	-	-	10
0.9	-	-	0.6	-	-	-	-	11
408	-	-	304	-	-	-	-	12
20.4	-	-	26.0	-	-	-	-	13
671.8	747.8	647.3	458.7	529.3	441.4	81.75	68.65	14
0.0	4.9	0.9	0.0	0.3	0.0	11.7	9.3	15
0.2	10.9	7.4	0.2	0.0	0.2	1.6	1.6	16
-	11.8 *	-	-	-	-	-	-	17
0.10	4.9	3.1	0.08	-	1.3	0.0	0.05	18
0.01	-	-	Trace	-	-	0.0	0.0	19
0.0	-	0.0	0.0	-	0.02	0.10	0.04	20
0.0	-	-	0.0	-	-	0.0	0.0	21
0.1	-	-	0.1	-	-	0.05	0.0	22
145	132	110	106	126	103	1.5	2.9	23
1.0	13.4	12.2	0.3	0.2	0.2	0.4	0.6	24
3.0	8.0	-	0.2	0.1	0.0	0.1	0.0	25
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26
235	293	258	211	234	233	43.3	36.4	27
23.5	27.9	12.0	23.5	44.9	18.0	2.5	2.5	28
81.5	73.4	65.3	23.4	24.5	16.8	0.2	0.0	29
0.0	-	-	0.0	-	-	0.6	-	30
Trace	0.8	0.4	1.6	0.2	0.4	0.0	0.8	31
9.4	12	10	9.1	11	8.8	15.7	-	32
0.8	57.0	32.6	0.8	0.8	0.8	35.5	29.8	33
0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	34
0.8	57.0	32.6	0.8	0.8	0.8	35.8	29.8	35
377	428	349	268	323	267	56.5	35.8	36
96.7	77.6	81.6	99.1	99.6	98.5	8.1	17.0	37
-1.9	-1.0	-1.6	-1.6	-1.3	-1.4	-1.1	-1.2	38
11.1	9.4	10.8	10.9	10.5	10.6	9.9	10.1	39

* Iron oxides mostly

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TABLE II - (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

TERRITORY — YUKON TERRITORY (Cont'd)

NO.	Camp or Establishment	ALASKA HIGHWAY (Cont'd)						
		Maintenance Camp-Mile 830		Maintenance Camp-Mile 1016		Maintenance Camp-Mile 1083		
	Source (s)	Brook's Creek		Shallow Well		Well		
		Raw and Finished Water		Raw and Finished Water		Raw and Finished Water		
	Sampling Point	At Pump		At Pump		At Pump		
1	Date of sampling	Aug.20/56	Feb.15/57	Aug.21/56	Feb.1/57	May 30/56	Aug.21/56	Feb.1/57
2	Storage period (days)	47:163	52:124	70:92	11:96	36:69	49:63	11:96
3	Sampling temperature, °C.	1.7	7.8	11.1	4.4	8.9	4.4	3.3
4	Test temperature, °C.	25.2	25.6	25.7	22.8	23.5	20.8	22.4
5	Oxygen consumed by $KMnO_4$	-	2.9	8.4	-	4.0	-	-
6	Carbon dioxide (CO_2), (calculated)	1.6	1.3	0.8	1.3	1.9	1.6	3.3
7	pH	8.0	8.2	8.4	8.2	8.2	8.3	8.0
8	Colour	20	10	5	5	5	10	5
9	Turbidity	3	-	0	-	0	3	-
10	Suspended matter, dried at 105°C.	-	-	-	-	-	-	-
11	Suspended matter, ignited at 550°C.	-	-	-	-	-	-	-
12	Residue on evaporation, dried at 105°C.	115	-	144	-	404	-	-
13	Ignition loss at 550°C.	31.6	-	20.4	-	50.8	-	-
14	Specific conductance, micromhos at 25°C.	167.4	231.2	219.4	229.9	590.1	589.7	612.4
15	Calcium (Ca)	22.7	29.5	35.7	36.4	32.4	32.2	30.3
16	Magnesium (Mg)	6.1	9.4	4.7	5.8	41.8	42.1	44.2
17	Iron (Fe) Total	-	-	0.02	-	-	0.32	-
18	Dissolved	Trace	0.08	-	-	0.06	-	-
19	Manganese (Mn)	0.0	0.0	0.01	-	0.0	-	-
20	Aluminum (Al)	0.1	0.12	0.24	-	0.21	-	-
21	Copper (Cu)	-	0.0	Trace	-	0.0	-	-
22	Zinc (Zn)	-	0.0	0.05	-	0.2	-	-
23	Sodium (Na)	2.7	5.5	2.8	3.0	27.0	30.2	33.5
24	Potassium (K)	0.9	0.9	1.4	1.2	4.4	4.7	5.1
25	Ammonium (NH_4)	0.05	0.0	0.0	0.0	0.0	0.1	0.05
26	Carbonate (CO_3)	0.0	0.0	1.0	0.0	0.0	0.0	0.0
27	Bicarbonate (HCO_3)	99.0	141	127	134	199	207	211
28	Sulphate (SO_4)	6.2	9.6	11.0	14.0	144	145	159
29	Chloride (Cl)	0.4	1.1	0.4	0.4	0.8	1.0	0.7
30	Fluoride (F)	0.0	-	0.15	-	0.15	-	-
31	Nitrate (NO_3)	0.8	2.0	1.2	0.2	4.0	1.6	0.8
32	Silica (SiO_2) colorimetric	13.4	15.8	9.9	8.1	20	19	22
33	Carbonate hardness as $CaCO_3$	81.2	112	105	110	164	170	173
34	Non-carbonate hardness as $CaCO_3$	0.5	0.0	2.8	4.9	89.1	83.5	84.4
35	Total hardness as $CaCO_3$	81.7	112	108	115	253	254	257
36	Sum of constituents	102	144	131	135	373	378	399
37	Per cent sodium	6.6	9.5	5.2	5.3	18.4	30.2	22.8
38	Saturation index at test temperature	-0.1	+0.3	+0.6	+0.3	+0.4	+0.5	+0.2
39	Stability index at test temperature	8.1	7.6	7.2	7.6	7.4	7.3	7.6
	Remarks:							

TABLE II - (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

YUKON TERRITORY (Cont'd)

Maintenance Camp - Mile 1202			WHITEHORSE and ENVIRONS									
			Camp Takhini									
Well			McIntyre Creek									
Raw and Finished Water			Raw and Finished Water									NO.
At Pump			At Tap in Central Heating Plant								At Barracks Tap	
May 29/56	Aug.21/56	Jan.31/57	Jan.13/55	Mar.9/55	Jan.3/56	Feb.7/56	Aug.26/56	Nov.26/56	Feb.4/57	May 27/57	May 10/57	1
35:60	49:63	12:97	15:42	13:47	20:28	20:27	65:87	18:43	8:93	21:56	11:17	2
3.9	7.8	5.6	1.7	1.1	-	-	10.0	4.5	1.1	4.4	-	3
23.5	20.8	22.4	17.3	20.6	24.6	22.0	25.8	23.2	22.6	23.4	19.8	4
4.4	-	-	1.2	2.2	-	-	11	-	-	11	-	5
2.3	2.5	1.3	1.8	3.5	0.5	1.2	1.4	1.4	0.9	5.1	1.6	6
8.1	8.1	8.4	8.3	8.0	8.7	8.3	8.3	8.2	8.4	7.8	8.2	7
5	5	5	10	0	5	5	20	10	5	45	30	8
0.8	0	-	0	0	-	-	3	0	0	30	-	9
-	-	-	-	-	-	-	-	-	-	35.8	-	10
-	-	-	-	-	-	-	-	-	-	22.0	-	11
207	-	-	209	198	-	-	179	243	-	179	-	12
17.2	-	-	22.4	15.6	-	-	32.4	44.8	-	24.8	-	13
326.7	325.5	319.7	327.6	352.6	274.2	263.7	272.2	370.8	250.7	300.2	265.3	14
55.2	55.4	54.0	49.3	50.1	38.8	37.8	41.0	33.1	36.2	48.0	38.6	15
7.0	6.8	8.3	12.5	12.9	11.5	9.6	9.3	20.4	9.0	10.3	9.7	16
-	Trace	-	-	-	-	-	-	-	-	-	-	17
0.12	0.0	-	0.0	0.05	-	-	0.0	0.0	-	0.03	0.05	18
0.0	-	-	0.0	Trace	-	-	0.0	0.0	-	0.0	0.0	19
0.55	-	-	0.0	0.03	-	-	0.1	0.11	-	0.0	-	20
Trace	-	-	Trace	0.0	-	-	Trace	0.0	-	0.0	-	21
0.4	-	-	-	-	-	-	0.0	0.0	-	0.0	-	22
2.5	2.7	3.2	4.7	3.9	4.5	3.5	3.7	11.4	4.2	2.1	2.8	23
1.2	1.1	1.3	1.2	1.1	1.1	1.1	1.0	2.0	1.0	1.8	1.5	24
0.0	0.1	0.0	-	-	0.0	0.1	0.0	0.0	0.0	0.05	0.0	25
0.0	0.0	1.9	0.0	0.0	12.0	0.0	0.0	0.0	0.0	0.0	0.0	26
181	185	184	215	222	151	156	175	154	158	194	169	27
20.2	21.4	23.3	8.3	8.0	6.5	8.0	7.4	65.7	9.1	7.8	7.6	28
0.8	1.3	0.6	0.2	0.1	0.5	0.3	0.4	1.6	0.2	2.3	0.9	29
0.0	-	-	-	0.1	-	-	0.0	0.05	-	0.0	-	30
3.2	1.6	0.8	1.0	0.8	0.8	15	1.2	1.2	0.6	0.4	0.0	31
14	13	15	15	17	-	23	13	13	15	10	12	32
149	152	154	174	178	143	128	141	127	127	159	136	33
18.3	14.2	15.1	0.0	0.0	0.6	5.8	0.0	40.0	0.0	2.7	0.0	34
167	166	169	174	178	144	134	141	167	127	162	136	35
194	195	199	198	203	-	175	163	224	154	179	156	36
3.1	3.4	3.9	5.5	4.5	6.3	5.3	5.3	12.7	6.6	2.7	4.2	37
+0.6	+0.5	+0.8	+0.7	+0.4	+1.0	+0.5	+0.7	+0.3	+0.6	+0.2	+0.4	38
6.9	7.1	6.8	6.9	7.2	6.7	7.3	6.9	7.6	7.2	7.4	7.4	39

