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SURFACE WATER QUALITY IN THE PEMBINA, SOURIS AND RED RIVER DRAINAGE BASINS IN CANADA - A PROGRESS REPORT FOR THE PERIOD MAY, 1960 TO SEPTEMBER, 1963

by

J. F. J. THOMAS & R. M. GALE

MINERAL PROCESSING DIVISION

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SUMMARY OF RESULTS

The chemical analyses of water samples collected from the Pembina, Souris and Red River systems in Canada from May 1960 to September 1963 are tabulated; these data cover daily, weekly or monthly samples collected at 13 locations and spot samples collected at 20 other locations.

Waters in these river systems are typical of surface waters of the Interior Plains Region, i.e. they are high in mineral content and alkali salts and are often quite turbid.

Chemical quality varies with stream discharge in the Pembina and Souris Rivers, total mineralization decreasing with increasing discharge, especially during spring floods. Chemical quality in the Red River does not vary significantly with spring flooding, indicating that most flood waters originate from large stored-up bodies of water such as swamps, underground streams and dammed-up reservoirs. The mineral content of the Red River was chiefly influenced by chlorides which enter the river system usually in the autumn of each year.

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INTRODUCTION

In the summer of 1960 a five-year survey was started to study long term changes in chemical quality of major rivers in western Canada. At about the same time the Canadian Section, International Joint Commission, requested a long term study on the chemical quality of International waters in Manitoba, especially the Pembina and Souris rivers. The Commission later requested that this survey be extended; as a result, daily sampling was initiated on the Red River and Pembina River in 1962.

This progress report tabulates the findings of these studies on the Pembina, Souris and Red River drainage basins from May 1960 to September 1963. A report of the five-year survey in these basins and in other major basins in western Canada will be published when completed in 1965.

SAMPLING PROCEDURE

Daily, weekly or monthly samples are now being collected at 13 locations in the Pembina, Souris and Red River drainage basins. During summer field work from 1961 to 1963, spot samples were collected at 20 locations in addition to the regular sampling sites. Water sampling locations and frequency of sampling are shown in Figure 1 and the sampling stations are listed in Appendix A.

As requested by the Canadian Section, International Joint Commission, sampling frequency was increased in June 1962 from monthly to daily sampling on the Pembina River at Windygates, Man. and from weekly to daily sampling on the Red River at Emerson, Man. At the same time, two new sampling stations were started on the Pembina River, a monthly sampling station near Killarney, Man., and a weekly sampling station, near Swan Lake, Man. Also, at the same time, the sampling location on the Roseau River was changed from Arbakka, Man. to Gardenton, Man.

Since 1962, weekly samples have been collected during the period of spring run-off from Whitemud, Crystal and Badger Creeks and Long River, tributaries of the Pembina River, and from Antler River and Gainsborough Creek, tributaries of the Souris River.

Composite samples of the Pembina and Red Rivers are prepared by combining 10 to 15 consecutive daily samples according to the method for preparing composite samples outlined in the

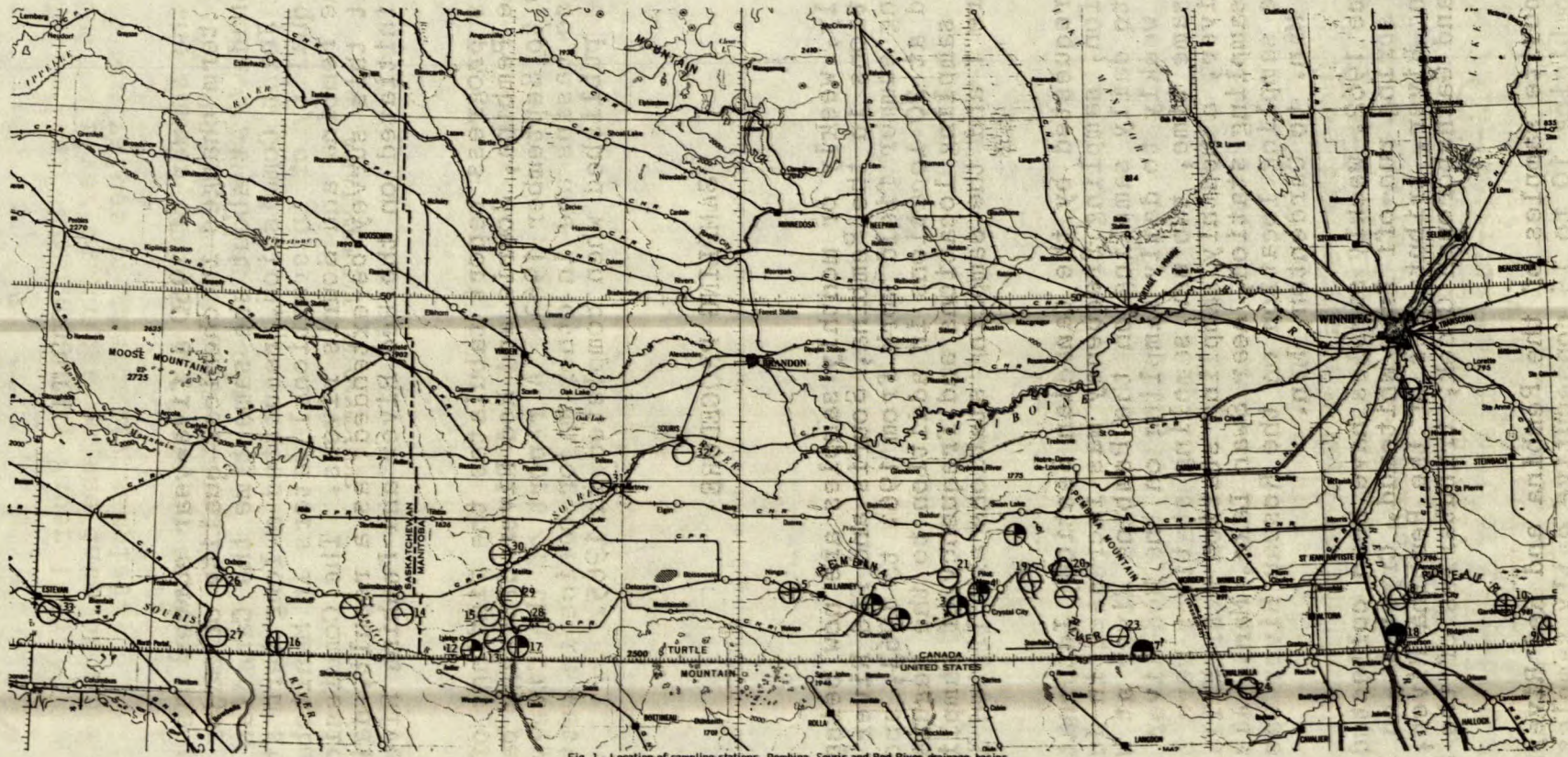

Fig. 1 - Location of sampling stations, Pembina, Souris and Red River drainage basins.
(for key to station numbering, see Appendix A)

daily sampling station
weekly sampling station
monthly sampling station
spot sampling station

Scale in miles

10 0 20 40

(Adopted from Assiniboine River 2218)

United States Geological Water - Supply Paper 1454.[1] This method is related to river discharge on the date of sampling and specific conductance values of the daily samples.

Cross-section sampling was done on several rivers to determine chemical quality variations across the streams and to locate representative sampling points.

ANALYTICAL PROCEDURE

The analytical methods used in this study are essentially the same as those employed in previous water quality surveys and discussed in Department of Mines and Technical Surveys water survey reports, the most recent of which is Water Survey Report No. 13.[2] Standard procedures for the analysis of water published by the American Public Health Association and/or the American Society for Testing and Materials were employed for most determinations.

TEST RESULTS

The chemical analyses of water samples collected in the Souris, Pembina and Red River drainage systems from May 1960 to September 1963 are tabulated in Table 1.

The analyses of water samples collected in the cross-section sampling of the Red, Roseau, Souris and Pembina Rivers are recorded in Table 2.

DISCUSSION

Table 1 shows that surface waters in the Pembina, Souris and Red River drainage basins are typical of most river waters of the Interior Plains Region of Canada. They are highly mineralized especially in hardness and alkali salts. Turbidity in these rivers is high during spring run-off. The lower alkali content of Roseau River water is the result of tributary inflow from the Canadian Shield Region where surface waters are softer and considerably lower in alkali than waters of the Interior Plains Region.

The relationship between mineral content and river discharge in the Pembina River at Windygates is shown in Figures 2, 3, and 4. Figure 2 reports monthly samples collected from September 1960 to December 1961, Figure 3, composite samples collected from July 1962 to September 1963 and Figure 4, the group of daily samples, collected in the spring of 1963, which were used to prepare the three composite samples A, B and C of Figures 3 and 4. These figures show that (1) the dissolved mineral content in the Pembina River decreases during spring run-off, no doubt due to dilution with low dissolved-solids surface waters originating from rapid snow-melt and (2) throughout the remainder of the year mineralization increases as discharge decreases.

Sharp peaks in the discharge rate and to some extent in the mineral content curves are not as pronounced in Figure 3 as in Figures 2 and 4 because discharge data have been averaged over the periods in which the daily samples were collected and variations in mineral content have been somewhat levelled out in the composite samples.

Information on water quality variation in the Souris River at Coulter (Table 1 page 30) is not complete because sampling at this location was irregular between January 1961 and March 1963. However the tabulated analyses do indicate that the dissolved mineral content of this river also decreases at high discharge and increases with decreasing discharge.

Table 1, pages 32 to 37, shows that the Red River at Emerson, Man. is highly turbid each year from April to November. This was especially so from April to mid-August, 1963, but decreased markedly from mid-August to September 30, 1963, that is to the end of the period covered by this progress report.

Figures 5 and 6 show the relationship between specific conductance, chloride content and river discharge in the Red River at Emerson. Figure 5 reports weekly samples collected from 1960 to 1962 and Figure 6, composite samples prepared from daily samples collected from June 1962 to September 1963. Figure 5 shows some decrease in specific conductance (a measure of mineral content) during the spring run-off periods. Figure 6 shows no such decrease in specific conductance during the 1963 spring run-off period; this may be partly due to an averaging of mineral content in the composite samples. The relatively small reductions in mineral content in the Red River during periods of spring high-water, as compared with the Pembina River, indicates that most of the increased flow originates from large stored-up bodies of waters such as swamps, underground streams and dammed-up reservoirs. Dissolved mineral concentrations in large bodies of water are usually not changed significantly by flash floods or heavy rainfalls because of the relative volumes involved.

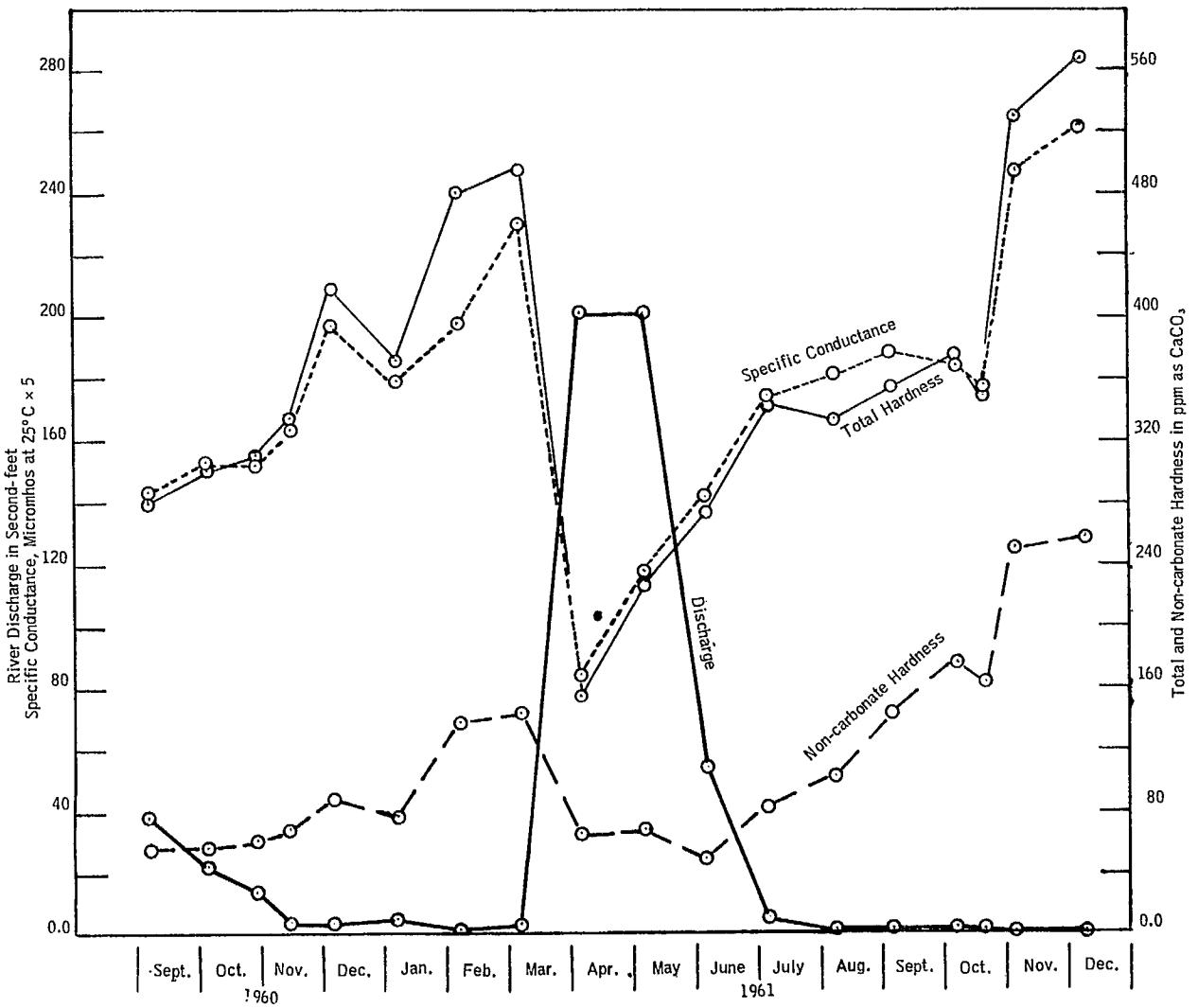

Fig. 2 Relationship belween Specific Conductance, Total Hardness, Non-carbonate Hardness and River Discharge, based on monthly samples, Pembina River at Windygates, Manitoba.