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TABLE II - (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

NO.	TERRITORY	YUKON TERRITORY (Concl'd)	NORTHWEST TERRITORIES			
		WHITEHORSE & ENVIRONS (Concl'd)	AKLAVIK			
	Camp or Establishment	Haines Road - Mile 75				
	Source (s)	Mule Creek	Aklavik or New Aklavik Municipal Supply*			
			Small Lake	Peel Channel (Mackenzie River) *		
		Raw & Finished Water	Raw and Finished Water			
	Sampling Point	At Pump	At Tap	From River		From Cistern Tap
1	Date of sampling	Aug.22/56	June 13/56	Sept.1956	Mar.13/57	June 24/57
2	Storage period (days)	69:148	26:57	-	27:56	14:28
3	Sampling temperature, °C.	10.6	-	10.0	0.6	-
4	Test temperature, °C.	25.8	23.5	24.8	23.9	26.0
5	Oxygen consumed by $KMnO_4$	-	9.9	-	3.4	6.6
6	Carbon dioxide (CO_2), (calculated)	1.7	3.7	0.9	6.0	4.3
7	pH	8.0	7.5	8.3	7.7	7.6
8	Colour	5	50	10	5	50
9	Turbidity	0.8	20	50	3	50
10	Suspended matter dried at 105°C.	-	9.8	-	-	20.6
11	Suspended matter ignited at 550°C.	-	4.9	-	-	16.8
12	Residue on evaporation, dried at 105°C	131	107	-	-	171
13	Ignition loss at 550°C.	20.8	24.0	-	-	44.0
14	Specific conductance, micromhos at 25°C.	174.3	166.9	267.0	407.5	234.1
15	Calcium (Ca)	30.6	20.9	33.5	53.0	30.2
16	Magnesium (Mg)	1.9	5.8	7.8	17.8	9.0
17	Iron (Fe) Total	-	-	-	-	-
18	Dissolved	0.03	0.4	0.02	-	0.28
19	Manganese (Mn)	0.01	0.04	0.0	-	0.0
20	Aluminum (Al)	0.33	0.0	0.07	-	0.03
21	Copper (Cu)	Trace	0.0	0.0	Trace	0.0
22	Zinc (Zn)	0.3	1.0	0.05	0.05	0.5
23	Sodium (Na)	1.2	2.3	7.7	5.8	3.2
24	Potassium (K)	1.8	2.0	0.9	0.7	1.7
25	Ammonium (NH_4)	0.0	0.3	0.2	0.05	0.0
26	Carbonate (CO_3)	0.0	0.0	0.0	0.0	0.0
27	Bicarbonate (HCO_3)	102	73.0	111	199	112
28	Sulphate (SO_4)	8.6	13.2	30.7	50.1	25.1
29	Chloride (Cl)	0.2	3.7	9.5	3.9	3.8
30	Fluoride (F)	0.0	0.0	0.0	-	0.0
31	Nitrate (NO_3)	0.8	4.8	0.0	0.8	0.6
32	Silica (SiO_2), colorimetric	7.2	2.2	3.6	14	2.9
33	Carbonate hardness as $CaCO_3$	83.8	59.9	90.9	163	91.8
34	Non-carbonate hardness as $CaCO_3$	0.4	16.1	24.8	41.8	20.6
35	Total hardness as $CaCO_3$	84.2	76.0	116	205	112
36	Sum of constituents	103	92.3	148	245	135
37	Per cent sodium	2.9	6.1	12.6	5.8	5.7
38	Saturation index at test temperature	0.0	+0.8	+0.4	+0.2	-0.3
39	Stability index at test temperature	8.0	9.1	7.5	7.3	8.2
	Remarks:		* *See* also W.S.R. No. 8			

(TABLE II - (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

NORTHWEST TERRITORIES (Cont'd)

FORT GOOD HOPE			FORT NORMAN			FORT PROVIDENCE		NO.
Mackenzie River *			Mackenzie River *			Mackenzie River *		
Raw and Finished Water			Raw and Finished Water			Raw and Finished Water		
At Tap			At Tap			At Tap		
June 16/56	Nov. 9/56	June 6/57	June 11/56	Aug.5/57	Apr.2/58	Aug.21/56	Aug.6/57	1
26:57	20:49	26:46	22:57	9:22	12:20	66:92	8:21	2
-	1.1	1.1	15.6	2.2	13.3	7.8	2.2	3
23.5	23.8	22.4	23.3	24.0	26.5	23.6	23.9	4
9.7	-	9.0	7.9	16	5.4	12	3.6	5
2.3	1.3	1.9	1.6	1.8	1.3	1.3	1.2	6
7.8	8.2	7.9	8.0	7.9	8.2	8.1	8.1	7
40	20	40	30	100	-	10	10	8
10	-	250	18	9	60	6	5	9
8.8	-	226	9.1	7.6	98	10.2	7.0	10
3.9	-	213	2.3	-	86	5.8	0	11
134	-	144	180	152	200	151	140	12
39.2	-	29.2	43.2	55.2	34.8	23.2	31.6	13
219.2	289.8	202.1	233.0	191.0	308.2	230.2	222.1	14
27.6	30.7	27.6	29.2	26.9	36.9	28.8	27.5	15
6.8	12.6	5.9	7.6	6.0	8.8	5.7	5.4	16
-	-	-	-	-	0.29	-	-	17
0.09	-	0.15	0.11	0.33	0.09	0.0	0.02	18
0.0	-	0.0	0.0	Trace	0.0	0.0	0.0	19
0.34	-	0.0	0.14	0.0	0.03	0.10	0.0	20
0.0	-	0.0	0.0	Trace	0.0	0.0	0.0	21
1.0	-	0.0	0.2	0.6	0.5	0.0	0.0	22
6.1	8.8	4.7	6.6	3.4	12.5	8.5	8.0	23
1.0	1.3	1.2	1.1	0.8	1.2	1.1	1.0	24
0.2	0.05	0.0	0.1	-	0.0	0.1	0.0	25
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26
91.8	126	91.4	97.3	92.3	124	100	91.4	27
21.9	31.7	20.8	23.3	19.2	30.6	20.8	21.3	28
7.5	10.2	5.1	8.4	3.9	16.2	9.3	9.2	29
0.0	-	0.0	0.0	0.0	0.0	0.0	0.0	30
4.0	0.8	0.0	4.0	0.3	0.3	1.2	0.25	31
4.0	5.3	4.3	3.7	3.0	4.7	4.5	4.6	32
75.3	103	75.0	79.8	75.7	102	82.0	75.0	33
21.5	24.5	18.1	24.3	16.1	26.3	13.3	15.8	34
96.8	128	93.1	104	91.8	128	95.3	90.8	35
125	163	115	132	110	173	129	122	36
11.7	12.9	9.7	11.8	7.3	17.2	16.0	15.9	37
+0.3	0.2	-0.3	-0.1	+0.2	+0.4	0.0	0.0	38
8.4	7.8	8.5	8.2	8.3	7.4	8.1	8.1	39
River high	River low	River above normal		River high	River low	River low	River high	

TABLE II - (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

	TERRITORY	NORTHWEST TERRITORIES (Cont'd)			
	Camp or Establishment	FORT RELIANCE			FORT RESOLUTION
NO	Source (s)	Great Slave Lake (McLeod Bay) Raw and Finished Water			Great Slave Lake Raw & Finished Water
	Sampling Point	At Tap			At Tap
1	Date of sampling	Aug.23/56	May 8/57	Mar.21/58	June 14/56
2	Storage period (days)	47:90	13:75	32:41	18:56
3	Sampling temperature, °C.	12.2	1.1	-	8.3
4	Test temperature, °C.	23.5	19.9	23.3	23.6
5	Oxygen consumed by $KMnO_4$	11	4.0	2.9	5.5
6	Carbon dioxide (CO_2),(calculated)	2.2	2.7	1.9	1.3
7	pH	6.9	7.0	6.8	7.9
8	Colour	20	10	0	10
9	Turbidity	0.8	4	0.4	0.9
10	Suspended matter, dried at 105°C.	-	-	-	-
11	Suspended matter, ignited at 550°C.	-	-	-	-
12	Residue on evaporation, dried at 105°C.	24.4	33.2	46.4	103
13	Ignition loss at 550°C.	9.2	16.0	28.0	23.6
14	Specific conductance, micromhos at 25°C.	26.48	34.09	20.2	174.3
15	Calcium (Ca)	2.2	3.3	1.3	21.6
16	Magnesium (Mg)	0.9	1.4	0.7	3.9
17	Iron (Fe) Total	-	-	-	-
18	Dissolved	0.0	0.01	0.0	Trace
19	Manganese (Mn)	0.0	0.0	0.01	0.0
20	Aluminum (Al)	0.09	0.02	0.01	0.35
21	Copper (Cu)	0.01	0.0	0.0	0.0
22	Zinc (Zn)	0.07	0.0	0.25	0.0
23	Sodium (Na)	0.5	0.7	0.6	6.3
24	Potassium (K)	0.4	0.6	0.6	0.8
25	Ammonium (NH_4)	0.1	0.0	0.3	0.0
26	Carbonate (CO_3)	0.0	0.0	0.0	0.0
27	Bicarbonate (HCO_3)	11.0	16.5	7.7	65.9
28	Sulphate (SO_4)	0.8	3.0	1.4	17.4
29	Chloride (Cl)	0.6	0.3	0.6	7.7
30	Fluoride (F)	0.0	0.0	0.0	0.0
31	Nitrate (NO_3)	0.8	0.4	0.1	2.0
32	Silica (SiO_2),colorimetric	0.5	1.1	0.6	2.7
33	Carbonate hardness as $CaCO_3$	9.0	13.5	6.1	54.1
34	Non-carbonate hardness as $CaCO_3$	0.2	0.5	0.0	15.8
35	Total hardness as $CaCO_3$	9.2	14.0	6.1	69.9
36	Sum of constituents	12.2	18.9	10.3	95.3
37	Per cent sodium	9.6	9.3	13.8	15.8
38	Saturation index at test temperature.	-3.1	-2.8	-3.6	+0.4
39	Stability index at test temperature.	13.1	12.6	14.0	8.7
	Remarks:	Very low	Low	Normal	Low

TABLE II - (Concl'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

NORTHWEST TERRITORIES (Concl'd)

FORT RESOLUTION (Concl'd)		FORT SIMPSON			HAY RIVER SETTLEMENT			NO
					Hay River Station			
Great Slave Lake (Concl'd)		Mackenzie (Snye) River			Great Slave Lake			
Raw and Finished Water		Raw and Finished Water			Raw and Finished Water			
At Tap or as Ice		From River *	Ice †	At Tap	At Storage Tank	From Lake		
Nov.22/56 *	May 29/57	May 28/56	Jan.14/57	May 24/57	June 15/56	Oct.23/56	June 25/57	1
7:47	13:54	30:72	14:141	14:59	18:53	10:19	13:27	2
1.1	1.1	14.8	0.0	1.7	20.0	0.0	7.2	3
23.3	23.3	22.2	23.7	21.5	23.4	21.8	25.8	4
-	3.6	11	11	15	18	-	13	5
1.4	1.3	3.8	Trace	2.4	2.1	3.8	3.8	6
8.1	7.9	7.6	8.1	7.8	7.8	7.8	7.9	7
40	10	60	10	High	120	160	Very High	8
-	9	75	0	575	0	20	15	9
-	1.7	74.4	-	895	-	-	10.4	10
-	0.0	45.9	-	822	-	-	8.0	11
-	108	145	52.4	154	201	-	263	12
-	33.6	33.2	36.8	67.6	48.0	-	58.8	13
272.4	161.2	178.8	49.22	176.5	264.1	391.1	363.1	14
35.1	18.3	28.0	8.2	27.4	33.3	51.1	55.8	15
6.7	4.4	5.6	0.3	6.1	7.5	12.0	9.6	16
-	-	0.70	-	-	-	-	-	17
-	0.01	0.06	0.01	0.15	0.43	-	3.3	18
-	0.0	0.0	0.01	0.0	0.0	-	0.01	19
-	0.02	0.03	0.24	0.0	0.0	-	0.0	20
-	0.0	0.0	0.0	0.0	0.0	-	0.0	21
-	0.0	0.0	0.05	0.0	0.5	-	0.8	22
11.7	6.2	1.8	0.9	2.3	7.9	14.4	6.5	23
1.2	0.7	1.1	0.2	1.6	2.6	1.5	2.1	24
-	0.0	0.0	0.1	-	0.0	-	0.0	25
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26
116	61.1	92.0	26.7	91.5	79.2	124	193	27
28.7	18.0	16.2	1.0	19.2	54.8	94.4	33.0	28
11.7	7.2	1.8	1.7	2.9	4.1	4.7	5.3	29
-	0.0	0.0	0.0	0.0	0.0	-	0.0	30
0.8	0.3	4.0	0.6	0.7	4.8	0.8	1.0	31
5.2	5.0	4.6	1.6	7.1	3.5	6.1	4.9	32
91.5	50.1	75.5	21.7	75.1	65.1	102	158	33
23.6	13.7	17.4	0.0	18.4	48.9	75.2	20.5	34
115	63.8	92.9	21.7	93.5	114	177	179	35
15.6	90.2	109	28.1	113	158	246	217	36
17.9	17.2	4.0	7.6	5.0	12.6	14.7	7.0	37
+0.2	-0.6	-0.5	-1.0	-0.4	-0.3	0.0	+0.4	38
7.7	9.1	8.6	10.1	8.6	8.4	7.8	8.3	39
*Ice	High	River very low * At junction of Liard and Mackenzie Rivers †Winter drinking water						

ADDENDUM TO TABLE II:

Additional Water Quality Data, – 1958

Prior to final printing of Water Survey Report #12 the analytical data from the 1958 annual survey of water quality at fifteen of the Army Establishments were available and are included herewith as an addendum to Table II of the main report. More recent data on chemical quality of waters from several other Camps were also obtained from studies carried out in connection with boiler water treatment control and water treatment studies and this information is also included in this addendum to Table II.

It will be noted that at several locations notably Valcartier, Camp Borden and the V.E. Proving Establishment near Orleans, new well supplies were in use or were being developed in 1958.

ADDENDUM TO TABLE II

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

PROVINCE NEW BRUNSWICK

NO	Camp or Establishment	Camp Gagetown †				McGIVNEY	
	Source(s)	Deep Wells				Deep Wells	
		Well No. 1		Well No. 2		PMQ Area Well	Administration Area Well
		Raw and Finished Water				Raw and Finished Water	
	Sampling Point	At Pump		At Pump		At Pump	At Pump
1	Date of sampling	June 23/58	Oct.1/58	June 24/58	Oct.1/58	July 3/58	July 3/58
2	Storage period (days)	28:43	14:21	27:42	14:21	20:21	20:21
3	Sampling temperature, °C.	9.4	15.0	9.4	15.0	4.4	5.0
4	Test temperature, °C.	23.2	26.6	23.0	26.5	25.0	25.0
5	Oxygen consumed by $KMnO_4$	-	-	-	-	-	-
6	Carbon dioxide (CO_2),(calculated)	3.2	3.3	1.5	1.7	3.3	3.5
7	pH	7.9	7.9	8.3	8.2	7.4	7.2
8	Colour	0	0	3	0	5	0
9	Turbidity	2	0	0	0	0	0
10	Suspended matter, dried at 105°C.			—			
11	Suspended matter, dried at 550°C.			—			
12	Residue on evaporation, dried at 105°C.	986	1011	554	748	80.8	61.0
13	Ignition loss at 550°C.	39.6	120	12.8	82.7	18.0	13.0
14	Specific conductance, micromhos at 25°C.	1674	1770	1016	1324	118.4	90.0
15	Calcium (Ca)	87.1	93.3	56.9	72.8	18.0	12.1
16	Magnesium (Mg)	6.8	8.7	4.7	7.1	1.3	1.1
17	Iron (Fe) Total		0.01	-	0.01	-	-
18	Dissolved	0.01	0.01	Trace	0.01	0.0	0.0
19	Manganese (Mn)	0.0	-	0.0	-	0.02	0.0
20	Aluminum (Al)	0.04	0.07	0.01	0.05	0.07	0.07
21	Copper (Cu)	0.0	0.0	0.0	0.0	0.0	0.0
22	Zinc (Zn)	0.0	0.05	0.0	0.05	0.0	0.60
23	Sodium (Na)	240	250	144	190	2.7	2.5
24	Potassium (K)	1.2	1.3	1.1	1.1	0.5	0.5
25	Ammonium (NH_4)	0.05	0.05	0.05	0.05	0.10	0.05
26	Carbonate (CO_3)	0.0	0.0	0.0	0.0	0.0	0.0
27	Bicarbonate (HCO_3)	178	176	192	184	55.2	35.6
28	Sulphate (SO_4)	33.7	31.0	30.0	27.3	9.5	8.5
29	Chloride (Cl)	424	448	205	307	1.7	3.6
30	Fluoride (F)	0.4	0.7	0.5	0.6	0.0	0.0
31	Nitrate (NO_3)	0.4	0.3	0.5	0.2	0.2	0.4
32	Silica (SiO_2), colorimetric	9.2	7.4	12	8.8	10	10
33	Carbonate hardness as $CaCO_3$	146	145	158	151	45.3	29.2
34	Non-carbonate hardness as $CaCO_3$	99	124	3	60	4.9	5.5
35	Total hardness as $CaCO_3$	245	269	161	211	50.2	34.7
36	Sum of constituents	890	928	550	705	71.5	56.7
37	Per cent sodium	67.9	66.8	65.8	66.1	10.3	12.9
38	Saturation index at test temperature	+0.5	+0.5	+0.7	+0.8	-1.1	-1.6
39	Stability index at test temperature	6.9	6.9	6.9	6.6	9.6	10.4
	Remarks:	At start of pump		At start of pump			

† *See* Also Separate Investigation Report Covering Water Quality at This Camp.

ADDENDUM TO TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

QUEBEC

Near STE. THERÈSE				VALCARTIER						
Camp Bouchard				Camp Valcartier						
Deep Wells				Deep Wells						
Well No. 1	Well No. 2	Well No. 4	Mixed Wells	Well No. 1	Well No. 3	Well No. 5	Well No. 27	Well No. 28	Mixed Wells	
Raw Water			Finished Water	Raw Water					Finished Water	NO.
	At Pumps		At Tap Bldg. No. 42	At Pumps					At Tap Bldg. No. 459	
July 3/58	July 3/58	July 3/58	July 3/58	June 30/58	June 30/58	June 30/58	June 30/58	June 30/58	June 30/58	1
21:33	21:33	21:33	21:33	8:14	8:14	8:14	8:14	8:14	8:14	2
7.8	7.8	7.8	7.8	7.8	7.2	7.2	7.8	7.2	7.8	3
26.2	26.4	26.2	26.2	24.6	24.5	24.6	24.7	24.6	24.6	4
-	-			1.2	1.2	1.6	1.6	1.6	1.6	5
1.6	4.5	2.4	3.4	3.3	3.5	4.0	4.1	8.0	3.0	6
8.5	8.1	8.2	8.2	6.8	6.7	6.7	6.6	6.5	6.9	7
40	45	0	45	5	5	5	5	5	5	8
0	0.7	0	0.8	0.8	0	2	0.8	0.8	1	9
										10
										11
371	475	253	436	37.6	35.2	40.4	43.6	65.2	58.8	12
46.0	54.8	24.4	46.0	9.2	11.6	11.6	17.6	13.6	8.0	13
628.0	789.0	399.8	717.5	34.9	34.2	39.0	44.6	66.5	43.1	14
6.2	7.8	62.0	7.3	3.3	2.8	3.5	4.2	5.8	3.1	15
8.1	10.1	9.5	9.0	0.9	0.8	0.9	1.1	1.4	1.5	16
										17
0.02	0.02	0.03	0.04	0.0	Trace	0.02	0.0	0.02	Trace	18
0.0	0.0	0.01	0.0	0.0	0.01	0.01	Trace	0.01	Trace	19
0.0	0.0	0.04	0.0	0.01	0.01	0.02	Trace	0.04	0.01	20
Trace	0.0	0.0	Trace	Trace	Trace	0.19	0.03	0.12	Trace	21
0.10	0.0	0.0	0.10	0.0	0.0	0.10	0.02	0.05	0.50	22
125	158	12.8	144	1.4	1.6	1.6	1.5	3.0	1.6	23
9.0	10.5	3.0	9.6	0.4	0.7	0.5	0.5	1.2	0.5	24
0.05	0.10	0.0	0.0	0.05	0.05	0.05	0.05	0.05	0.05	25
5.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26
330	385	244	360	13.0	11.6	13.0	11.0	16.1	16.2	27
8.2	15.2	21.5	10.9	4.0	3.6	3.0	3.4	5.8	4.0	28
30.7	57.7	2.0	50.7	0.5	0.7	1.4	3.4	2.7	1.0	29
1.1	1.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	30
1.0	1.0	0.4	1.0	0.6	1.5	1.5	3.0	6.0	1.0	31
12	12	16	10	16	12	13	12	14	14	32
48.8	61.0	194	55.2	10.7	9.5	10.7	9.0	13.2	13.3	33
0.0	0.0	0.0	0.0	1.2	0.8	1.7	6.0	7.0	0.6	34
48.8	61.0	194	55.2	11.9	10.3	12.4	15.0	20.2	13.9	35
369	462	248	421	33.2	29.9	32.2	35.0	47.7	35.1	36
81.8	82.2	12.3	82.2	19.4	23.4	20.1	17.1	22.5	18.3	37
+0.3	0.0	+0.9	+0.1	-3.0	-3.2	-3.1	-3.1	-2.9	-2.8	38
7.9	8.1	6.4	8.0	12.8	13.1	12.9	12.8	12.3	12.5	39
Water level - 39 feet	Water level - 30 feet	Water level - 41 feet								