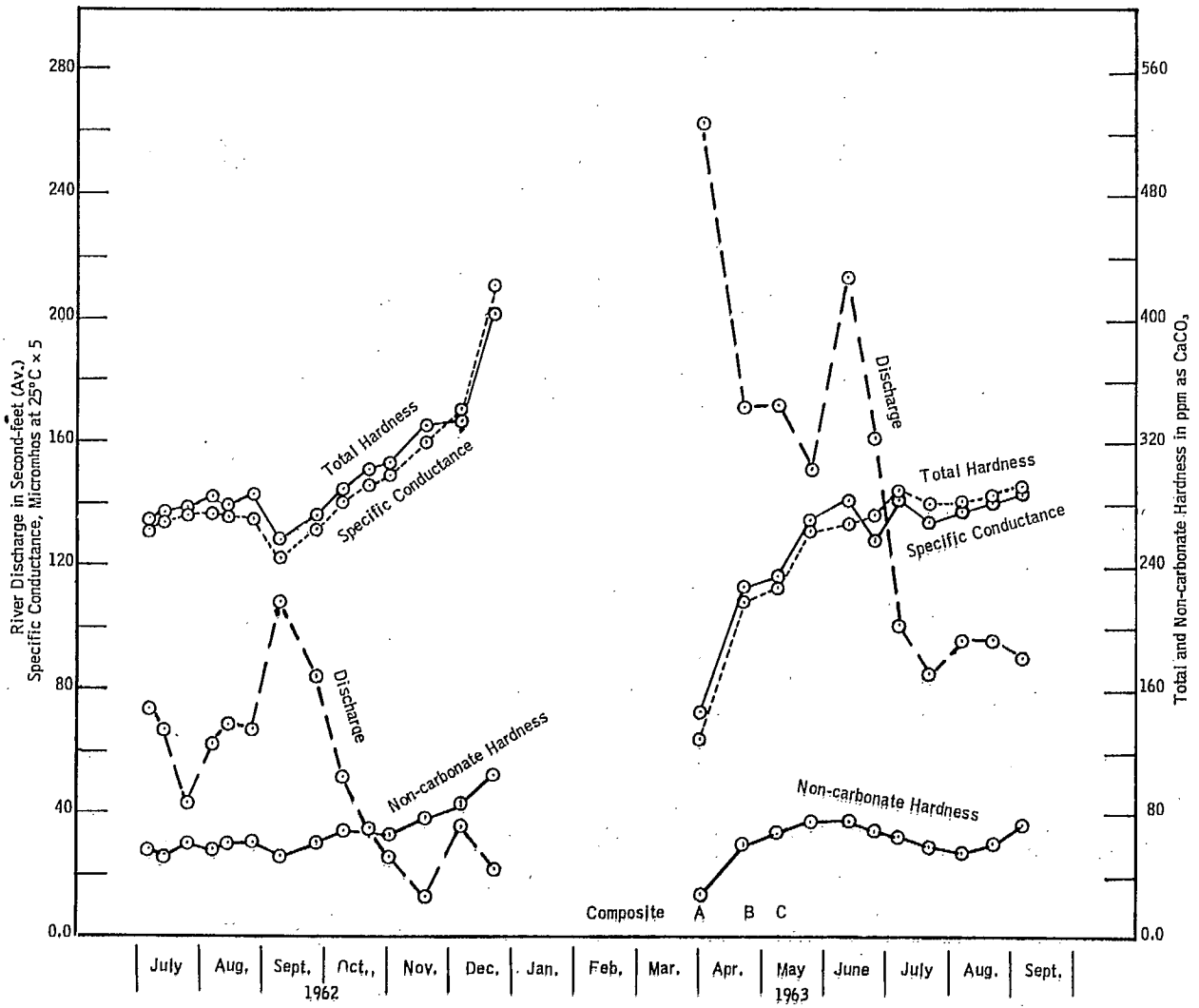

Fig. 3 Relationship between Specific Conductance, Total Hardness, Non-carbonate Hardness and River Discharge, based on composite daily samples, Pembina River at Windygates, Manitoba.
A, B and C are composite samples, prepared from daily samples (see Fig. 4)

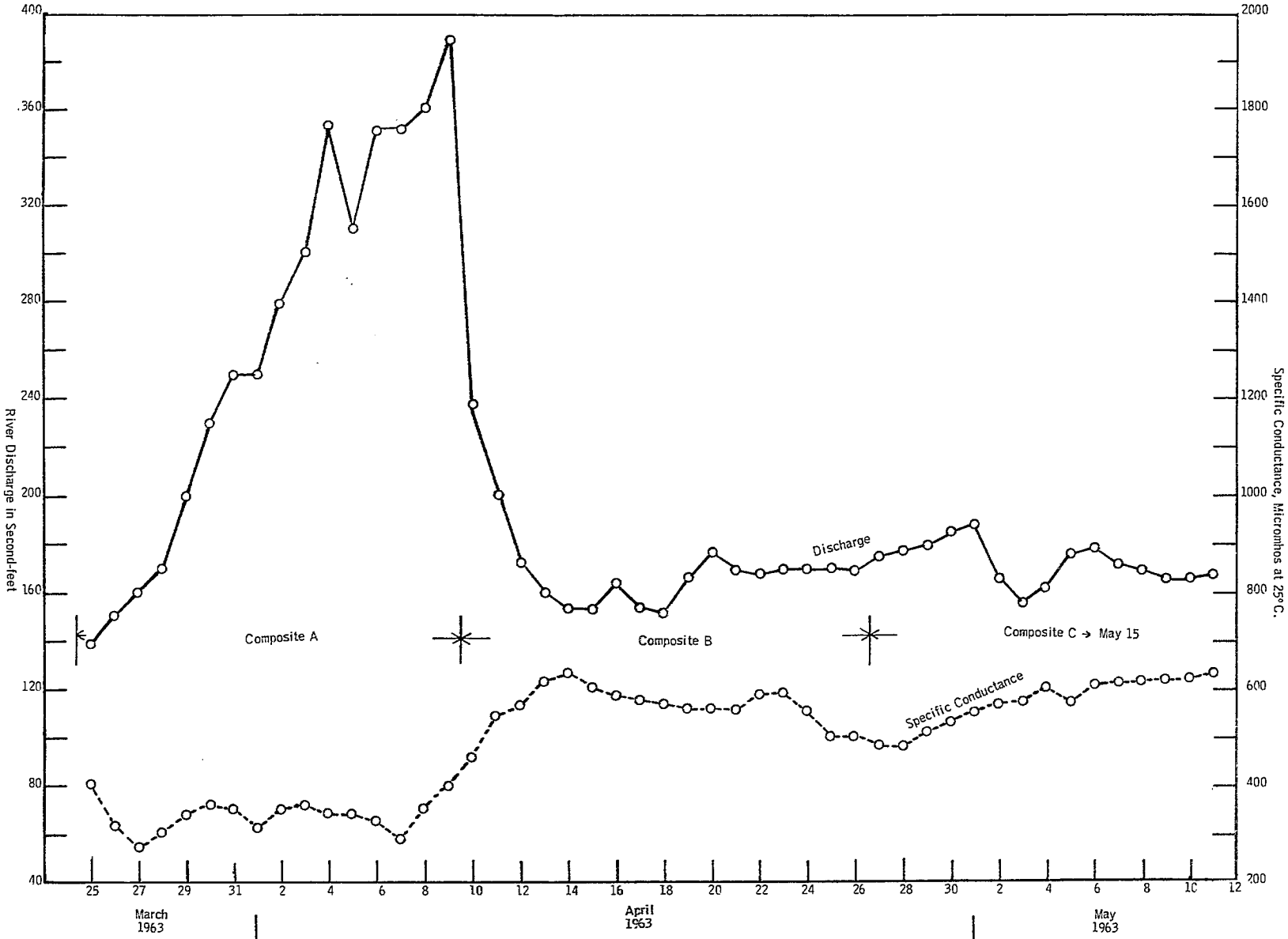

Fig. 4 Relationship between Specific Conductance and River Discharge, based on daily samples, Pembina River at Windygates, Manitoba.

Note: Composite samples A, B and C, referred to in Fig. 3, were prepared from daily samples collected between dates indicated by arrows.

Figures 5 and 6, do, however, show marked increases in specific conductance in the Red River in the latter part of each year, particularly in November and December. These increases are due to an increase in chlorides in the river water. A similar increase in chlorides was observed in samples from the Red River in November and December, 1963, the analyses of which are not included in this report. In this river specific conductance is affected more by varying chloride content throughout the year than by seasonal discharge. It appears that chlorides are entering the Red River system at about the same time each year; some of these chlorides may be entering from ground water inflow to the river during low discharge periods.

Figures 5 and 6 also show that in 1962 and again in 1963, there were two high-water periods on the Red River at Emerson, one in April and one in June. In both years, the chloride content was higher during the April high-water period than during the June period which may be significant.

Table 2 shows and Figures 7 and 8 illustrate variations in mineral content in samples collected at different points in the cross section of several rivers. In all cases, mineral content differences at each sampling location are not considered significant and samples collected at any of these points across the streams are sufficiently representative of the streams.

REFERENCES

1. F.H. Rainwater and L.L. Thatcher, "Methods for Collection and Analysis of Water Samples", Geological Survey Water - Supply Paper, 1454, Washington, U.S. Government, Printing Office, 1960.

2. J.F.J. Thomas, "The Lower St. Lawrence River Drainage Basin in Canada, 1955-60," Water Survey Report No. 13, Department of Mines and Technical Surveys, Ottawa, page 12 (1962).

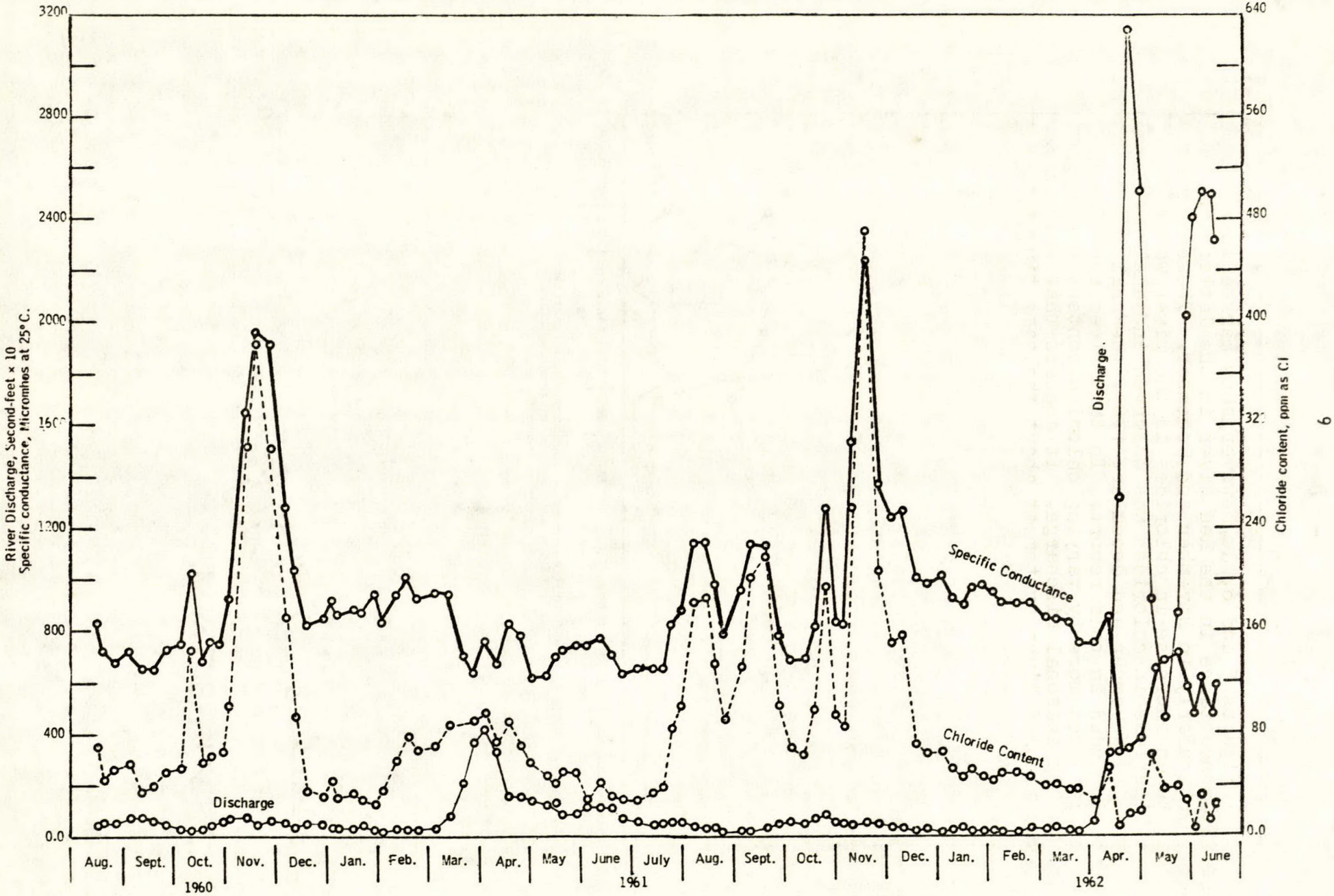

Fig. 5 Relationship between Specific Conductance, Chloride Content and River Discharge based on weekly samples
Red River at Emerson Manitoba