ADDENDUM TO TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

NO.	PROVINCE	QUEBEC (Concl'd)		ONTARIO			
		QUEBEC CITY AND ENVIRONS		Near HAGERSVILLE		Near PETAWAWA	
	Camp or Establishment	Ste. Foy - P.M.Q. Area		Camp Hagersville		Camp Petawawa	
	Source (s)	Ste. Foy Municipal Supply - Deep Wells		Lake Erie and Wells		Ottawa River & Spring	
		Well No. 1	Well No. 2	Lake Erie	Well No. 3†	Ottawa R.	Spring Water
		Raw & Finished Water		Finished Water	Raw & Finished Water	Raw Water	
	Sampling Point	At Tap	At Tap	At Tap R.C.E. Camp»	At Pump	At Pump	Near Bldg. C.C. 19
1	Date of sampling	May 21/58	May 21/58	June 16/58	June 16/58	May 27/58	May 27/58
2	Storage period (days)	13:22	13:22	4:16	4:16	22:36	22:36
3	Sampling temperature, °C.	5.6	5.6	15.0	10.0	8.9	7.8
4	Test temperature, °C.	23.1	23.1	24.6	24.5	23.4	23.2
5	Oxygen consumed by $KMnO_4$	2.4	2.3	2.2	1.5	9.1	1.2
6	Carbon dioxide (CO_2), (calculated)	2.4	3.9	2.3	3.9	2.4	4.5
7	pH	8.1	7.9	7.9	8.1	6.9	7.1
8	Colour	10	10	5	5	40	0
9	Turbidity	0	0	1	15	1	0
10	Suspended matter, dried at 105°C.				22.0	-	
11	Suspended matter, ignited at 550°C.				22.0	-	
12	Residue on evaporation, dried at 105°C	254	272	192	681	50.4	146
13	Ignition loss at 550°C.	50.0	26.8	36.8	69.6	24.8	57.6
14	Specific conductance, micromhos at 25°C.	455.5	438.2	306.7	959.6	50.4	203.1
15	Calcium (Ca)	69.3	69.4	38.9	104	5.4	14.4
16	Magnesium (Mg)	8.0	7.0	8.4	35.0	1.6	9.4
17	Iron (Fe) Total			-	1.6	-	
18	Dissolved	0.02	0.02	0.04	0.03	0.06	0.0
19	Manganese (Mn)	0.06	0.17	0.0	0.02	0.0	Trace
20	Aluminum (Al)	0.10	0.0	0.05	0.06	0.0	Trace
21	Copper (Cu)	0.0	0.0	0.02	0.0	0.0	0.0
22	Zinc (Zn)	0.0	0.05	0.10	0.0	0.0	0.0
23	Sodium (Na)	13.4	10.9	8.4	61.2	1.3	6.4
24	Potassium (K)	1.4	1.5	1.1	2.5	0.6	1.4
25	Ammonium (NH_4)	0.05	0.05	-	-	0.10	0.05
26	Carbonate (CO_3)	0.0	0.0	0.0	0.0	0.0	0.0
27	Bicarbonate (HCO_3)	190	194	114	326	12.1	34.5
28	Sulphate (SO_4)	36.0	38.0	22.3	256	9.7	21.0
29	Chloride (Cl)	29.8	22.3	24.5	3.8	0.8	22.5
30	Fluoride (F)	-	0.0	0.0	0.60	0.0	0.0
31	Nitrate (NO_3)	0.3	0.4	0.0	0.0	0.8	12
32	Silica (SiO_2), colorimetric	9.2	8.1	0.9	7.1	4.7	14
33	Carbonate hardness as $CaCO_3$	156	159	93.8	268	9.9	28.3
34	Non-carbonate hardness as $CaCO_3$	49.9	42.9	37.8	134	10.2	46.3
35	Total hardness as $CaCO_3$	206	202	131.6	402	20.1	74.6
36	Sum of constituents	261	253	161	630	30.9	118
37	Per cent sodium	12.3	10.4	12.1	24.7	11.9	15.4
38	Saturation index at test temperature	+0.6	+0.5	0.0	+1.0	-2.7	-1.8
39	Stability index at test temperature	6.9	6.9	7.9	6.1	12.3	10.7
	Remarks:	Water level -125 feet	Water level 124.5 feet		†Standby Supply	River - low	Normal level

ADDENDUM TO TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million

ONTARIO (Concl'd)

Near PETAWAWA (Concl'd)		LAKEVIEW	Near ORLEANS					
Camp Petawawa		Lakeview Depot	V.E. Proving Establishment			Camp Borden.		
Ottawa River & Spring		Lakeview Municipal Supply - Lake Ontario, Treated	Deep Wells			Deep Wells		
Mixed Supply				New Well		Well No. 1	Well No. 4	
Finished Water		Finished Water	Raw and Finished Water			Raw and Finished Water		NO.
At Tap Bldg. GI	At Tap Bldg. J 102	At C.H. Plant Tap	At Pump			At Pumps		
May 27/58	Sept. 23/58	July 30/58	Aug. 27/58	Sept. 29/58	Oct. 3/58	July 3/58	July 3/58	1
22:36	7:27	15:19	1:6	7:18	3:14	20:21	20:21	2
11.1	18.0	-	-	10.0	12.8	8.9	7.8	3
23.5	22.9	26.3	24.9	20.5	20.4	25.1	25.0	4
6.9	6.6	-	2.0	-	-	-	-	5
2.5	2.3	2.9	6.7	28	14	3.1	2.6	6
6.9	7.2	7.8	7.9	7.4	7.7	8.0	8.1	7
35	-	5	15	0	10	5	0	8
1	45 *	0	Clear	0	2	0	2	9
			-				-	10
			-				-	11
62.0			-	945	921	244	200	12
27.6			-	244	239	42.4	27.6	13
64.9	92.8	311.2	987	1342	1340	412.8	338.8	14
6.3	8.4	40.0	117	166	166	47.1	45.7	15
2.1	3.2	8.9	48.3	68.1	66.4	16.7	11.4	16
	7.6	-	0.07	-			-	17
0.08		Trace	0.02	0.02	0.07	0.16	0.31	18
0.0	0.14	0.01	0.02	0.20	0.16	0.02	0.16	19
0.0	0.0	-	0.09	0.26	0.29	0.06	0.06	20
0.0	0.0	-	0.01	Trace	Trace	Trace	0.0	21
0.02	Trace	-	2.5	5.0	5.0	0.20	0.05	22
1.6	2.4	9.4	15.7	23.8	23.5	13.4	9.1	23
0.7	0.9	1.2	7.7	10.0	10.0	1.2	1.1	24
0.10		0.05	0.35	0.3	0.2	0.05	0.0	25
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26
13.2	22.7	116	355	479	468	215	214	27
10.4	11.0	25.7	131	175	180	7.3	5.4	28
4.0	6.2	26.0	47.7	75.1	74.4	22.9	2.1	29
0.0		-	0.0	-		0.0	0.0	30
1.2	0.8	1.0	47	87	84	0.4	0.2	31
5.7	5.7	2.1	9.0	7.5	7.7	17	18	33
9.8	18.6	95.4	291	393	384	177	161	33
14.6	15.5	41.0	201	301	303	9.6	0.0	34
24.4	34.1	136	492	694	687	187	161	35
38.0	49.9	172	602	854	848	233	199	36
12.0	12.8	12.9	6.4	6.7	6.7	13.4	10.8	37
-2.7	-2.0	0.0	+0.9	+0.6	+0.9	+0.5	+0.6	38
12.3	10.2	7.8	6.1	6.2	5.9	7.0	6.9	39
	* Suspended Iron Pb - Trace					Water level -15 feet	Water level - 40 feet	

ADDENDUM TO TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

NO.	PROVINCE	MANITOBA					
	Camp or Establishment	WINNIPEG			SHILO		
		Fort Osborne Barracks			Camp Shilo		
	Source (s)	Winnipeg Municipal Supply - Shoal Lake			Deep Wells		
					Well No. 1	Well No. 2	Well No. 3
		Raw and Finished Water			Raw Water		
	Sampling Point	At No. 2 C.H. Plant Tap	At. No. 1 C.H. Plant Tap	At No. 2 C.H. Plant Tap	At Pumps		
1	Date of sampling	Aug.25/58	Sept. 23/58	Sept.24/58	June 30/58	June 30/58	June 30/58
2	Storage period (days)	8:24	13:24	12:23	21:24	21:24	21:24
3	Sampling temperature, °C.	-	-	-	5.6	5.6	5.6
4	Test temperature, °C.	21.7	22.9	23.6	23.8	24.0	24.1
5	Oxygen consumed by $KMnO_4$	-	-	-	-	-	-
6	Carbon dioxide (CO_2), (calculated)	4.0	4.4	3.9	4.1	5.8	-
7	pH	7.6	7.6	7.7	8.0	7.9	8.2
8	Colour	15	5	10	5	5	0
9	Turbidity	-	-	-	4	1	16
10	Suspended matter, dried at 105°C.				5.0	-	5.0
11	Suspended matter, ignited at 550°C.				0.7	-	1.3
12	Residue on evaporation, dried at 105°C.				289	328	314
13	Ignition loss at 550°C.				49.6	45.2	74.4
14	Specific conductance, micromhos at 25°C.	175.1	173.9	177.9	448.7	494.1	536.2
15	Calcium (Ca)	25.1	23.6	25.6	71.6	78.5	88.5
16	Magnesium (Mg)	5.8	6.7	6.0	15.4	16.8	16.6
17	Iron (Fe) Total	-	-	-	1.38	-	2.56
18	Dissolved	0.02	0.03	-	0.58	0.36	0.92
19	Manganese (Mn)		-	-	0.18	0.02	0.05
20	Aluminum (Al)		-	-	0.04	0.06	0.07
21	Copper (Cu)			-	0.0	0.17	Trace
22	Zinc (Zn)			-	0.0	0.0	0.0
23	Sodium (Na)	2.3	2.3	1.9	1.5	2.6	1.5
24	Potassium (K)	1.2	1.2	1.3	1.1	1.3	1.4
25	Ammonium (NH_4)	0.05	0.1	0.05	0.05	0.05	0.05
26	Carbonate (CO_3)	0.0	0.0	0.0	0.0	0.0	0.0
27	Bicarbonate (HCO_3)	98.7	99.1	98.5	272	293	358
28	Sulphate (SO_4)	4.3	3.8	3.8	19.3	23.9	5.8
29	Chloride (Cl)	2.0	1.2	1.2	2.3	3.7	1.0
30	Fluoride (F)	-	-	-	0.0	0.0	0.0
31	Nitrate (NO_3)	0.8	1.2	0.6	1.5	2.0	0.05
32	Silica (SiO_2), colorimetric	7.0	8.3	4.7	24	25	26
33	Carbonate hardness as $CaCO_3$	81.0	81.3	80.8	223	240	289
34	Non-carbonate hardness as $CaCO_3$	5.5	5.1	7.7	19.0	24.7	0.0
35	Total hardness as $CaCO_3$	86.5	86.4	88.5	242	265	289
36	Sum of constituents	97.1	97.1	93.6	271	298	319
37	Per cent sodium	5.4	5.4	4.4	1.3	2.1	1.1
38	Saturation index at test temperature	-0.6	-0.6	-0.4	+0.7	+0.7	+1.1
39	Stability index at test temperature	8.8	8.8	8.5	6.6	6.5	6.0
	Remarks:				Water levels -40'	= 40'	= 40'

ADDENDUM TO TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million

MANITOBA (Concl'd)							SASKATCHEWAN		
SHILO (Concl'd)						Near CLEAR LAKE	DUNDURN		
Camp Shilo (Concl'd)				Fort Churchill		Clear Lake Camp	Camp Dundurn		
Deep Wells				Lake Isobelle		Clear Lake	Deep Wells		
Well No. 4	Disposal Plant Well No. 5	Rifle Range Well No.6	Mixed Wells				North Well	West Well	
Raw Water			Finished Water	Raw Water	Finished Water	Raw & Finished Water	Raw & Finished Water		NO.
At Pumps			At Coffee Shop Tap	At Pump	At Plant Tap	From Tap	At Pumps		
June 30/58	June 30/58	Aug. 14/58	June 30/58	May 22/58	May 22/58	June 6/58	June 26/58	June 26/58	1
21:24	23:24	8:19	21:24	12:21	12:21	132:152	15:22	15:22	2
5.6	7.8	6.7	11.1	0.0	-	-	5.6	5.6	3
23.7	25.0	23.7	23.9	23.0	23.0	26.2	25.2	25.3	4
-		2.1	-	7.2	4.0	-	7.8	3.4	5
5.2	3.9	3.3	3.3	2.9	0.9	1.6	3.8	2.4	6
8.0	7.9	8.0	8.2	7.8	7.9	8.4	8.3	8.3	7
0	5	5	0	35	10	5	10	5	8
11	0.9	0	0.8	4	0	-	25	5	9
6.3	-			15.5	-		15.7	13.5	10
4.3	-			13.2	-		6.4	5.0	11
347	233	232	360	240	240		754	490	12
78.8	28.4	36.4	49.6	51.6	38.0		204	84.0	13
546.3	348.8	361.4	559.0	339.0	384.9	458.8	1112	680.9	14
88.1	55.0	57.3	18.3	32.6	37.7	31.4	97.1	105	15
18.0	13.2	12.5	8.7	10.5	6.5	31.9	45.1	25.6	16
1.91	-	-		0.26	-	-	4.58	1.61	17
0.74	0.08	Trace	0.01	0.02	Trace	0.90	0.37	0.89	18
0.31	0.02	0.0	Trace	0.0	0.0	-	0.15	0.41	19
0.08	0.09	0.08	0.09	0.0	0.59	-	0.08	0.06	20
0.23	0.0	0.0	0.01	0.0	0.0	-	Trace	Trace	21
0.0	0.05	0.10	0.0	0.0	0.0	-	0.0	0.0	22
3.8	0.9	0.8	103	28.0	23.0	16.2	93.5	6.6	23
1.7	0.7	0.5	2.9	3.0	2.3	5.0	6.3	2.3	24
0.05	0.10	0.20	0.05	-	0.05	-	-	-	25
0.0	0.0	0.0	0.0	0.0	0.0	1.9	0.0	0.0	26
335	120	217	337	116	44.1	210	533	347	27
20.3	14.9	8.4	21.0	18.1	70.4	62.3	197	95.7	28
5.6	0.5	1.0	6.6	55.2	47.1	3.1	7.0	2.3	29
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30
1.0	4.0	8.0	1.0	1.0	0.2	0.2	1.8	0.3	31
25	21	23	25	5.7	1.3	-	21	17	32
275	172	178	81.4	94.9	36.2	175	428	285	33
18.9	19.2	16.8	0.0	29.6	84.6	34.4	0.0	82.4	34
294	191	195	81.4	125	121	209	428	367	35
330	214	218	353	211	211	-	732	427	36
2.7	1.0	0.9	72.3	32.2	28.2	14.0	31.7	3.7	37
+0.9	+0.4	+0.5	+0.4	-0.2	-0.5	+0.7	+1.4	+1.2	38
6.2	7.1	7.0	7.4	8.2	8.9	7.0	5.5	5.9	39
- 40'	- 18'	- 14'					Water level - 10'	Water level - 33'	

ADDENDUM TO TABLE II (Cont'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

NO.	PROVINCE OR TERRITORY	ALBERTA			BRITISH COLUMBIA
	Camp or Establishment	Near WAINWRIGHT			Near CHILLIWACK
		Camp Wainwright			Camp Chilliwack
	Source (s)	Battle River, Betty Lake & Wells †			Vedder R. & Well
		Battle River	Betty Lake	Mixed River & Lake, Camp Supply	Vedder River
		Raw Water	Raw Water	Finished Water	Raw & Finished Water
	Sampling Point	At Intakes		At Camp Tap	At Pump No.1
1	Date of sampling	July 24/58	July 24/58	July 24/58	July 15/58
2	Storage period (days)	7:17	7:17	7:17	16:26
3	Sampling temperature, °C.	20.6	20.0	20.0	15.6
4	Test temperature, °C.	25.0	25.0	25.1	25.2
5	Oxygen consumed by $KMnO_4$	7.4	16	8.3	2.3
6	Carbon dioxide $(CO_2)_3$ (calculated)	4.1	4.2	4.8	1.2
7	pH	8.1	8.2	8.1	7.5
8	Colour	35	25	40	0
9	Turbidity	0.9	8	3	0
10	Suspended matter, dried at 105°C.	-	9.4	10.4	-
11	Suspended matter, ignited at 550°C.	-	2.7	4.0	-
12	Residue on evaporation, dried at 105°C.	456	440	458	49.2
13	Ignition loss at 550°C.	62.8	139	103	12.0
14	Specific conductance, micromhos at 25°C.	692.1	664.5	632.5	64.3
15	Calcium (Ca)	50.0	26.8	37.4	8.9
16	Magnesium (Mg)	25.8	49.8	35.8	0.9
17	Iron (Fe) Total	-	0.63	0.94	-
18	Dissolved	0.02	0.02	0.03	Trace
19	Manganese (Mn)	0.0	0.0	0.0	0.0
20	Aluminum (Al)	0.02	0.05	0.04	0.0
21	Copper (Cu)	0.0	Trace	0.0	0.0
22	Zinc (Zn)	0.0	0.0	0.0	0.0
23	Sodium (Na)	69.0	48.5	59.5	0.8
24	Potassium (K)	7.3	10.5	8.8	0.5
25	Ammonium (NH_4)	-	-	-	0.05
26	Carbonate (CO_3)	0.0	0.0	0.0	0.0
27	Bicarbonate (HCO_3)	350	433	390	27.2
28	Sulphate (SO_4)	93.1	22.4	62.9	5.6
29	Chloride (Cl)	8.2	7.3	8.1	0.6
30	Fluoride (F)	0.0	0.2	0.2	0.0
31	Nitrate (NO_3)	0.3	1.5	0.8	0.3
32	Silica (SiO_2) colorimetric	8.5	8.2	8.5	5.9
33	Carbonate hardness as $CaCO_3$	231	272	241	22.3
34	Non-carbonate hardness as $CaCO_3$	0.0	0.0	0.0	3.6
35	Total hardness as $CaCO_3$	231	272	241	25.9
36	Sum of constituents	434	389	414	36.9
37	Per cent sodium	38.4	27.0	37.9	6.2
38	Saturation index at test temperature.	+0.8	+0.7	+0.7	-1.5
39	Stability index at test temperature.	6.5	6.8	6.7	10.5
	Remarks:	† Standby supply			River low

ADDENDUM TO TABLE II (Concl'd)

CHEMICAL ANALYSES OF ARMY WATER SUPPLIES

(In parts per million)