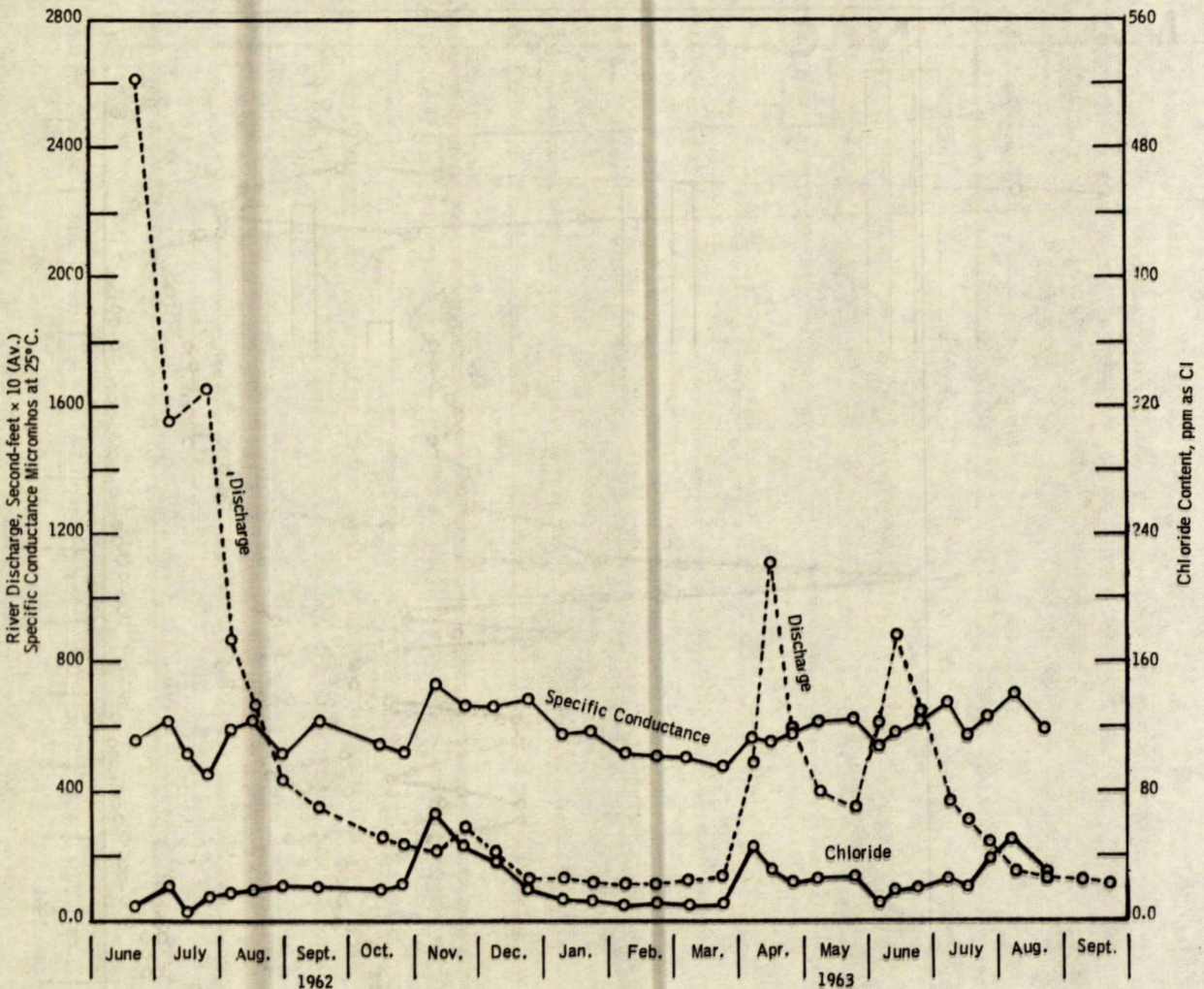

Fig.6 Relationship between Specific Conductance, Chloride Content and River Discharge, based on composite daily samples – Red River at Emerson, Manitoba.

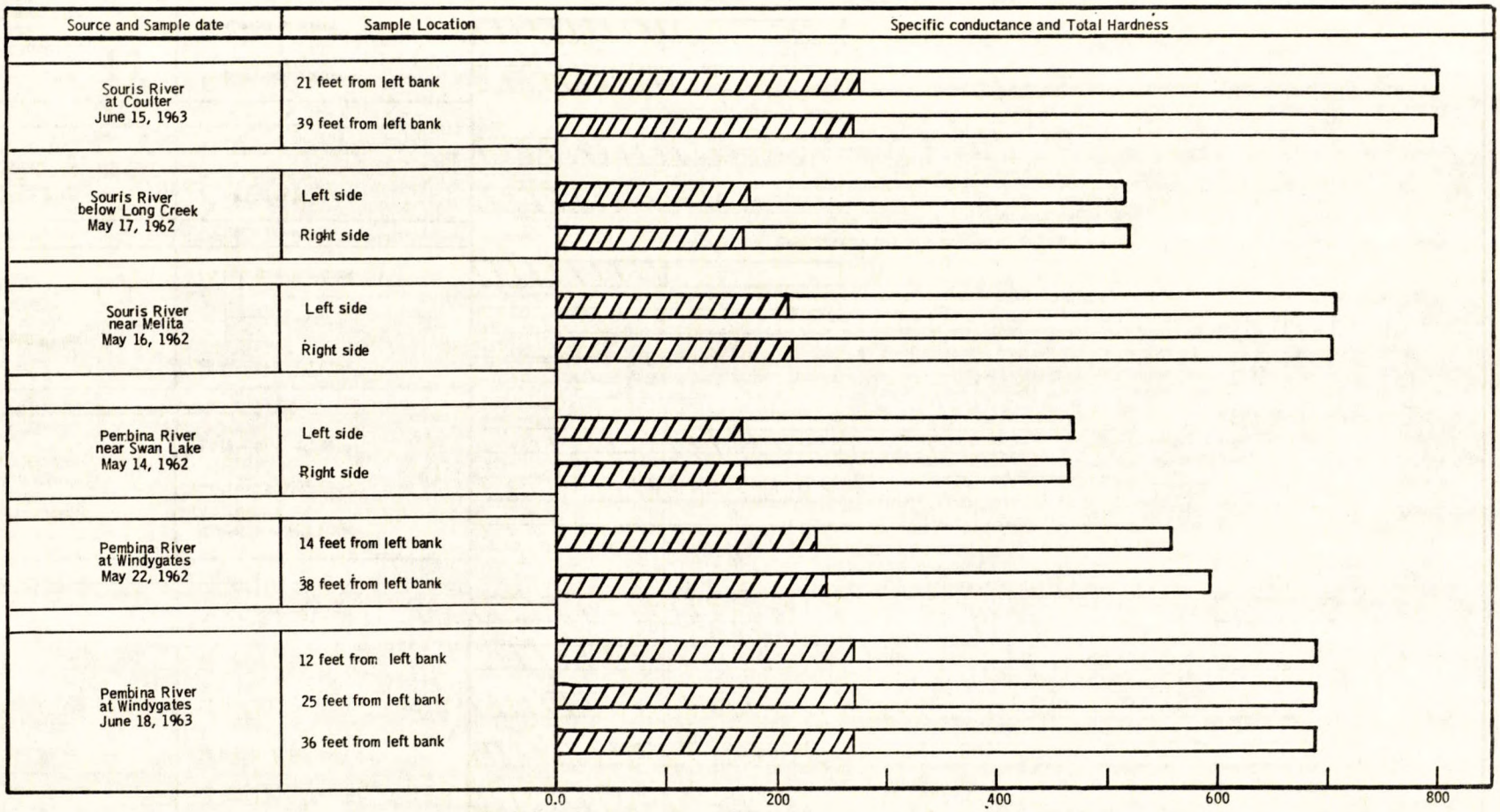

Fig. 7 Cross section sampling of the Souris and Pembina Rivers, Manitoba. Total length of bar is specific conductance in micromhos at 25°C; Hatched area of bar is total hardness in parts per million.

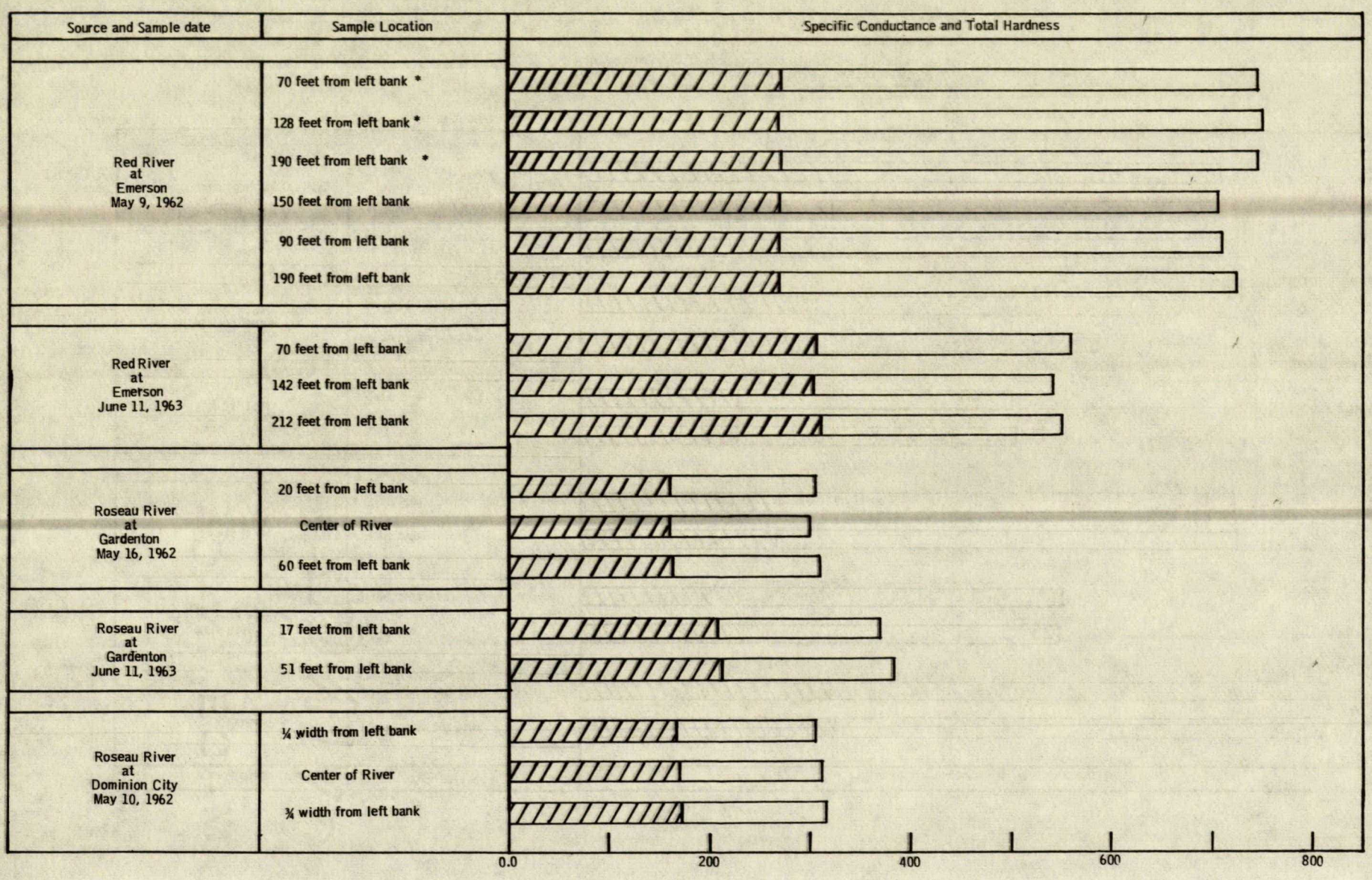

Fig. 8 Cross Section sampling of the Red and Roseau Rivers, Manitoba. Total length of bar is specific conductance in micromhos at 25° C; Hatched area of bar as total hardness in parts per million.

Note * integrated depth sampled. All other samples in figure were collected near the surface.