	BRITISH COLUMBIA (Concl'd)					YUKON TERRITORY	
Near CHILLIWACK	Near FORT NELSON †					WHITEHORSE	
Camp Chilliwack	Muskwa Garrison - Mile 295 Alaska Highway					Camp Takhini	
Vedder R. & Well	Deep Well					McIntyre Creek	
Well at Wet Bridging Area	Raw Water		Finished Water			Raw & Finished Water	NO.
Raw & Finished Water							
At Pump	At Intake		At Tap or In Plant			At Camp Tap	
July 15/58	July 6/58 *	Oct. 5/58	July 6/58	Oct. 5/58	Oct. 6/58	June 27/58	1
9:27	25:35	25:31	25:35	25:31	24:30	11:17	2
15.6	5.0	-	18.0	-	-	8.9	3
25.6	25.0	24.2	25.0	24.3	24.3	24.7	4
1.9	-	-	3.2	-		3.2	5
6.1	28	9	3.0	1.3	0	1.0	6
7.2	7.4	8.0	7.9	8.1	9.9	8.4	7
0	10	-	0	-	-	10	8
13	340	-	3	6	17	0.8	9
22.8	121	-		-			10
17.3	95.4	-		-			11
104	1091	-	789	-		182	12
35.6	102	-	85.6	-		16.8	13
124.7	1381	1639	1005	1100	957	274.6	14
14.1	259 *	320	158	163	184	39.7	15
4.8	44.4	59.6	39.3	52.0	13	10.0	16
12.4	61	74	-	0.81	0.78	-	17
1.0	1.06	0.01	0.07	0.02	0.16	0.01	18
0.05	0.47	0.18	0.05	0.04	0.02	0.0	19
0.0	0.06	0.14	0.19	0.29	0.17	0.0	20
0.0	0.0	-	0.0	-		Trace	21
0.4	0.0	-	0.0	-		0.0	22
2.3	6.2	7.6	7.0	9.8	9.9	4.0	23
0.7	2.5	2.8	2.6	3.2	3.0	0.9	24
0.05	-	-	-	-		0.05	25
0.0	0.0	0.0	0.0	0.0	10.0	2.0	26
62.2	542	640	160	132	OH 0.9	166	27
3.2	394	508	413	511	489	8.2	28
6.3	1.8	1.5	5.8	3.9	4.2	0.7	29
0.0	0.0	-	0.0	-		0.0	30
0.2	4.0	0.2	0.2	0.2	0.2	0.2	31
14	10	9.8	3.6	3.0	2.6	15	32
51.0	445	525	131	108	19	140	33
3.9	385	505	425	512	493	0.0	34
54.9	830	1030	556	620	512	140	35
76.7	991	1278	709	812	717	162	36
7.7	1.6	1.6	2.6	3.3	3.9	5.8	37
-1.3	+0.7	+1.5	+0.7	+0.8	+1.8	+0.7	38
9.8	6.0	5.0	6.5	6.5	6.3	7.0	39

† *See* also Investigation Report I.R. 58-215

* Probably lost $CaCO_3$ on storage

68664-8

DISCUSSION

The usefulness of the data on plant operation and analytical water quality varies with the nature and extent of the problem. It is not proposed in this report to cover the many applications, although a few comments are made on problems of scaling, corrosion, and water hardness.

Tables II, III and IV show that problems of corrosion are the most probable although a number of the waters are hard and may cause scaling and other difficulties associated with the use of hard waters.

Tables I and III show that almost 50 per cent of the waters supplied are not treated and only 21 per cent receive treatment in addition to chlorination, and many of these are so treated in municipal plants.

About one-half the waters (46 per cent) used are ground waters (wells and springs), the remainder, except for two mixed supplies, being from surface sources. About 40 per cent of the population served use the ground and mixed waters. As would be expected, many of the smaller establishments use well waters.

A limited number of waters - about 7 - show iron and manganese content high enough to give rise to possible problems of staining and discolouration. Other waters, because of excessive pick-up of iron from piping and tanks due to corrosion, will also cause red water problems unless adequate treatment is carried out.

Water hardness and quality:

Table III summarizes much of the data on the hardness of the 100 water supplies reported in Table II. These hardnesses expressed in parts per million of calcium carbonate, are classified, as in previous Water Survey Reports, as follows:

Soft water	- 0 to 60 p.p.m. hardness
Medium hard water	- 61 to 120 p.p.m. "
Hard water	- 121 to 180 p.p.m. "
Very hard water	- over 180 p.p.m. "

Sixty-three waters of the 100 fall within the soft to medium hard classification, where maximum hardness is about that of Lake Ontario and Lake Erie waters, but most are soft waters. A further breakdown of the hardness shows that 23 per cent are very soft (below 25 p.p.m. hardness) and most of the remainder lie within the range of 51 to 199 p.p.m. hardness as $CaCO_3$.

The weighted average hardness[1] of the waters supplied to all Army establishments studied in Canada is about 115 p.p.m. or about the upper limit of a medium hard water. Camps in Newfoundland and Nova Scotia receive very soft water, well below the country average but establishments in the Territories, Ontario and Saskatchewan receive waters with hardness above this average. The few locations in Saskatchewan receive very hard waters, weighted average hardness of over 400 p.p.m. Army installations in the remaining provinces are below or near the country average of 115 p.p.m.

These weighted average hardness values are significantly influenced by a few larger establishments in each area. For example the inclusion of the large Ottawa headquarters population served with a soft water would lower significantly the average hardness for Ontario.

A study of the data of Table II shows that hardness in most of the waters is chiefly due to the bicarbonate salts of calcium and magnesium. Therefore, much of the hardness can be readily removed by lime treatment, although these waters will raise problems in certain uses due to release of carbon dioxide and/or deposition of calcium carbonate.

About one-half the population served, 51 per cent, use soft and medium hard waters, about 30 per cent use a hard water, while 19 per cent are supplied with waters over 180 p.p.m. hardness, that is, very hard waters. While many factors must be considered it is usually economical to soften waters for municipal use when the hardness is greater than about 200 p.p.m. as $CaCO_3$: such softening results in a water of 80 to 100 p.p.m. hardness.

[1]Weighted average hardness is calculated by multiplying the average hardness of each supply by the population (no. of consumers) and the sum of these products is divided by the total population (sum of all consumers).

TABLE III

ARMY WATER SUPPLIES

Summary of Data on Source, Treatment and Water Hardness

Province	No. of Establishments Studied	No. of Sources Considered	Water Sources			Treatment of Water Supplies			Water Hardness Classed as:			
			Ground	Surface	Mixed	None	Chlorination Only	Other than Chlorination	Soft	Med. Hard	Hard	Very Hard
Newfoundland	1	1		1		1			1			
Nova Scotia	11	12	8	4		7	3	2	8	2	2	
New Brunswick	8	8	6	2		6	2		4	3	1	
Quebec	6	6	4	2		3	1	2	4	1	1	
Ontario **	19	19	7	11	1	5	7	7	2	4	8	5
Manitoba	5	5	1	4			3	2		4		1
Saskatchewan	4	4	3		1	3		1				4
Alberta	10	11	7	4		7		4	3	4	2	2
British Columbia	18	18	6	12		6	10	2	10	1	4	3
Yukon Territory	8	8	4	4		2	5	1	2	3	2	1
Northwest Territories	8	8		8		7	1		1	6	1	
CANADA	98	100	46*	52*	2	47*	32	21	35*	28	21	16

*Also per cent
**Does not include Ottawa headquarters

Scale-formation and corrosion:

The corrosivity and the scaling tendency of a water are often the most important factors in its use in an Army establishment. This is particularly true where waters are to be used in central heating plants. These tendencies, especially the tendency to attack or corrode the distribution system and equipment, depend upon many factors. Besides the general chemical quality the temperature, velocity, amount of dissolved gases (carbon dioxide, oxygen, hydrogen sulphide, and ammonia), presence of galvanic couples, and design of the system or equipment must be considered.

It has always been the hope of water technologists to be able to quickly classify waters as to their corrosive or scaling tendencies, so that, if required, suitable methods of treatment may be recommended. The Industrial Waters Section is continually studying this problem and cooperating with international committees and others working toward the same goal. The large number of variables makes the problem particularly difficult and there is much technical literature on the subject. It is not the intention at this time to attempt to summarize these findings or even to classify definitely the waters studied, but a few comments may help in the interpretation of data included in this report.

The Langelier saturation index, pH - pH_s, was one of the earlier attempts to classify waters from their chemical analyses as to corrosivity or scale-forming tendency. Because it shows only the relative saturation of the water with respect to calcium carbonate and does not consider such important variables as velocity, dissolved gases, etc., it falls short of the ideal. Some workers, from long experience with corrosion of iron and steel in natural waters, consider that corrosion will occur at ordinary temperatures when the index is below about -0.75,

TABLE III –Continued

ARMY WATER SUPPLIES

Summary of Data on Source, Treatment and Water Hardness

Water Hardness, p.p.m. $CaCO_3$ in Range												Per cent of Population Served with Waters Classed as				Weighted Average Water Hardness
0 -10	11 -25	26 -50	51 -99	100 -199	200 -299	300 -399	400 -499	500 -599	600 -699	700 -999	1000 & over	Soft	Med. Hard	Hard	Very Hard	p.p.m. $CaCO_3$
1												100				5
2	5	1	2	2								77.4	22.0	0.6		25
	3		4	1								39.2	4.4	56.4		115
1	2		1	2								61.7	22.7	15.6		70
		1	2	12	4							17.6	11.5	28.7	42.2	140**
			4		1							95.6			4.4	80
					1		1		1		1				100	415
1			5	3	1		1					41.0	5.2	53.5	0.3	105
1	5	3	2	4			1		2			82.9		14.8	3.2	65
1		1	2	3	1							0.8	1.6	96.6	1.0	150
	1		5	2								12.6	87.4			165
7*	16	6	27	29	8		3		3		1	42.0	9.0	29.6	19.4	115

and scale will deposit if it is above about +0.75. Between these values either corrosion or scaling may occur depending upon other variables, but this index gives little indication of the rate of such corrosion or scale formation. Temperature is an important factor since the pH_S, and consequently the index itself, changes with the temperature. Some waters that are satisfactory at ordinary temperatures may be quite scale-forming at the higher temperatures used in domestic hot water systems.

Because this index is a measure of the degree of saturation with $CaCO_3$ it is of considerable value in determining and controlling the treatment of a water with lime, to inhibit corrosion by deposition of a thin protective coating of calcium carbonate on piping, etc.

Some workers have found a more satisfactory co-relation between the stability index, $2pH_S$ - pH, and the corrosion and/or scaling occurring in actual service. It is usually considered that a water with a stability index below 6 will be scale-forming while one with an index greater than 8 will be corrosive: this index also changes with temperature.

Several formulae and indices have been developed and discussed from time to time in the literature in an attempt to more satisfactorily determine the corrosive or scaling tendency of waters. Some of them appear worthy of further study but none have been so universally used as the saturation and stability indices mentioned above.

Table IV summarizes most of the information on these indices set out in Table II. From the approximate classification outlined above it is evident that most of the Army waters show a corrosive tendency, 47 per cent having a stability index greater than 8. The high percentage sodium and low calcium content of other waters further increases their corrosive tendency. It appears from Table IV that only about 15 per cent of the waters might be considered as scale-forming when used at ordinary temperatures.

TABLE IV

ARMY WATER SUPPLIES

Summary of Data on Corrosivity of Waters

Province	No. of Water Sources Considered	Langelier Sat'n Index (pH - pH_S) at Test Temperature			Stability Index ($2pH_S$ - pH) at Test Temperature			Calcium (p.p.m.)				Per cent Sodium		
		<-.75	-.75 to +.75	>+.75	<6	6 to 8	>8	0 -25	26 -50	51 -200	>200	<40	40 to 60	>60
Newfoundland	1	1					1	1					1	
Nova Scotia	12	7	5			3	9	10		2		7	4	1
New Brunswick	8	5	3			3	5	5	3			7		1
Quebec	6	2	4			4	2	4	1	1		4		2
Ontario	19	1	13	5	1	16	2	3	9	5	2	17		2
Manitoba	5		5			2	3	4	1			3	1	1
Saskatchewan	4			4	4					2	2	3	1	
Alberta	11	2	7	2	1	6	4	6	4	1		7		4
British Columbia	18	10	4	4	3	4	11	11	4	2	1	18		
Yukon Territory	8	2	6			6	2	3	4	1		7		1
Northwest Territories	8	1	7				8	2	5	1		8		
CANADA	100	31	54	15	9	44	47	49	31	15	5	81	7	12

* *See* also Table V
† + - Shows Attacks
†† – - Shows No Attack
††† nr.-No Report

Table V tabulates the replies to the questionnaire regarding problems of corrosion and scaling in Army establishments. Only with waters with a high stability index, and low calcium content and/or high sodium chloride content, were troubles reported. A number of establishments submitted no report on corrosivity, while others reported no serious problems even though all other factors indicated these waters to be corrosive. Since the questionnaire replies are in most cases the opinion of one person only, the relative corrosiveness of a water is largely the result of personal experience. For example, one who is accustomed to seeing galvanized hot water storage tanks last 15 to 20 years will consider a water corrosive if failure occurs in 8 years, while a person whose experience has been in locations where failure occurred within a year or so will doubtless report a water in which tanks lasted 8 years as very satisfactory. A controlled study of the relative corrosivity of a number of the camp waters would be of more value.

TABLE IV – Concluded

ARMY WATER SUPPLIES

Summary of Data on Corrosivity of Waters

Reported Corrosive Attack (From Questionnaires)*			High Iron and/or Manganese Waters	Classification of Waters Into U.S. Army Scaling and Corrosion Categories				
On Iron and Steel	On Galv. Iron Hot Water Tanks	On Copper Pipes, etc.		No. 1	No. 2	No. 3	No. 4	No. 5
+†	+	+		1				
7+ 5–††	7+ 5–	7+ 5–	2	8		2		2
7–	1+ 6–	2+ 5–		5	3			
2+ 3–	2+ 3–	0 5–		4	1	1		
6+ 13–	3+ 16–	0 19–		3	9	1	4	2
3+ 1–	2+ 2–	1+ 3–		4	1			
2+ 1–	0 3–	0 3–	2					4
3+ 8–	1+ 10–	0 11–	2	5	4			2
4+ 9–	6+ 7–	1+ 12–		11	4			3
			1	2	4	1		1
8–	8–	8–		2	5	1		
28+ 55– 17nr.†††	23+ 60– 17nr.	12+ 71– 17nr.	7	45	31	6	4	14

No establishment reported a serious scaling problem, although indications are that certain waters should give rise to such problems.

During World War II a study of water quality at more than 750 U.S. Army establishments was made[1]. This work co-related corrosion and scaling with water quality, using test coupons, and studied several methods of treatment. The different waters supplying these camps were classified into 5 categories on the basis of corrosion and scaling problems in normal camp use. Table VI summarizes these categories which are based on the Langelier saturation index, the calcium content of the water, and certain other factors.

[1] Water Supply Practice in Army Training Centers - Lewis H. Kessler, V. Bruce Sundstrom and Arthur O. Tomek; Journal of the American Water Works Association, Vol. 35, p. 1009, August, 1943.

TABLE V

RESULTS OF QUESTIONNAIRES ON CORROSIVITY

Province	Camp or Establishment	Attack Reported			No Marked Attack Reported
		On Iron & Steel	On Galv. Iron Hot Water Tanks	On Copper	
Newfoundland	St. Johns	X	X	X	
Nova Scotia	Aldershot				X
	Debert				X
	Bedford R.R.	X	X	X	
	Elkins Bks.	X	X	X	
	Hammond Plains	X	X	X	
	Garrison Bks., Halifax	X	X	X	
	McNabs Island	X	X	X	
	Wallace Hill	X	X	X	
	York Redoubt	X	X	X	
	Johnston				X
	Petrie Road				X
New Brunswick	Hanwell Road				X
	Maryland Hill				X
	Camp Gagetown		X	X	
	Moncton			X	
	Saint John				X
	Pennfield				X
	Utopia				X
Quebec	Camp Bouchard	X	X		
	Citadel	X	X		
	Ste. Foy	X			
	St. Bruno				X
	Camp Valcartier				X
Ontario	Camp Barriefield	X	X		
	Blackdown Park	X			
	Camp Borden	X			
	Cobourg				X
	Camp Hagersville				X
	Camp Ipperwash				X
	Lakeview		X		
	Leitrim				X
	Cedar Springs, London				X
	London (Wolseley Bks.)				X
	Meaford R.R.				X
	Orleans	X (H_2S)			
	V.E.P.E.				X
	Oshawa				X
	Connaught Ranges				X
	Camp Petawawa	X	X		
	Camp Picton				X
	Point Petrie	X			
Manitoba	Clear Lake				X
	Fort Whyte (well)	X			
	Camp Shilo	X	X	X	
	Fort Churchill	X	X		

TABLE V -- Continued

RESULTS OF QUESTIONNAIRES ON CORROSIVITY

Province	Camp or Establishment	Attack Reported: On Iron & Steel	Attack Reported: On Iron Hot Water Tanks	Attack Reported: On Copper	No Marked Attack Reported
Saskatchewan	Camp Dundurn	X			
	Grenfell	X			
	Regina				X
Alberta	Banff Camp				X
	Sarcee Camp				X
	Currie Bks.				X
	Griesbach Bks.				X
	Bissell				X
	Winterburn Range				X
	Ft. Chipewyan	X			
	McMurray				X
	Strathmore				X
	Camp Wainwright	X			
British Columbia	Camp Chilliwack		X (8 yrs)		
	Camp Courtenay				X
	Camp Vernon				X
	Nanaimo				X
	Kamloops	X			
	Ladner	X			
	Rayleigh	X	X	X	
	Vancouver	X			
	Victoria -				
	Albert Head		X		
	Gordon Head		X		
	Mary Hill		X		
	Work Point		X		
	Heales R.R.		X		
Northwest Territories	Aklavik				X
	Fort Good Hope				X
	Fort Norman				X
	Fort Providence				X
	Fort Reliance				X
	Fort Resolution				X
	Fort Simpson				X
	Hay River				X

68664-9

TABLE VI

GENERAL CATEGORY OF WATERS AT U.S. ARMY CAMPS AND POSTS*

Category	Calcium as Ca in p.p.m.	General Description
1 (U.S. Army No. 1)	0 to 25	Normal soft water free from high concentrations of iron and manganese and non-scaling. Corrosive if dissolved oxygen is present.
2 (U.S. Army No. 1a)	26 to 50	Medium soft to hard water free from high concentrations of iron and manganese. May cause scale trouble.
3 (U.S. Army No. 2)	over 50	Saturation index changes from negative to positive in temperature range of 20° to 90° C.
4 (U.S. Army No. 2a)	over 50	Saturation index always positive.
5 (U.S. Army No. 3)	Hardness excessive; special or difficult waters	All waters not falling in categories 1 to 4 inclusive.

* From reference 1, p. 113

Category 1 includes all waters having less than 25 p.p.m. calcium, and therefore almost all waters in the general classification of soft waters. Waters with such low calcium contents cannot, in normal camp usage, cause serious scaling. These waters are usually high in free carbon dioxide and therefore low in pH. The saturation index is usually negative and the stability index correspondingly high. Table IV shows that the majority, about 45 per cent, of the Canadian Army waters reported fall in this category. These waters are especially corrosive if dissolved oxygen is present. Their use in hot water storage tanks of galvanized iron often gives rise to serious attack due to their acidity, the fact that no protective coating of $CaCO_3$ can be formed, and to their increasing corrosivity at higher temperatures.

To decrease attack by these soft waters lined iron tanks or other resistant metal tanks should be used, but not galvanized iron. The waters should be stabilized to a higher pH (8.5) with lime or other caustic, but the calcium content should not exceed 25 p.p.m. Silicates are often used to decrease attack, sometimes in addition to lime treatment of pH adjustment. Some waters of this category supplied to Army establishments in Canada are already treated with lime to decrease corrosivity, as for example Halifax municipal water.

The second category (U.S. Army Category No. 1a), includes those waters that have a calcium content between 26 and 50 p.p.m., and are free from undesirable contents of iron and manganese. These waters may in certain uses cause scaling problems and a careful study must be made to cover all applications. With these waters it is considered that insufficient calcium is present to always develop and maintain a protective film of $CaCO_3$ on equipment: the saturation index is still generally negative. Such waters may also be quite corrosive, especially if dissolved oxygen is present or other conditions are favourable.

About 31 per cent of the waters studied in this report are placed in this category. When heated they may become significantly corrosive or even scale-forming and it is often necessary to use lined tanks, or to protect the tanks with sacrificial anodes, etc. Treatment to decrease attack again includes adjustment of pH similarly to category 1 waters, but lime is not used because it could cause deposition of $CaCO_3$ (scaling) with higher calcium

waters. Soda ash and/or sodium silicate is usually recommended. Sometimes threshold treatment with phosphates or certain organic compounds is necessary and useful.