TABLE 1

Chemical Analyses of Surface Waters in the Souris, Pembina and Red River Drainage Systems in Canada

No.	Date of collection	Storage period (Days)	Stream discharge (Second-feet) On sampling date	Stream discharge (Second-feet) Monthly mean	Water temperature (°F.)	Oxygen consumed by $KMnO_4$	Carbon dioxide (calculated) (CO_2)	pH	Colour (Hazen) (Units)	Turbidity (Units)	Redox potential (mV)	Suspended matter Dried at 105°C.	Suspended matter Ignited at 550°C.	Residue on evaporation dried at 105°C. (Dissolved solids) P.P.M.	Residue on evaporation dried at 105°C. (Dissolved solids) Tons per acre-foot	Residue on evaporation dried at 105°C. (Dissolved solids) Tons per day	Loss on ignition at 550°C.	Specific conductance K × 10⁶ at 25°C.	Calcium (Ca)	Magnesium (Mg)
STATION NO. 1 – WHITEMUD CREEK																				
1	May 15/62	55:65	5.5	8.6	49.5	4.3	7	7.9	15	2	.....	.....	.....	1,107	1.51	16.5	227	1,362	171	70.6
2	Apr. 10/63	44:61	33.7	43.0	38	11.8	2	8.2	50	2	-419	.....	.....	.....	.....	.....	.....	568	58.6	25.4
3	Apr. 17	28:34	40.7	43.0	28	.....	12	7.5	.....	3	-421	.....	.....	.....	.....	.....	.....	772	77.4	40.9
4	Apr. 23	44:57	44.4	43.0	34	12.3	2	8.3	50	9	-417	.....	.....	.....	.....	.....	.....	726	74.2	38.0
5	Apr. 30	37:41	34.8	43.0	32	.....	6	7.9	40	3	-427	.....	.....	.....	.....	.....	.....	959	94.2	54.8
6	May 7	31:45	21.2	19.0	32	12.2	8	7.8	25	0.1	-458	.....	.....	.....	.....	.....	.....	916	96.2	49.5
7	May 14	27:34	25.1	19.0	30	.....	6	8.0	40	0.1	-438	.....	.....	.....	.....	.....	.....	1,109	119	63.5
8	May 21	20:31	16.4	19.0	28	13.3	7	8.0	40	1	-429	.....	.....	.....	.....	.....	.....	1,177	130	63.3
9	May 28	22:25	8.7	19.0	34	.....	5	8.1	35	2	-430	.....	.....	.....	.....	.....	.....	1,136	131	58.5
10	June 17	35:57	42.0	50.9	74	18.6	17	7.5	50	2	-459	.....	.....	631	0.860	71.6	92.8	879	89.4	50.2
STATION NO. 2 – BADGER CREEK																				
1	May 15/62	55:65	4.0	3.7	50.4	6.4	2	8.3	35	1	.....	.....	.....	460	0.625	5.0	166	648	68.9	31.8
2	Mar. 27/63	41:55	49.0	7.6	34	13.2	12	7.2	75	4	-432	13.1	4.2	238	0.324	31.4	79.6	341	32.6	15.2
3	Apr. 4	34:56	24.0	12.6	35	13.9	2	8.0	75	2	-413	.....	.....	263	0.358	17.0	48.0	386	39.1	18.4
4	Apr. 14	51:79	6.9	12.6	46	15.6	4	7.8	60	2	-416	.....	.....	320	0.435	6.0	56.4	446	44.1	23.2
5	Apr. 22	45:49	1.2	12.6	42	.....	7	7.7	20	1	-431	.....	.....	.....	.....	.....	.....	512	53.6	24.3
6	Apr. 29	38:53	2.2	12.6	49	13.0	7	7.7	50	7	-441	13.2	8.1	373	0.507	2.2	105	535	55.8	25.0
7	May 5	32:43	0.4	0.6	52	.....	4	8.0	50	3	-427	.....	.....	.....	.....	.....	.....	590	60.6	28.6
8	May 13	28:39	0.5	0.6	50	16.9	5	7.9	45	4	-431	9.0	3.9	439	0.596	0.59	130	630	65.8	29.1
9	May 19	22:79	0.7	0.6	55	.....	7	7.8	40	6	-434	.....	.....	.....	.....	.....	.....	685	71.0	34.1
10	June 17	70:87	4.5	37.0	74	13.1	3	8.2	50	3	-466	.....	.....	358	0.486	4.3	52.8	526	60.2	23.6

TABLE 1 (cont'd)

Chemical Analyses of Surface Waters in the Souris, Pembina and Red River Drainage Systems in Canada

Iron (Fe)		Manganese (Mn)					Alkalis									Phosphate (PO_4)				Hardness as $CaCO_3$							
Total	Dissolved	Total	Dissolved	Aluminum (Al)	Copper (Cu)	Zinc (Zn)	Sodium (Na)	Potassium (K)	Ammonia (NH_3)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulphate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Total	Dissolved	Silica (colorimetric) (SiO_2)	Boron (B)	Non-carbonate	Total	Sum of constituents	Per cent sodium	Sodium absorption ratio	Saturation index	Stability index	No.
near HOLMFIELD																											
0.25	Trace	0.09	0.00	0.09	0.00	0.00	44.0	6.8	0.0	0.0	344	518	7.5	1.3	1.4	0.4	.....	9.3	...	436	718	566	11	0.713	+1.1	5.7	1
.....	0.00	.....	0.00	0.03	.....	.....	18.3	8.8	0.0	0.0	157	154	4.9	0.29	5.7	0.4	.....	15	...	122	251	369	13	0.503	+0.6	7.0	2
.....	.....	.....	.....	.....	.....	.....	25.5	7.7	.....	0.0	229	214	4.1	.....	0.2	.....	.....	17	...	169	357	499	13	0.587	+0.2	7.1	3
.....	0.00	.....	0.00	0.06	.....	.....	24.8	7.2	0.0	0.0	242	186	3.7	0.37	2.0	.....	.....	14	...	143	342	469	13	0.585	+1.0	6.3	4
.....	.....	.....	.....	.....	.....	.....	34.0	7.4	.....	0.0	296	287	4.4	.....	0.3	.....	.....	4.4	...	218	461	632	14	0.690	+0.8	6.3	5
.....	0.00	.....	0.00	0.10	.....	.....	36.0	7.0	0.0	0.0	327	244	3.8	0.45	0.0	.....	.....	2.7	...	176	444	600	15	0.744	+0.7	6.4	6
.....	.....	.....	.....	.....	.....	.....	41.0	7.4	.....	0.0	264	335	6.2	.....	0.2	.....	.....	7.0	...	260	558	758	14	0.756	+1.1	5.8	7
.....	.....	.....	.....	.....	.....	.....	51.0	7.4	0.0	0.0	398	353	6.8	0.62	0.1	.....	.....	3.6	...	258	584	811	16	0.920	+1.1	5.8	8
.....	.....	.....	.....	.....	.....	.....	40.5	7.3	.....	0.0	406	315	6.3	.....	0.0	.....	.....	7.9	...	235	568	766	13	0.740	+1.2	5.7	9
0.26	0.00	0.21	0.00	0.12	0.005	0.00	29.4	7.1	0.0	0.0	344	201	3.1	0.38	0.3	0.3	.....	16	...	147	430	566	13	0.617	+0.4	6.7	10
near CARTWRIGHT																											
0.10	Trace	0.00	0.00	0.00	0.00	0.00	20.0	6.9	0.0	0.0	222	155	8.1	0.35	1.6	0.2	.....	12	...	121	303	414	12	0.500	+0.9	6.5	1
.....	0.04	.....	0.00	0.02	.....	0.00	7.8	9.1	0.1	0.0	118	61.8	2.6	0.26	6.9	1.2	.....	11	...	47.2	144	207	9.8	0.283	−0.7	8.6	2
.....	0.02	.....	0.00	0.01	.....	0.0	8.2	8.7	0.0	0.0	144	69.5	3.0	0.26	4.5	<0.1	.....	14	...	54.8	173	234	8.8	0.271	+0.2	7.6	3
.....	0.01	.....	0.00	0.08	.....	.....	12.0	8.6	0.0	0.0	148	97.9	2.8	0.29	9.0	0.5	.....	18	...	77.1	198	289	11	0.372	+0.1	7.6	4
.....	.....	.....	.....	.....	.....	.....	13.5	9.1	.....	0.0	188	104	4.0	.....	3.3	.....	.....	15	...	79.7	234	319	11	0.384	+0.2	7.3	5
.....	.....	.....	.....	.....	.....	.....	15.0	8.6	.....	0.0	195	107	6.2	0.28	2.0	0.3	.....	12	...	82.3	242	328	11	4.200	+0.2	7.3	6
.....	.....	.....	.....	.....	.....	.....	18.0	8.8	.....	0.0	219	120	6.3	.....	1.4	.....	.....	9.7	...	89.8	269	361	12	0.477	+0.6	6.8	7
.....	0.00	.....	0.00	0.04	.....	.....	20.0	9.0	0.0	0.0	239	128	7.8	0.31	1.4	0.28	.....	9.1	...	88.1	284	389	13	0.517	+0.5	6.9	8
.....	.....	.....	.....	.....	.....	.....	22.0	9.4	.....	0.0	263	139	8.9	.....	0.9	.....	.....	8.7	...	102	318	423	13	0.337	+0.5	6.8	9
.....	.....	.....	0.00	0.07	.....	0.00	14.6	6.2	.....	0.0	232	83.3	3.7	0.26	1.1	0.5	.....	21	...	57.6	248	329	11	0.404	+0.8	6.6	10

TABLE 1 (cont'd)

Chemical Analyses of Surface Waters in the Souris, Pembina and Red RiverDrainage Systems in Canada

No.	Date of collection	Storage period (Days)	Stream discharge (Second-feet): On sampling date	Stream discharge (Second-feet): Monthly mean	Water temperature (°F.)	Oxygen consumed by $KMnO_4$	Carbon dioxide (calculated) (CO_2)	pH	Colour (Hazen) (Units)	Turbidity (Units)	Redox potential (mV)	Suspended matter: Dried at 105°C.	Suspended matter: Ignited at 550°C.	Residue on evaporation dried at 105°C. (Dissolved solids): P.P.M.	Residue on evaporation dried at 105°C. (Dissolved solids): Tons per acre-foot	Residue on evaporation dried at 105°C. (Dissolved solids): Tons per day	Loss on ignition at 550°C.	Specific conductance $K \times 10^6$ at 25°C.	Calcium (Ca)	Magnesium (Mg)
STATION NO. 3 – LONG RIVER																				
1	May 21/62	73:106	0.5	0.6	59	.....	5	7.8	25	.....	.....	.....	.....	.....	.....	.....	.....	680	65.3	25.0
2	Apr. 5/63	40:46	3.2	5.5	38	12.4	13	7.2	50	5	-448	17.2	6.1	209	0.284	1.8	68.4	336	31.4	12.2
3	Apr. 12	33:39	4.0	5.5	44	.....	7	7.5	50	1	-447	.....	.....	.....	.....	.....	.....	363	34.3	12.9
4	Apr. 19	46:74	20.7	5.5	44	14.4	5	7.7	50	2	-422	.....	.....	303	0.412	16.9	62.4	444	40.6	17.6
5	Apr. 26	41:45	1.7	5.5	52	.....	6	7.8	35	2	-442	.....	.....	.....	.....	.....	.....	515	48.0	19.1
6	May 3	35:49	0.7	0.6	58	12.3	3	8.2	30	3	-446	11.0	5.0	427	0.580	0.80	130	628	62.6	23.3
7	May 9	29:39	0.6	0.6	55	.....	7	7.8	30	2	-443	.....	.....	.....	.....	.....	.....	668	68.0	26.8
8	May 16	25:36	0.6	0.6	64	13.6	6	7.9	40	2	-427	.....	.....	482	0.655	0.78	338	708	74.2	27.6
9	May 23	27:34	0.4	0.6	62	.....	7	7.9	40	1.5	-438	.....	.....	.....	.....	.....	.....	817	82.8	30.2
10	June 17	35:57	16.1	76.0	68	10.3	4	7.9	50	11	-448	19.5	12.4	383	0.520	16.6	66.4	470	49.6	17.4
STATION NO. 4 – CRYSTAL CREEK																				
1	May 14/62	56:65	0.7	0.7	54	6.2	6	7.7	25	4	.....	11.2	6.7	581	0.790	1.1	101	811	53.4	22.4
2	Apr. 1/63	36:42	3.4	0.7	38	15.5	3	7.8	90	9	-412	.....	.....	.....	.....	.....	.....	366	22.3	10.3
3	Apr. 8	37:43	0.2	0.7	44	.....	4	7.7	90	10	-437	.....	.....	.....	.....	.....	.....	385	22.8	11.5
4	Apr. 15	50:78	1.1	0.7	44	17.0	2	8.1	90	7	-407	.....	.....	.....	.....	.....	.....	473	28.2	13.6
5	Apr. 22	44:49	0.0	0.7	42	.....	13	7.3	70	5	-432	.....	.....	.....	.....	.....	.....	517	31.8	14.6
6	Apr. 29	39:53	0.0	0.0	54	16.3	3	7.9	65	6	-471	.....	.....	.....	.....	.....	.....	522	32.1	14.6
7	May 6	32:42	0.0	0.0	51	.....	7	7.6	60	5	-484	.....	.....	.....	.....	.....	.....	543	33.7	15.3
8	May 13	25:39	0.0	0.0	50	17.0	4	7.9	55	2	-426	.....	.....	.....	.....	.....	.....	580	36.1	16.6
9	May 20	21:28	0.0	0.0	45	.....	11	7.5	50	7	-449	.....	.....	.....	.....	.....	.....	619	38.3	17.8
10	June 17	35:57	0.0	0.0	74	22.3	3	8.2	30	4	-429	11.1	5.4	631	0.860	0.0	67	931	51.9	25.2

TABLE 1 (cont'd)

Chemical Analyses of Surface Waters in the Souris, Pembina and Red River Drainage Systems in Canada