Category 3 (U.S. Army No. 2) includes those waters with a calcium content over 50 p.p.m. whose saturation indices change from negative to positive as the waters are heated to the temperatures used in hot water storage tanks.

It is estimated that about 6 such waters are supplied to Canadian Army Camps, and they usually require only the minor pH adjustments necessary to counteract temperature conditions; in some cases treatment such as threshold conditioning to prevent excessive deposition of calcium carbonate is required. Such treatment should be designed to leave a slight protective coating of calcium carbonate on the metal surfaces.

The next category No. 4 (U.S. Army No. 2a) covers those waters with calcium contents greater than 50 p.p.m. and having a definitely positive saturation index and therefore low stability index. They are classed as heavily scale-forming, and treatment is designed to limit such scaling, especially in hot water storage tanks. It is estimated that about 4 waters supplied to Canadian camps fall within this category.

The final category No. 5; (U.S. Army No. 3) covers a wide range of waters, since it includes all those not covered by the previous four categories, and any waters in these categories that do not respond to the suggested, simple treatments. Included in this category are excessively hard waters, those high in manganese, iron, and total dissolved solids, and those which require special treatment for algae, colour and turbidity removal. About 14 Canadian Army waters are placed in category No. 5.

The treatments recommended for waters of categories 1, 2 and 3, namely pH adjustment and addition of inhibitors or threshold conditioning, is often simple and effective. However, care must be taken in the application of such treatments since under certain conditions inhibition is under anodic control and increased attack may result. The subject of inhibition and threshold conditioning in waters has been studied intensively and it is not possible to summarize all the findings at this time.

Sodium silicate has been successfully used for corrosion control in water systems for many years but the results are often unpredictable. Its protection is considered to be due to a deposited film of iron oxide and colloidal silica. It is claimed some initial corrosive attack is necessary to obtain satisfactory protection. Because protection is dependent upon film formation it is subject to the usual difficulties, such as the formation of relatively porous films due to extraneous foreign matter, organics, bacteria, the difficulty in maintaining a film of uniform thickness, and of preventing excessive deposition in certain areas, etc. The nature of the silica present in waters is of major importance and successful treatment is to some extent still a matter of trial and error. Usually an excess silica of 8 to 15 p.p.m. is maintained. Care must be taken to see that too heavy a deposition does not occur in hot water tanks.

The use of polyphosphates or threshold treatment has considerable advantages. A number of workers claim these glassy phosphates are cathodic inhibitors and therefore safe inhibitors for use in aqueous solutions. The polyphosphates are said to protect over a wide range of aqueous pH with only 2 to 5 p.p.m. being required, the amount depending upon conditions in the system, size of system, etc.

The film formed does not build up and the phosphate is protective at relatively high temperatures, although above 180°F its protection is not satisfactory. Some calcium is necessary for good protection, so that these phosphates are not used in almost zero softened water.

The corrosion preventive qualities of the polyphosphates have several well-known disadvantages that often outweigh their advantages for other than domestic or municipal waters. Polyphosphate action is not always predictable especially at higher temperatures; in the pH range 7 - 8 at elevated temperatures there may be sufficient reversion of the polyphosphates to orthophosphates to cause precipitation of calcium phosphate. Also, it is neces-

sary that sufficient flow be maintained in the system to which the polyphosphates are continuously fed.

These phosphates are of great value in preventing the deposition of iron salts and red water problems. In some cases red water believed to be caused by corrosion was actually due to precipitation of iron naturally dissolved in the water. The addition of polyphosphates in sufficient amount did not decrease corrosion but rather sequestered the iron and prevented its oxidation and precipitation. The successful use of phosphates to prevent red water and the discolouration due to manganese depends upon many factors such as location of the feed, amount fed, etc. Unlike its application for corrosion control, its use as a stabilizer for iron and manganese demands that it be fed in proportion to the amount of iron and manganese present. Normally 2 parts of the phosphate are required for every part of iron and manganese present. If chlorination is practiced, higher ratios are needed, at least initially. It is necessary that these phosphates be fed to the water with adequate mixing prior to any aeration, chlorination, or use of any substance that might oxidize the iron or manganese. Iron bacteria will, however, oxidize iron even in the presence of phosphates; also, the stabilization or sequestration of iron and manganese by polyphosphates will not last indefinitely.

The phosphates are also used to sequester or hold up calcium, and prevent its deposition as calcium carbonate. They are used to prevent after-precipitation in lime-softening or after pH adjustment with lime.

In some waters a mixture of sodium silicate and a polyphosphate may be advantageous, although such mixtures have their greatest use for corrosion control in cooling waters. In some waters natural colours and organics are present, which apparently act as inhibitors and greatly influence the rate of attack by the waters.

It is evident from the above that despite efforts to classify and simplify the problem of scaling and corrosion, careful studies must still be made of many waters to solve each individual problem, since any of a variety of factors may be controlling the reaction.

SUMMARY

The water quality used at Army installations in Canada is generally typical of the water quality of each geographical area. Most of the establishments use waters of soft to medium hard character, and corrosion is the major problem.

Smaller installations and some medium-sized establishments in the Prairie Provinces use well waters of less satisfactory quality and a few, therefore, have problems of scale formation especially at higher temperatures.

The survey indicates that additional treatment is desirable at a number of locations, not necessarily to decrease corrosion and related problems, but to provide personnel with a more satisfactory supply for general domestic use.

The waters are classified in a manner similar to the U.S. Army classification, and some brief comments on treatment methods used to decrease corrosion are given. The classification emphasizes the corrosivity of most waters and the need for some treatment.

Despite the extensive knowledge available on water quality, corrosion, and water treatment, many water problems require study before applying even the simpler treatments discussed. To solve these problems it is vitally important to have adequate knowledge on water quality and plant operation: the data tabulated in this report should materially assist in their solution.

APPENDIX A

ARMY ESTABLISHMENTS STUDIED

APPENDIX A–(Continued)

ARMY ESTABLISHMENTS STUDIED

APPENDIX A–(Continued)

ARMY ESTABLISHMENTS STUDIED

APPENDIX A–(Concluded)

ARMY ESTABLISHMENTS STUDIED

APPENDIX B

DEPARTMENT OF MINES AND TECHNICAL SURVEYS
MINES BRANCH

Industrial Minerals Division
40 Lydia Street
Ottawa

Industrial Waters Investigation
D.N.D. (ARMY) Water Supply Questionnaire

1) Name and location of camp .....
2) Officer-in-charge .....
3) Is water supplied to camp from a municipality? .....
4) If so, name of municipality? .....
5) Source(s) of water supply other than municipality, including auxiliary supplies,(name of lake, river, well, etc.)

6) Approximate population served in camp .....
7) Major uses of water at camp other than domestic (such as boilers, process, cooling, etc.) .....

8) Is water pumped by camp? .....
9) Reservoirs at camp (type and capacity in imp. gal.) .....

10) Treatment of water at camp, including brief flow sheet of plant, amount of chemicals added, etc. .....

		Max.	Min.	Ave.
11) Comsumption: (Imp. gal./day)	Domestic			
	Other			
	Total			
	Camp Plant Capacity			

12) Percent of total consumpti on supplied by municipality .....
13) Approx. percentage of total consumption used for purposes other than domestic .....

14) Camp service problems, such as corrosion, treatment, pollution, algae, etc. .....

15) Is failure of domestic galv. hot water tanks a problem in your camp? .....
16) Is copper piping or fittings attacked by your domestic supply? .....

Signature .....

Date .....

APPENDIX C

Mines Branch report No. 819 "Industrial Waters of Canada", a report on investigations covering the period 1934 to 1943, was the last general report published and is now out of print. Since then the Branch has published various reports specific to certain river basins or drainage areas, as follows:

No. 833. Industrial Water Resources of Canada, Water Survey Report No. 1, Scope, Procedure and Interpretation of Survey Studies, by J.F.J. Thomas, 1953. (75 cents)

No. 834. Industrial Water Resources of Canada, Report No. 2, Chemical Quality of Surface and Civic Water Supplies, Ottawa River Drainage Basin, 1947-48, by J.F.J. Thomas, 1953. (75 cents)

No. 837. Industrial Water Resources of Canada, Water Survey Report No. 3, Upper St. Lawrence River - Central Great Lakes Drainage Basin, by J.F.J. Thomas, 1954. ($1.50)

No. 838. Industrial Water Resources of Canada, Water Survey Report No. 4, Columbia River Drainage Basin, 1949-50, by J.F.J. Thomas, 1953. (75 cents)

No. 839. Industrial Water Resources of Canada, Water Survey Report No. 5, Skeena River, Vancouver Island, and Coastal Areas of British Columbia, 1949-51, by J.F.J. Thomas, 1953. (75 cents)

No. 842. Industrial Water Resources of Canada, Water Survey Report No. 6, Fraser River Drainage Basin, 1950-51, by J.F.J. Thomas, 1954. (75 cents)

No. 849. Industrial Water Resources of Canada, Water Survey Report No. 7, Saskatchewan River Drainage Basin, 1951-52, by J.F.J. Thomas, 1956. (75 cents)

No. 856. Industrial Water Resources of Canada, Water Survey Report No. 8, Mackenzie River and Yukon River Drainage Basins in Canada, 1952-53, by J.F.J. Thomas, 1957. ($1.00)

No. 858. Industrial Water Resources of Canada, Water Survey Report No. 9, Churchill River and Mississippi River Drainage Basins in Canada, 1952-54, by J.F.J. Thomas, 1958. (50 cents)

No. 861. Industrial Water Resources of Canada, Water Survey Report No. 10, Nelson River Drainage Basin in Canada, 1953-56. (in press)

No. 864. Industrial Water Resources of Canada, Water Survey Report No. 11, Water Quality in the Atlantic Provinces and the Saint John River Drainage Basin in Canada, 1954-56. (in press)

No. 865. Industrial Water Resources of Canada, Water Survey Report No. 12, Water Quality at some Canadian Military Establishments, 1956-58, by J.F.J. Thomas, 1959.

Memorandum
Series

No. 132. Interim Report on Hardness of Major Canadian Water Supplies by J.F.J. Thomas, 1956. (25 cents)

Any of the above mentioned publications are obtainable from The Queen's Printer, Ottawa or the Publications Distribution Office, Department of Mines and Technical Surveys, Ottawa, Ontario, Canada.