Iron (Fe)		Manganese (Mn)					Alkalis									Phosphate (PO_4)				Hardness as $CaCO_3$						
Total	Dissolved	Total	Dissolved	Aluminum (Al)	Copper (Cu)	Zinc (Zn)	Sodium (Na)	Potassium (K)	Ammonia (NH_3)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulphate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Total	Dissolved	Silica (colorimetric) (SiO_2)	Boron (B)	Non-carbonate	Total	Sum of constituents	Per cent sodium	Sodium absorption ratio	Saturation index	Stability index	No.
near CLEARWATER																											
0.05	0.00	.....	0.00	0.01	0.00	0.00	47.2	8.8	0.1	0.0	214	175	19.7	0.35	0.1	0.5	.....	18	...	90.4	266	465	27	1.259	+0.4	7.0	1
.....	0.02	.....	0.00	Trace	.....	.....	15.0	9.6	.....	0.0	128	48.2	6.6	0.23	6.0	.....	.....	12	...	23.9	129	204	19	0.575	−0.7	8.6	2
.....	.....	.....	.....	.....	.....	.....	15.7	9.1	.....	0.0	142	52.6	7.1	.....	4.2	.....	.....	11	...	21.9	139	217	19	0.581	−0.4	8.3	3
.....	0.01	.....	0.00	0.02	.....	.....	23.0	9.1	0.0	0.0	170	74.2	7.9	0.27	9.8	0.8	.....	15	...	34.2	174	282	21	0.760	0.0	7.7	4
.....	.....	.....	.....	.....	.....	.....	26.5	9.6	.....	0.0	200	80.6	10.2	.....	3.0	.....	.....	9.9	...	34.4	199	305	22	0.818	+0.3	7.2	5
.....	0.10	.....	0.00	0.04	.....	.....	33.5	10.2	0.0	0.0	252	104	13.5	0.30	2.0	0.6	.....	12	...	45.5	252	386	22	0.919	+0.9	6.4	6
.....	.....	.....	.....	.....	.....	.....	37.2	10.0	.....	0.0	285	113	14.1	.....	1.3	.....	.....	14	...	46.0	280	424	22	0.968	+0.5	6.8	7
.....	0.01	.....	0.00	0.10	.....	.....	37.2	9.6	0.0	0.0	302	117	15.1	0.31	0.8	0.6	.....	11	...	41.0	299	443	21	0.936	+0.7	6.5	8
.....	.....	.....	.....	.....	.....	.....	48.0	10.0	.....	0.0	340	146	15.9	.....	0.7	.....	.....	11	...	52.7	331	511	23	1.147	+0.8	6.3	9
0.45	Trace	0.13	0.00	0.04	0.00	0.00	23.5	7.5	0.0	0.0	212	69.4	6.5	0.23	1.8	0.8	.....	27	...	22.0	196	307	20	0.732	+0.4	7.1	10
near CRYSTAL CITY																											
0.20	Trace	0.12	0.00	0.03	0.00	0.00	86.0	10.0	0.0	0.0	186	222	33.8	0.43	1.9	0.4	.....	19	...	73.0	226	541	44	2.491	+0.1	7.5	1
.....	0.01	.....	0.00	0.00	.....	0.00	29.5	11.5	0.2	0.0	106	65.0	13.4	0.26	2.2	0.6	.....	14	...	11.2	98.3	221	36	1.295	−0.4	8.6	2
.....	.....	.....	.....	.....	.....	.....	32.5	11.5	.....	0.0	115	69.7	15.7	.....	0.8	.....	.....	12	...	9.8	104	233	37	1.383	−0.4	8.5	3
.....	0.00	.....	0.00	0.04	.....	.....	45.0	12.5	0.0	0.0	141	85.7	20.5	0.30	6.6	0.9	.....	17	...	11.0	127	300	41	1.740	+0.2	7.7	4
.....	.....	.....	.....	.....	.....	.....	50.0	12.0	.....	0.0	160	94.4	24.2	.....	1.6	.....	.....	16	...	8.5	140	323	41	1.843	−0.5	8.3	5
.....	0.01	.....	0.00	0.01	.....	.....	50.0	12.5	0.0	0.0	163	92.6	24.4	0.27	1.1	.....	.....	14	...	6.4	140	322	41	1.835	+0.1	7.7	6
.....	.....	.....	.....	.....	.....	.....	50.0	12.5	.....	0.0	171	91.6	24.8	.....	1.2	.....	.....	13	...	6.4	147	327	40	1.796	−0.2	8.0	7
.....	0.00	.....	0.00	0.00	.....	.....	55.0	13.0	0.0	0.0	192	93.2	26.6	0.31	1.5	.....	.....	14	...	0.7	159	351	41	1.902	+0.2	7.5	8
.....	.....	.....	.....	.....	.....	.....	58.5	14.0	.....	0.0	207	96.1	29.1	.....	0.3	.....	.....	13	...	0.0	169	329	41	1.961	−0.1	7.7	9
0.30	Trace	0.37	0.00	0.06	0.009	0.00	114	11.7	0.1	0.0	307	154	62.5	0.38	1.8	1.5	.....	20	...	0.0	233	592	50	3.236	+0.8	6.6	10

TABLE 1 (cont'd)

Chemical Analyses of Surface Waters in the Souris, Pembina and Red River Drainage Systems in Canada

No.	Date of collection	Storage period (Days)	Stream discharge (Second-feet) On sampling date	Stream discharge (Second-feet) Monthly mean	Water temperature (°F.)	Oxygen consumed by $KMnO_4$	Carbon dioxide (calculated) (CO_2)	pH	Colour (Hazen) (Units)	Turbidity (Units)	Redox potential (mV)	Suspended matter Dried at 105°C.	Suspended matter Ignited at 550°C.	Residue on evaporation dried at 105°C. (Dissolved solids) P.P.M.	Residue on evaporation dried at 105°C. (Dissolved solids) Tons per acre-foot	Residue on evaporation dried at 105°C. (Dissolved solids) Tons per day	Loss on ignition at 550°C.	Specific conductance $K \times 10^6$ at 25°C.	Calcium (Ca)	Magnesium (Mg)
																		STATION NO. 5 – PEMBINA RIVER		
1	May 15/62	56:76	0.8	7.8	52	6.4	8	7.9	35	0.4	.....	.....	.....	1,495	2.03	3.2	276	1,751	182	87.1
2	June 26	72:91	5.8	42.0	72	11.5	18	7.6	50	4	.....	17.2	13.4	876	1.19	13.7	191	1,200	106	51.3
3	July 30	38:48	1.2	1.3	64	.....	13	7.8	30	2	.....	.....	.....	.....	.....	.....	.....	1,425	126	65.8
4	Aug. 28	21:28	0.4	1.1	62	.....	10	7.6	40	3	.....	.....	.....	.....	.....	.....	.....	980	97.8	44.5
5	Oct. 1	16:58	0.0	0.0	58	8.0	9	7.9	35	0	.....	.....	.....	1,384	1.88	0.0	438	1,510	143	75.2
6	Oct. 30	31:43	0.0	0.0	38	.....	4	8.2	20	0.0	.....	.....	.....	.....	.....	.....	.....	1,747	189	96.4
7	Mar. 21/63	53:61	16.2	17.4	34	19.7	4	7.7	70	20	−446	38.2	8.3	324	0.440	14.1	121	453	39.0	18.8
8	Apr. 6	37:45	74	29.2	37	.....	23	7.2	60	4	−454	.....	.....	.....	.....	.....	.....	1,232	53.0	26.7
9	May 7	36:56	18.8	18.5	60	.....	4	8.2	40	15	−425	.....	.....	.....	.....	.....	.....	276	108	56.3
10	June 5	16:57	236	41.0	68	19.7	7	7.7	90	45	−442	54.5	44.9	490	0.666	311	92	622	48.6	25.7
11	June 17	35:91	17.3	41.0	74	18.7	3	8.4 (8.3)	70	15	−434	42.1	32.7	731	0.995	34.1	210	895	89.8	50.7
12	July 9	59:69	0.3	1.1	79	.....	6	8.1	50	6	−491	.....	.....	.....	.....	.....	.....	1,175	101	54.4
13	Aug. 6	98:100	0.6	0.4	74	.....	5	8.2	35	6	−452	.....	.....	.....	.....	.....	.....	1,390	108	64.5
14	Sept. 12	64:74	0.3	0.2	68	7.7	9	7.8	25	2.6	−475	.....	.....	1,332	1.81	1.1	262	1,604	144	91.8

TABLE 1 (cont'd)

Chemical Analyses of Surface Waters in the
Souris, Pembina and Red River Drainage Systems in Canada

Iron (Fe)		Manganese (Mn)					Alkalis									Phosphate (PO_4)				Hardness as $CaCO_3$						
Total	Dissolved	Total	Dissolved	Aluminum (Al)	Copper (Cu)	Zinc (Zn)	Sodium (Na)	Potassium (K)	Ammonia (NH_3)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulphate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Total	Dissolved	Silica (colorimetric) (SiO_2)	Boron (B)	Non-carbonate	Total	Sum of constituents	Per cent sodium	Sodium absorption ratio	Saturation index	Stability index	No.
near KILLARNEY																											
.....	0.02	0.02	0.00	0.07	Trace	0.00	108	7.6	0.0	0.0	368	714	10.4	1.3	1.8	0.3	.....	19	....	512	814	1,313	22	.....	+1.1	5.7	1
.....	Trace	0.00	0.00	0.03	.....	0.00	89.5	6.5	0.0	0.0	420	313	9.6	0.65	0.2	1.1	.....	24	....	132	477	809	29	1.783	+0.6	6.4	2
.....	.....	.....	.....	.....	.....	.....	110	5.5	0.4	0.0	456	431	10.2	.....	1.4	.....	.....	8.2	0.14	212	586	983	29	1.977	+0.9	6.0	3
.....	.....	.....	.....	.....	.....	.....	49.5	7.5	0.1	0.0	237	328	6.3	.....	1.9	.....	.....	17	....	233	427	669	20	0.809	+0.4	6.8	4
.....	0.00	.....	0.00	0.14	.....	.....	91.0	10.0	0.0	0.0	440	488	12.1	1.5	0.7	<0.1	.....	3.1	....	305	666	1,041	23	1.534	+1.1	5.7	5
.....	.....	.....	.....	.....	.....	.....	103	8.5	.....	0.0	380	759	13.8	.....	1.1	.....	.....	12	....	558	870	1,370	20	1.487	+1.4	5.4	6
.....	0.03	....	0.00	0.03	.....	.....	21.5	12.0	0.1	0.0	113	121	3.2	0.29	10	.....	.....	8.6	0.06	87.3	180	290	20	0.708	−0.2	8.1	7
.....	.....	.....	.....	.....	.....	.....	53.6	9.3	.....	0.0	201	191	6.0	.....	3.5	.....	.....	17	....	77.1	242	458	32	1.499	−0.4	8.0	8
.....	.....	.....	.....	.....	.....	.....	97.0	7.9	.....	0.0	412	366	7.7	.....	2.9	.....	.....	18	....	163	500	867	29	1.887	+1.2	5.8	9
.....	0.09	.....	0.00	0.15	.....	.....	59.0	6.6	.....	0.0	224	169	2.4	0.27	2.0	0.7	.....	24	....	43.1	227	448	35	1.705	+0.2	7.3	10
.....	0.01	.....	0.00	0.09	0.03	.....	67.5	6.3	0.0	11.4	426	207	5.0	0.50	1.0	0.5	.....	19	....	64.2	433	668	25	1.412	+1.4	5.6	11
.....	.....	.....	.....	.....	.....	.....	89.5	7.0	.....	0.0	470	276	7.0	.....	2.0	.....	.....	17	....	90.2	476	786	29	1.786	−1.2	5.7	12
.....	.....	.....	.....	.....	.....	.....	102	8.6	.....	0.0	478	406	9.5	.....	3.9	.....	.....	15	....	192	584	952	27	.....	+1.3	5.6	13
.....	0.01	.....	0.00	0.15	.....	.....	96.0	10.6	0.1	0.0	375	617	10.0	0.18	4.3	0.6	.....	14	....	431	739	1,173	22	1.540	+0.9	6.0	14

TABLE 1 (cont'd)

Chemical Analyses of Surface Waters in the
Souris, Pembina and Red River Drainage Systems in Canada

No.	Date of collection	Storage period (Days)	Stream discharge (Second-feet) On sampling date	Stream discharge (Second-feet) Monthly mean	Water temperature (°F.)	Oxygen consumed by $KMnO_4$	Carbon dioxide (calculated) (CO_2)	pH	Colour (Hazen) (Units)	Turbidity (Units)	Redox potential (mV)	Suspended matter Dried at 105°C.	Suspended matter Ignited at 550°C.	Residue on evaporation dried at 105°C. (Dissolved solids) P.P.M.	Residue on evaporation dried at 105°C. (Dissolved solids) Tons per acre-foot	Residue on evaporation dried at 105°C. (Dissolved solids) Tons per day	Loss on ignition at 550°C.	Specific conductance $K \times 10^6$ at 25°C.	Calcium (Ca)	Magnesium (Mg)
														STATION NO. 6 – PEMBINA RIVER						
1	May 14/62	57:67	.....	.....	51.6	6.7	.....	7.5	25	8	.....	22.3	12.8	308	.....	.....	64.8	463	36.1	19.4
2	May 14	57	.....	.....	51.6	.....	18	7.1	.....	.....	.....	.....	.....	.....	.....	.....	.....	467	.....	.....
3	June 29	68:75	110	133	72	7.5	2	8.2	35	1	.....	.....	.....	440	0.598	130	95	627	48.6	29.0
4	July 3	64:66	105	92.0	70	.....	8	7.7	40	0	.....	.....	.....	.....	.....	.....	.....	639	48.9	30.9
5	July 11	Sample broken in shipment			69															
6	July 18	49:51	88.0	92.0	68	7.7	13	7.5	35	2	.....	.....	.....	474	0.645	112	91	673	51.2	32.5
7	July 25	43:48	87.0	92.0	66	.....	20	7.3	30	0.8	.....	.....	.....	.....	.....	.....	.....	679	49.9	33.5
8	Aug. 1	36:41	81.0	92.0	64	.....	8.1	7.7	25	0	.....	.....	.....	.....	.....	.....	.....	692	52.0	33.2
9	Aug. 8	30:34	98.0	92.0	64	7.5	6	7.8	30	4	.....	10.9	5.3	468	0.636	124	112	809	40.7	33.6
10	Aug. 15	23:27	84.0	92.0	65	.....	11	7.5	30	1	.....	.....	.....	.....	.....	.....	.....	646	42.5	32.0
11	Aug. 22	27:34	76.0	92.0	70	.....	23	7.4	30	0.7	.....	.....	.....	.....	.....	.....	.....	680	45.8	33.8
12	Aug. 29	20:27	98.0	92.0	59	9.8	7	7.7	45	4	.....	15.4	9.0	453	0.615	120	88	641	46.6	30.5
13	Sept. 5	20:42	82.0	59.0	55	.....	18	7.3	40	10	.....	.....	.....	.....	.....	.....	.....	676	64.6	23.1
14	Sept. 12	13:35	74.0	59.0	55	.....	12	7.5	35	8	.....	.....	.....	.....	.....	.....	.....	679	45.8	34.5
15	Sept. 19	16:33	49.0	59.0	52	10.8	16	7.4	40	15	.....	32.4	14.4	503	0.684	66.3	125	694	47.0	36.5
16	Sept. 27	9:21	33.0	59.0	54	.....	13	7.5	35	15	.....	.....	.....	.....	.....	.....	.....	706	47.8	36.0
17	Oct. 3	21:34	57.5	40.1	53	.....	14	7.5	30	15	.....	.....	.....	.....	.....	.....	.....	726	52.6	34.8
18	Oct. 10	14:61	43.0	40.1	54	10.3	16	7.4	25	9	.....	17.4	9.1	512	0.695	59.3	170	737	53.0	37.2
19	Oct. 17	36:42	36.0	40.1	45	.....	14	7.5	25	10	.....	.....	.....	.....	.....	.....	.....	733	52.6	37.6
20	Oct. 24	29:35	32.5	40.1	40	.....	7	7.8	30	15	.....	.....	.....	.....	.....	.....	.....	723	54.6	37.1
21	Oct. 31	30:82	26.0	40.1	40	9.6	3	8.1	30	15	.....	20.7	17.2	531	0.722	37.2	119	737	54.6	37.7
22	Nov. 7	23:35	27.0	24.5	35	.....	5	7.9	25	8	.....	.....	.....	.....	.....	.....	.....	749	56.4	38.8
23	Nov. 14	20:32	22.5	24.5	37	.....	7	7.8	25	10	.....	.....	.....	.....	.....	.....	.....	758	55.2	38.7
24	Nov. 21	71:92	24.0	24.5	34	7.8	7	7.8	20	8	.....	47.6	41.7	550	0.748	35.6	141	796	58.1	39.4
25	Nov. 28	40:42	27.0	24.5	36	.....	7	8.0	25	7	.....	.....	.....	.....	.....	.....	.....	798	58.2	40.7
26	Dec. 5	33:35	32.0	30.0	33	.....	5	8.1	25	6	.....	.....	.....	.....	.....	.....	.....	830	59.8	43.6
27	Dec. 12	27:83	21.0	30.0	33	10.7	5	8.0	30	5	.....	10.1	4.5	643	0.875	36.4	134	890	69.3	47.8
28	Dec. 20	19:25	27.0	30.0	34	.....	5	8.0	30	6	.....	.....	.....	.....	.....	.....	.....	941	72.3	48.7
29	Dec. 26	43:69	32.5	30.0	33	.....	7	8.0	30	3	.....	.....	.....	.....	.....	.....	.....	1,016	80.0	53.0
30	Jan. 2/63	36:84	27.0	20.0	34	11.4	8	7.9	30	3	.....	.....	.....	782	1.063	56.9	176	1,048	84.6	55.5
31	Jan. 9	33:61	26.0	20.0	32	.....	9	7.9	35	3	.....	.....	.....	.....	.....	.....	.....	1,145	91.7	57.1
32	Jan. 17	25:63	19.0	20.0	32	.....	9	8.0	35	10	.....	.....	.....	.....	.....	.....	.....	1,319	103	73.6
33	Jan. 23	22:70	18.5	20.0	32	19.6	7	8.2	50	5	.....	17.5	11.8	1,229	1.67	61.3	304	1,556	130	89.3
34	Jan. 30	15:40	10.0	20.0	32	.....	19	7.8	50	5	.....	.....	.....	.....	.....	.....	.....	1,798	156	110
35	Feb. 6	22:47	10.4	4.3	33	.....	27	7.7	45	5	.....	.....	.....	.....	.....	.....	.....	2,068	177	121
36	Feb. 15	13:38	2.0	4.3	33	.....	.....	7.7	50	7	.....	.....	.....	.....	.....	.....	.....	2,204	192	127
37	Feb. 20	33:35	0.0	4.3	33	25.7	31	7.7	50	8	-384	23.3	15.3	1,878	2.55	0.0	474	2,326	205	138
38	Feb. 27	49:55	.....	4.3	34	.....	20	7.9	50	15	-407	.....	.....	.....	.....	.....	.....	2,347	189	147
39	Mar. 6	42:48	.....	8.7	34	.....	53	7.5	50	15	-418	.....	.....	.....	.....	.....	.....	2,538	229	151
40	Mar. 14	34:40	.....	8.7	33	.....	55	7.5	50	20	-422	.....	.....	.....	.....	.....	.....	2,651	239	160
41	Mar. 20	33:42	2.0	8.7	35	7.4	8	7.1	90	60	-451	79.8	61.8	164	0.233	0.92	60.8	192	18.8	6.1
42	Mar. 26	27:41	25.0	8.7	35	.....	10	7.3	60	45	-460	.....	.....	.....	.....	.....	.....	304	29.8	11.4
43	Apr. 3	42:56	59.0	106	35	.....	7	7.9	20	7	-419	.....	.....	.....	.....	.....	.....	818	70.8	43.2
44	Apr. 10	45:59	75.0	106	36	7.1	2	8.3	10	4	-412	9.7	5.5	358	0.486	72.3	55.2	528	43.4	25.7
45	Apr. 18	27:35	120	106	.....	.....	5	7.6	15	6	-430	.....	.....	.....	.....	.....	.....	366	27.1	17.2
46	Apr. 23	22:30	151	106	.....	.....	6	7.7	15	4	-434	.....	.....	.....	.....	.....	.....	512	38.3	26.3
47	May 1	41:56	186	152	48	6.9	5	7.8	20	10	-451	11.6	3.9	406	0.553	204	92.0	572	43.1	27.3
48	May 8	36:58	174	152	58	.....	7	7.7	20	15	-434	.....	.....	.....	.....	.....	.....	593	45.7	28.5
49	May 15	26:42	167	152	54	.....	4	7.9	20	8	-434	.....	.....	.....	.....	.....	.....	638	49.7	31.4
50	May 22	27:58	133	152	45	10.1	4	7.9	15	8	-444	12.5	7.4	435	0.591	156	92.0	646	49.7	31.8
51	May 29	23:69	98.0	152	60	.....	6	7.8	20	7	-438	.....	.....	.....	.....	.....	.....	649	69.3	22.7
52	June 5	16:64	133	120	69	.....	3	8.1	35	15	-437	.....	.....	.....	.....	.....	.....	640	58.7	29.9
53	June 13	113:118	128	120	59	8.1	3	8.1	20	15	-506	24.8	18.3	456	0.620	157	105	664	54.0	32.0
54	June 18	69:86	121	120	69	10	15	7.4	20	2	-506	.....	.....	456	0.620	149	115	683	55.5	32.8
55	June 19	77:79	117	120	71	.....	3	8.2	25	7	-497	.....	.....	.....	.....	.....	.....	678	54.8	32.2
56	June 25	90:93	133	120	69	.....	7	7.7	20	3	-508	.....	.....	.....	.....	.....	.....	670	54.6	30.9
57	July 3	82:85	104	76.0	67	9.3	16	7.4	30	0.9	-431	.....	.....	468	0.636	129	126	688	55.0	32.6
58	July 10	125:127	83.0	76.0	67	.....	3	8.2	30	2	-462	.....	.....	.....	.....	.....	.....	659	55.2	33.7
59	July 18	117:119	62.0	76.0	67	.....	8	7.7	25	2	-472	.....	.....	.....	.....	.....	.....	675	55.5	33.8
60	July 24	63:103	64.0	76.0	75	8.5	4	8.0	25	3	-496	.....	.....	493	0.670	84.9	122	708	55.2	35.5
61	July 31	104:106	82.0	76.0	70	.....	5	7.9	25	4	-462	.....	.....	.....	.....	.....	.....	667	52.1	32.5
62	Aug. 7	98:103	98.0	86.6	73	.....	3	8.2	25	4	-452	.....	.....	.....	.....	.....	.....	682	53.9	33.3
63	Aug. 14	91:96	82.0	86.6	66	9.9	14	7.4	25	4	-481	9.1	4.0	486	0.661	107	114	676	46.8	33.7
64	Aug. 22	84:88	82.0	86.6	67	.....	2	8.2	20	2	-453	.....	.....	.....	.....	.....	.....	685	46.5	34.4
65	Aug. 27	79:83	75.0	86.6	67	.....	4	7.9	20	1	-460	.....	.....	.....	.....	.....	.....	673	43.9	34.2
66	Sept. 4	75:82	.....	.....	63	7.8	12	7.4	25	5	-487	19.0	13.3	448	0.609	.....	136	695	44.7	36.1
67	Sept. 11	68:75	64.0	54.6	59	.....	22	7.2	25	7	-492	.....	.....	.....	.....	.....	.....	713	45.1	38.0
68	Sept. 18	62:68	43.8	54.6	55	.....	7	7.7	25	15	-527	.....	.....	.....	.....	.....	.....	709	46.1	37.0
69	Sept. 25	55:61	29.0	54.6	56	9.4	3.5	8.0	30	10	-507	24.4	17.7	519	0.705	40.5	126	717	49.1	35.5

TABLE 1 (cont'd)

Chemical Analyses of Surface Waters in the Souris, Pembina and Red River Drainage Systems in Canada

Iron (Fe)		Manganese (Mn)					Alkalis									Phosphate (PO_4)				Hardness as $CaCO_3$						
Total	Dissolved	Total	Dissolved	Aluminum (Al)	Copper (Cu)	Zinc (Zn)	Sodium (Na)	Potassium (K)	Ammonia (NH_3)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulphate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Total	Dissolved	Silica (colorimetric) (SiO_2)	Boron (B)	Non-carbonate	Total	Sum of constituents	Per cent sodium	Sodium absorption ratio	Saturation index	Stability index	No.
near SWAN LAKE																											
0.28	Trace	0.15	0.00	0.00	0.00	0.00	26.2	6.3	0.0	0.0	147	102	7.8	0.29	0.2	0.2	.....	9.0	....	49.1	170	280	24	0.874	−0.3	8.1	1
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.0	147	.....	.....	.....	.....	.....	.....	.....	....	49.7	170	.....	.....	.....	.....	.....	2
.....	Trace	.....	0.00	0.01	.....	0.00	37.0	6.7	0.1	0.0	224	126	10.0	0.40	1.5	1.5	.....	24	....	57.1	241	395	24	1.037	+0.7	6.8	3
.....	.....	.....	.....	.....	.....	.....	37.9	6.7	0.1	0.0	232	133	10.3	.....	.....	.....	.....	8	....	59.4	249	392	24	1.044	+0.2	7.3	4
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	....	.....	.....	.....	.....	.....	.....	.....	5
.....	0.00	.....	0.00	0.01	Trace	0.00	38.7	7.3	0.1	0.0	240	141	10.3	0.36	1.3	0.9	.....	24	....	64.6	262	434	24	1.042	0.0	7.5	6
.....	.....	.....	.....	.....	.....	.....	40	7.4	0.2	0.0	239	144	10.2	.....	1.8	.....	.....	26	....	66.6	263	431	24	1.074	−0.2	7.7	7
.....	.....	.....	.....	.....	.....	.....	41.0	8.1	0.0	0.0	239	148	11.2	.....	2.3	.....	.....	28	....	70.5	267	442	24	1.092	+0.2	7.3	8
.....	0.03	.....	0.00	0.01	.....	0.00	41.2	8.5	0.4	0.0	204	147	11.4	0.47	4.7	1.9	.....	29	....	72.0	240	420	26	1.158	+0.1	7.6	9
.....	.....	.....	.....	.....	.....	.....	40.0	8.6	0.4	0.0	207	144	11.2	.....	4.3	.....	.....	29	....	68.3	238	413	26	1.129	−0.2	7.9	10
.....	.....	.....	.....	.....	.....	.....	42.2	9.2	0.3	0.0	218	151	13.0	.....	5.0	.....	.....	32	....	73.6	254	439	26	1.153	−0.2	7.8	11
.....	Trace	.....	0.00	0.00	.....	.....	39.5	9.5	0.2	0.0	213	135	11.4	0.41	5.6	0.8	.....	32	....	67.4	243	415	25	1.104	+0.1	7.5	12
.....	.....	.....	.....	.....	.....	.....	41.9	9.3	.....	0.0	295	149	12.1	.....	7.7	.....	.....	30	....	76.7	257	446	25	1.138	−0.1	7.5	13
.....	.....	.....	.....	.....	.....	.....	42.0	9.4	.....	0.0	297	153	11.2	.....	8.7	.....	.....	29	....	75.4	256	443	25	1.141	0.0	7.5	14
.....	0.03	.....	0.00	0.12	.....	.....	44.3	9.8	0.0	0.0	231	154	12.2	0.33	7.5	0.8	.....	29	....	75.8	268	456	26	1.178	−0.1	7.6	15
.....	.....	.....	.....	.....	.....	.....	42.5	9.7	.....	0.0	238	153	12.1	.....	6.7	.....	.....	29	....	72.4	267	454	25	1.137	0.0	7.5	16
.....	.....	.....	.....	.....	.....	.....	44.0	10.5	.....	0.0	247	155	13.3	.....	7.0	.....	.....	31	....	74.7	277	470	25	1.155	0.0	7.5	17
.....	0.00	.....	0.00	0.06	.....	.....	44.0	10.0	0.0	0.0	253	159	13.3	0.40	7.8	1.1	.....	30	....	77.5	285	480	24	1.132	0.0	7.4	18
.....	.....	.....	.....	.....	.....	.....	44.0	11.3	.....	0.0	248	160	14.4	.....	7.9	.....	.....	29	....	82.6	286	479	24	1.133	0.0	7.5	19
.....	.....	.....	.....	.....	.....	.....	44.0	10.2	.....	0.0	251	162	13.3	.....	7.6	.....	.....	29	....	83.3	289	481	24	1.125	+0.4	7.0	20
.....	Trace	.....	0.00	0.13	.....	.....	45.5	10.0	0.0	0.0	255	164	13.0	0.31	7.2	0.6	.....	28	....	82.1	292	486	25	1.160	+0.6	6.9	21
.....	.....	.....	.....	.....	.....	.....	45.0	10.0	.....	0.0	264	162	14.4	.....	6.5	.....	.....	28	....	83.8	301	491	24	1.127	+0.5	6.9	22
.....	.....	.....	.....	.....	.....	.....	44.5	9.9	.....	0.0	260	165	14.2	.....	6.3	.....	.....	26	....	83.4	297	488	24	1.123	+0.4	7.0	23
.....	0.00	.....	0.00	0.12	.....	.....	47.5	10.2	0.1	0.0	272	171	13.8	0.40	7.5	1.0	.....	30	....	83.7	307	513	24	1.180	+0.4	7.0	24
.....	.....	.....	.....	.....	.....	.....	46.5	9.6	.....	0.0	271	177	14.6	.....	6.8	.....	.....	18	....	91.1	313	505	24	1.144	+0.6	6.8	25
.....	.....	.....	.....	.....	.....	.....	49.5	10.2	.....	0.0	286	186	15.0	.....	7.1	.....	.....	20	....	94.2	329	532	24	1.188	+0.7	6.7	26
.....	Trace	.....	0.00	0.08	.....	0.00	55.0	12.0	0.1	0.0	323	206	16.9	0.44	8.0	0.7	.....	36	....	105	370	608	24	1.244	+0.8	6.4	27
.....	.....	.....	.....	.....	.....	.....	59.5	12.0	.....	.....	336	211	17.2	.....	7.0	.....	.....	30	....	105	381	623	25	1.324	+0.8	6.4	28
.....	0.02	.....	0.00	0.21	.....	.....	63.5	13.0	.....	0.0	371	234	19.7	.....	8.2	.....	.....	36	....	114	418	690	24	1.350	+0.9	6.2	29
.....	.....	.....	.....	.....	.....	.....	67.5	14.2	0.0	0.0	390	247	18.2	0.51	8.6	0.6	.....	40	....	120	440	729	24	1.401	+0.8	6.3	30
.....	.....	.....	.....	.....	.....	.....	72.0	15.5	.....	0.0	423	265	21.3	.....	8.1	.....	.....	38	....	127	474	777	24	1.440	+0.9	6.1	31
.....	.....	.....	.....	.....	.....	.....	85.0	16.5	.....	0.0	504	312	24.6	.....	8.8	.....	.....	42	....	147	561	914	24	1.559	+1.1	5.8	32
.....	0.01	.....	0.00	0.16	.....	.....	108	21.5	0.00	0.0	616	394	28.3	0.97	10	1.1	.....	48	....	188	693	1,136	24	1.777	+1.5	5.2	33
.....	.....	.....	.....	.....	.....	.....	125	23.5	.....	0.0	730	470	46.2	.....	12	.....	.....	55	....	243	842	1,357	24	1.874	+1.2	5.4	34
.....	.....	.....	.....	.....	.....	.....	143	26.0	.....	0.0	823	540	40.5	.....	14	.....	.....	55	....	267	942	1,521	24	2.026	+1.2	5.3	35
.....	.....	.....	.....	.....	.....	.....	153	27.0	.....	0.0	874	579	43.0	.....	14	.....	.....	55	....	287	1,004	1,621	24	2.101	+1.2	5.3	36
.....	Trace	.....	0.00	0.25	.....	.....	159	30.0	.....	0.0	939	621	45.3	0.37	13	1.0	.....	30	....	308	1,078	1,705	24	2.108	+1.4	4.9	37
.....	.....	.....	.....	.....	.....	.....	174	33.5	.....	0.0	910	671	48.3	.....	9.2	.....	.....	66	....	329	1,075	1,785	25	2.307	+1.5	4.9	38
.....	.....	.....	.....	.....	.....	.....	170	31.5	.....	0.0	1,034	678	48.7	.....	10	.....	.....	65	0.59	356	1,192	1,892	23	2.141	+1.2	5.1	39
.....	.....	.....	.....	.....	.....	.....	175	32.0	.....	0.0	1,087	708	51.4	.....	10	.....	.....	63	....	362	1,254	1,972	23	2.149	+1.3	4.9	40
.....	0.02	.....	0.00	0.03	.....	.....	5.5	10.1	0.1	0.0	65.6	28.9	2.9	0.29	9.7	2.0	.....	8.5	....	18.4	72.2	125	12	0.282	−1.3	9.7	41
.....	.....	.....	.....	.....	.....	.....	12.0	8.1	.....	0.0	113	53.1	4.6	.....	6.5	.....	.....	13	....	29.0	121	194	16	0.474	−0.7	8.7	42
.....	.....	.....	.....	.....	.....	.....	50.0	10.6	.....	0.0	311	192	13.2	.....	4.1	.....	.....	26	....	99.4	355	563	23	1.155	+0.7	6.5	43
.....	0.01	.....	0.00	0.02	.....	.....	30.0	6.2	0.0	0.0	191	109	7.8	0.29	4.0	0.1	.....	16	....	57.7	214	336	23	0.890	+0.7	6.9	44
.....	.....	.....	.....	.....	.....	.....	19.0	4.5	.....	0.0	127	72.8	3.0	.....	1.2	.....	.....	8.8	....	34.5	138	216	22	0.703	−0.4	8.4	45
.....	.....	.....	.....	.....	.....	.....	28.5	6.3	.....	0.0	173	115	8.2	.....	1.2	.....	.....	11	....	62.0	204	320	23	0.869	0.0	7.7	46
.....	Trace	.....	0.00	0.07	.....	.....	33.0	6.6	0.0	0.0	189	128	8.3	0.29	0.1	0.4	.....	13	....	65.5	220	354	24	0.970	+0.2	7.4	47
.....	.....	.....	.....	.....	.....	.....	33.5	7.2	.....	0.0	195	135	7.7	.....	1.9	.....	.....	11	....	71.7	232	366	23	0.959	+0.1	7.5	48
.....	.....	.....	.....	.....	.....	.....	35.5	7.4	.....	0.0	210	150	9.0	.....	0.6	.....	.....	1.2	....	81.4	254	388	23	0.977	+0.4	7.1	49
.....	0.00	.....	0.00	0.13	.....	.....	36.5	7.6	0.0	0.0	211	150	9.3	0.32	1.7	0.3	.....	11	....	81.9	255	402	23	0.996	+0.4	7.1	50
.....	.....	.....	.....	.....	.....	.....	37.0	7.9	.....	0.0	223	151	9.4	.....	2.1	.....	.....	9.1	....	83.6	267	419	23	0.987	+0.4	7.0	51
.....	.....	.....	.....	.....	.....	.....	34.5	7.5	.....	0.0	241	144	9.1	.....	2.0	.....	.....	14	....	72.0	270	418	21	0.915	+0.7	6.7	52
.....	0.02	.....	0.01	0.10	.....	0.05	36.5	7.4	0.1	0.0	235	146	8.2	0.31	2.5	1.1	.....	17	....	74.2	268	419	22	0.973	+0.6	6.9	53
.....	.....	.....	0.00	0.07	.....	0.00	38.5	7.6	.....	0.0	238	149	8.8	0.31	0.2	0.5	.....	11	....	78.1	273	421	23	1.014	−0.1	7.6	54
.....	.....	.....	.....	.....	.....	.....	39.0	7.5	.....	0.0	240	150	9.2	.....	1.7	.....	.....	19	....	72.3	269	432	23	1.035	+0.7	6.8	55
.....	.....	.....	.....	.....	.....	.....	37.5	8.0	.....	0.0	242	141	9.4	.....	1.7	.....	.....	17	....	65.6	264	419	23	1.007	+0.2	7.3	56
.....	0.03	.....	0.00	0.04	.....	.....	38.0	8.1	0.1	0.0	246	145	9.3	0.33	2.1	0.5	.....	16	....	70.2	272	428	23	1.004	0.0	7.4	57
.....	.....	.....	.....	.....	.....	.....	36.5	8.2	.....	0.0	254	140	9.3	.....	0.8	.....	.....	20	....	68.6	277	429	22	0.955	+0.8	6.6	58
.....	.....	.....	.....	.....	.....	.....	37.0	8.3	.....	0.0	253	144	9.9	.....	1.6	.....	.....	21	....	69.9	278	435	22	0.967	+0.3	7.1	59
.....	0.01	.....	0.00	0.03	.....	.....	39.3	9.0	0.1	0.0	263	146	10.5	0.30	1.0	1.2	.....	24	....	68.5	284	450	22	1.015	+0.6	6.8	60
.....	.....	.....	.....	.....	.....	.....	36.5	8.7	.....	0.0	242	140	9.5	.....	4.0	.....	.....	26	....	65.7	264	428	22	0.960	+0.5	7.1	61
.....	.....	.....	.....	.....	.....	.....	39.2	9.3	.....	0.0	246	143	9.9	.....	3.1	.....	.....	30	....	69.7	272	444	23	1.03	+0.8	6.6	62
.....	0.01	.....	Trace	0.09	.....	.....	42.0	9.4	0.1	0.0	225	142	10.4	0.27	7.7	1.2	.....	32	....	70.9	255	436	25	1.14	−0.1	7.6	63
.....	.....	.....	.....	.....	.....	.....	41.5	9.9	.....	0.0	225	146	10.9	.....	14	.....	.....	35	....	73.6	258	449	25	1.12	+0.7	6.8	64
.....	.....	.....	.....	.....	.....	.....	41.5	9.7	.....	0.0	215	151	11.0	.....	10	.....	.....	32	....	74.4	251	438	26	1.14	+0.3	7.3	65
.....	0.01	.....	0.00	0.07	.....	.....	42.3	10.0	0.1	0.0	219	159	10.8	0.32	13	1.1	.....	16	....	80.6	260	440	25	1.14	−0.2	7.8	66
.....	.....	.....	.....	.....	.....	.....	43.5	9.9	.....	0.0	225	154	11.6	.....	16	.....	.....	33	....	84.0	269	463	25	1.16	−0.4	8.0	67
.....	.....	.....	.....	.....	.....	.....	46.3	9.8	.....	0.0	225	160	11.4	.....	11	.....	.....	31	....	83.0	267	462	26	1.23	+0.1	7.5	68
.....	0.04	.....	0.00	0.07	.....	.....	44.5	9.9	0.1	0.0	227	166	11.8	0.36	13	1.4	.....	31	....	83.0	269	474	26	1.18	+0.5	7.0	69

TABLE 1 (cont'd)

Chemical Analyses of Surface Waters in the
Souris, Pembina and Red River Drainage Systems in Canada

No.	Date of collection	Storage period (Days)	Stream discharge (Second-feet) On sampling date	Stream discharge (Second-feet) Monthly mean	Water temperature (°F.)	Oxygen consumed by $KMnO_4$	Carbon dioxide (calculated) (CO_2)	pH	Colour (Hazen) (Units)	Turbidity (Units)	Redox potential (mV)	Suspended matter Dried at 105°C.	Suspended matter Ignited at 550°C.	Residue on evaporation dried at 105°C. (Dissolved solids) P.P.M.	Residue on evaporation dried at 105°C. (Dissolved solids) Tons per acre-foot	Residue on evaporation dried at 105°C. (Dissolved solids) Tons per day	Loss on ignition at 550°C.	Specific conductance $K \times 10^6$ at 25°C.	Calcium (Ca)	Magnesium (Mg)
STATION NO. 7 – PEMBINA RIVER																				
1	Sept. 6/60	167:216	38.8	31.5†	71	8.4	2	8.4	15	10	.....	14.9	5.6	488	0.663	51.0	70.4	716	56.5	34.0
2	Oct. 4	140:188	21.2	18.1	58	.....	3	8.3	10	5	.....	.....	.....	.....	.....	.....	.....	769	60.6	37.1
3	Oct. 31	79:184	14.4	18.1	38	6.2	4	8.2	25	6	.....	6.1	0.7	525	0.715	20.4	74.4	764	63.2	37.2
4	Nov. 16	59:125	3.9	6.7	33	.....	4	8.1	25	5	.....	.....	.....	.....	.....	.....	.....	813	69.6	38.4
5	Dec. 4	40:86	3.4	4.2	33	.....	4	8.3	25	3	.....	.....	.....	.....	.....	.....	.....	997	93.4	45.1
6	Jan. 7/61	6:100	4.7	4.4	33	.....	5.0	8.1	35	2	.....	.....	.....	.....	.....	.....	.....	896	85.4	38.6
7	Feb. 4	23:123	0.5	2.0	33	6.5	4	8.3	5	6	.....	40.0	32.7	608	0.826	0.82	69.2	996	115	46.9
8	Mar. 4	12:62	2.7	21.5	34	.....	12	7.8	10	2	.....	.....	.....	.....	.....	.....	.....	1,154	119	48.4
9	Apr. 4	9:70	207	254	33	.....	6	7.5	60	50	.....	.....	.....	.....	.....	.....	.....	417	36.9	14.7
10	May 4	19:57	208	140	50	9.2	2	8.2	10	30	.....	126	113	410	0.557	230	103	587	48.4	25.4
11	June 4	16:46	54.1	27.4	73	.....	2	8.3	15	35	.....	.....	.....	.....	.....	.....	.....	706	57.0	31.7
12	July 6	10:29	5.4	2.8	64	.....	3	8.2	10	5	.....	.....	.....	.....	.....	.....	.....	877	75.0	38.6
13	Aug. 7	11:17	0.6	0.5	74	7.7	3	8.2	10	5	.....	16.5	7.5	664	0.900	1.07	112	902	72.3	36.8
14	Sept. 6	15:47	0.3	0.8	57	.....	5	7.8	5	5	.....	.....	.....	.....	.....	.....	.....	944	73.3	41.4
15	Oct. 10	51:92	0.2	0.2	48	.....	3	8.2	5	2	.....	.....	.....	.....	.....	.....	.....	934	84.0	39.2
16	Oct. 16	49:86	0.2	0.2	50	2.7	2	8.4	0	4	.....	6.1	0.4	664	0.900	0.36	131	892	75.4	38.8
17	Nov. 6	36:79	0.0	0.0	34	.....	9	7.8	10	2	.....	.....	.....	.....	.....	.....	.....	1,298	118	56.7
18	Dec. 6	30:71	0.0	0.0	32	.....	13	7.7	5	.....	.....	.....	.....	.....	.....	.....	.....	1,304	129	59.4
19	Apr. 19/62	60:67	1,380	421	37	.....	5	7.5	45	1,000	.....	.....	.....	.....	.....	.....	.....	286	31.9	7.7
20	May 4	33:39	240	205	54	5.7	10	7.4	25	15	.....	115	102	369	0.502	238	83.2	525	46.6	21.8
21	May 22	72:80	204	205	56.0	.....	2	8.2	25	.....	.....	.....	.....	.....	.....	.....	.....	592	55.2	25.0
22	July 5	21:28	72	55	76	.....	4	8.0	25	9	.....	.....	.....	.....	.....	.....	.....	678	59.3	28.4
23	July 1-16	50:57	67.2 av.	54.8	63-77	5.0	4	8.1	25	10	.....	19.2	14.3	489	0.665	88.5	111	683	63.1	25.8
24	July 17-31	35:48	41.6 av.	54.8	63-78	4.8	4	8.0	20	8	.....	15.4	12.8	503	0.685	56.5	133	697	58.3	30.0
25	Aug. 7	31:49	62.4	77.3	76	6.1	9	7.7	20	4	.....	15.1	12.2	498	.....	.....	107	710	57.9	30.6
26	Aug. 7-17	25:31	69.3 av.	77.3	64-78	.....	4	8.1	30	.....	.....	.....	.....	.....	.....	.....	.....	698	57.9	31.4
27	Aug. 18-28	14:20	84.6 av.	77.3	67-81	.....	3	8.2	25	.....	.....	.....	.....	.....	.....	.....	.....	711	58.1	30.8
28	Aug. 29 -																			
28	Sept. 15	.....	109 av.	95.7	53-68	7.5	2	8.3	35	10	.....	32.2	24.0	448	0.610	132	111	638	48.8	29.7
29	Sept. 16 -																			
	Oct. 2	.....	82.0 av.	95.7	47-64	.....	3	8.2	25	6	.....	.....	.....	.....	.....	.....	.....	680	52.8	33.0
30	Oct. 4-9	.....	52.9 av.	38.1	56-63	.....	3	8.2	20	9	.....	.....	.....	.....	.....	.....	.....	719	58.0	35.5
31	Oct. 10-25	.....	34.8 av.	38.1	36-60	6.1	3	8.2	20	10	.....	12.8	6.6	497	0.675	46.5	378	755	59.8	35.1
32	Oct. 26 -																			
	Nov. 11	.....	23.4 av.	.....	.....	.....	4	8.1	25	10	.....	.....	.....	.....	.....	.....	.....	766	61.7	36.3
33	Nov. 12-29	.....	11.5 av.	16.9	33-36	.....	4	8.1	25	5	.....	.....	.....	.....	.....	.....	.....	850	71.1	38.9
34	Nov. 30 -																			
	Dec. 7	.....	28.1 av.	23.4	30-35	6.7	3	8.3	20	5	.....	17.4	10.9	590	0.804	44.7	139	848	70.3	40.6
35	Dec. 9, 28																			
	& Jan. 7	.....	.....	.....	31-33	.....	3	8.3	20	16	.....	.....	.....	.....	.....	.....	.....	1,017	86.1	50.0
36	Feb. 12/63	14:50	0.0	0.0	33	5.0	13	7.7	10	155	.....	140	126	740	1.01	0.0	134	1,045	99.2	45.2
37	Mar. 8	40:46	0.0	45.0	33	.....	13	7.8	10	10	-417	.....	.....	.....	.....	.....	.....	1,176	123	56.6
38	Mar. 25 -																			
	Apr. 9	.....	265 av.	45.0	31-36	6.4	5	7.6	35	55	-441	101	81.5	234	0.318	167	36	352	28.2	13.9
39	Apr. 10-26	.....	171 av.	219	33-48	5.9	2	8.2	15	50	-436	96.4	83.2	384	0.523	177	78	571	47.0	25.2
40	Apr. 27 -																			
	May 15	.....	172 av.	160	43-63	.....	3	8.0	20	55	-447	.....	.....	.....	.....	.....	.....	584	46.6	27.2
41	May 16 -																			
	June 4	.....	152 av.	175	48-72	.....	3	8.1	15	40	-452	.....	.....	.....	.....	.....	.....	680	58.9	29.0
42	June 6	67	250	175	69	.....	.....	7.8	25	.....	-413	.....	.....	.....	.....	.....	.....	721	62.2	30.2
43	June 5,7,8 & 14	.....	216 av.	175	58-71	.....	11	7.5	20	340	-464	.....	.....	.....	.....	.....	.....	714	61.2	28.6
44	June 18	21:58	176	175	75	9.1	8	7.7	40	210	-439	216	198	474	0.645	225	80	691	57.1	31.3
45	June 15-30	.....	162 av.	175	64-75	5.6	4	8.0	20	65	-374	.....	.....	.....	.....	.....	.....	648	59.0	31.8
46	July 1-15	.....	105 av.	93.4	67-76	.....	2	8.3	20	30	-449	.....	.....	.....	.....	.....	.....	715	60.2	33.2
47	July 16-31	.....	82.5 av.	93.4	66-83	.....	3	8.2	20	20	-451	.....	.....	.....	.....	.....	.....	679	60.8	31.7
48	Aug. 1-13	105:109	95.4 av.	94.7	65-80	5.4	1	8.6	20	25	-442	69.3	60.9	505	0.686	129	130	697	56.7	33.2
49	Aug. 14-31	.....	94.2 av.	94.7	59-70	.....	1	8.6	25	20	-472	.....	.....	.....	.....	.....	.....	709	57.9	33.6
50	Sept. 1-15	.....	71.5 av.	61.0	52-68	.....	32	8.1	25	50	-469	.....	.....	.....	.....	.....	.....	720	54.5	36.7
51	Sept. 16-20																			
	& 22	.....	55.6 av.	61.0	52-59	5.8	3	8.2	15	35	-494	82.3	68.6	526	0.715	79.0	136	726	54.4	35.9
52	Sept. 23 -																			
	Oct. 2	.....	.....	.....	50-59	.....	4	8.0	15	15	-493	.....	.....	.....	.....	.....	.....	762	57.6	35.8

TABLE 1 (cont'd)

Chemical Analyses of Surface Waters in the Souris, Pembina and Red River Drainage Systems in Canada

Iron (Fe)		Manganese (Mn)					Alkalis									Phosphate (PO_4)				Hardness as $CaCO_3$						
Total	Dissolved	Total	Dissolved	Aluminum (Al)	Copper (Cu)	Zinc (Zn)	Sodium (Na)	Potassium (K)	Ammonia (NH_3)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulphate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Total	Dissolved	Silica (colorimetric) (SiO_2)	Boron (B)	Non-carbonate	Total	Sum of constituents	Per cent sodium	Sodium absorption ratio	Saturation index	Stability index	No.
near WINDYGATES																											
0.11	0.03	0.05	0.00	0.06	0.00	0.00	45.2	9.6	0.0	1.8	273	139	12.7	0.39	0.4	0.4	0.4	29	....	54.1	281	464	25	.....	+1.0	6.4	1
.....	.....	.....	.....	.....	.....	.....	48.3	9.1	.....	0.0	302	148	13.7	.....	0.4	.....	.....	22	....	55.9	304	488	25	.....	+1.0	6.3	2
0.21	0.04	0.20	0.00	0.16	0.00	0.00	48.5	8.2	0.0	0.0	305	153	13.8	0.39	0.6	0.3	0.3	19	....	60.9	311	494	25	.....	+0.8	6.6	3
.....	.....	.....	.....	.....	.....	.....	50.5	7.8	.....	0.0	322	162	14.1	.....	0.6	.....	.....	21	....	67.5	332	522	24	.....	+0.8	6.5	4
.....	.....	.....	.....	.....	.....	.....	63.0	9.1	0.0	0.0	406	212	17.9	.....	0.6	.....	.....	23	....	85.6	419	664	24	.....	+1.3	5.7	5
.....	.....	.....	.....	.....	.....	.....	55.2	7.9	0.1	0.0	361	178	16.8	.....	0.4	.....	.....	22	....	75.9	372	896	24	.....	+1.0	6.0	6
0.11	0.00	0.60	0.00	0.01	0.00	0.00	70.0	8.4	0.1	0.0	419	266	19.4	0.49	0.6	0.2	0.1	21	....	137	480	754	24	.....	+1.4	5.5	7
.....	.....	.....	.....	.....	.....	.....	72.7	8.4	0.2	0.0	430	271	21.6	.....	4.0	.....	.....	22	....	144	496	778	24	.....	+0.9	6.0	8
.....	.....	.....	.....	.....	.....	.....	21.9	5.9	0.2	0.0	108	102	5.6	.....	8.0	.....	.....	15	....	64.1	153	263	23	.....	−0.5	8.5	9
1.11	0.02	0.30	0.00	0.00	0.01	0.00	38.5	6.9	0.1	0.0	188	143	11.3	0.37	6.0	0.7	0.6	22	....	63.9	226	394	26	.....	+0.6	7.0	10
.....	.....	.....	.....	.....	.....	.....	45.7	8.4	0.1	0.0	261	150	11.0	.....	0.7	.....	.....	23	0.19	51.2	273	457	26	.....	+0.9	6.5	11
.....	.....	.....	.....	.....	.....	.....	56.8	10.1	0.1	0.0	322	199	14.6	.....	0.5	.....	.....	27	....	81.8	346	580	26	.....	+1.0	6.2	12
0.11	0.02	0.13	Trace	0.12	0.01	0.00	65.2	11.9	0.0	0.0	270	237	16.9	0.52	1.2	1.0	0.3	31	....	111	332	606	29	.....	+0.9	6.4	13
.....	.....	.....	.....	.....	.....	.....	66.0	11.3	0.0	0.0	254	268	18.7	.....	1.5	.....	.....	22	....	145	353	627	28	.....	+0.5	6.8	14
.....	.....	.....	.....	.....	.....	.....	57.0	9.5	0.2	0.0	238	270	18.8	.....	0.3	.....	.....	22	....	176	371	625	25	.....	+0.9	6.4	15
0.08	0.00	0.17	0.00	0.03	Trace	0.00	59.9	9.2	0.1	0.4	229	274	18.5	0.50	1.0	0.3	0.3	19	....	160	348	610	27	.....	+1.0	6.4	16
.....	.....	.....	.....	.....	.....	.....	90.0	11.4	.....	0.0	340	403	29.5	.....	0.5	.....	.....	23	....	250	529	900	27	.....	+0.8	6.2	17
.....	.....	.....	.....	.....	.....	.....	78.6	9.1	0.1	0.0	373	400	25.8	.....	0.0	.....	.....	20	....	259	566	905	23	.....	+0.8	6.1	18
.....	.....	.....	.....	.....	.....	.....	12.0	3.6	0.1	0.0	105	48.1	2.9	.....	2.7	.....	.....	16	....	25.0	111	176	18	0.495	−0.5	8.5	19
0.31	0.01	0.09	0.00	0.00	0.00	Trace	30.5	6.6	0.0	0.0	161	128	9.1	0.32	1.8	0.9	0.8	19	....	73.7	206	343	24	0.927	−0.3	8.0	20
0.61	Trace	0.14	0.00	0.05	0.01	0.00	38.1	6.9	0.0	0.0	187	161	9.4	0.41	0.6	0.2	.....	16	....	87.2	241	405	25	1.068	+0.6	7.0	21
.....	.....	.....	.....	.....	.....	.....	40.0	7.6	0.1	0.0	251	141	10.1	.....	Trace	.....	.....	26	0.00	59.1	265	436	24	1.07	+0.6	6.8	22
.....	0.02	.....	0.00	0.00	.....	0.00	42.7	8.0	0.0	0.0	252	142	10.9	0.41	0.9	0.9	.....	25	....	57.2	264	453	25	1.145	+0.7	6.7	23
.....	Trace	.....	0.00	0.10	.....	0.00	43.5	7.7	0.0	0.0	255	143	10.9	0.42	0.4	0.7	.....	25	....	60.3	269	456	25	1.153	+0.6	6.8	24
.....	0.02	0.00	0.00	0.01	.....	0.00	44.0	8.0	0.3	0.0	257	145	11.2	0.44	0.2	1.2	....	29	....	59.8	271	454	25	1.163	+0.3	7.1	25
0.17	.....	0.09	.....	.....	.....	.....	42.5	7.5	0.2	0.0	257	145	10.6	0.40	0.4	.....	.....	28	....	62.9	274	450	25	1.120	+0.7	6.7	26
0.20	.....	0.09	.....	.....	.....	.....	43.5	8.3	0.05	0.0	255	149	11.9	0.40	0.2	.....	.....	27	....	62.4	272	455	25	1.149	+0.8	6.6	27
.....	0.00	.....	0.00	0.06	.....	.....	41.0	8.4	0.1	0.0	230	130	11.2	0.36	1.1	0.9	.....	26	....	55.0	244	410	26	1.143	+0.8	6.8	28
.....	.....	.....	.....	.....	.....	.....	40.5	8.8	.....	0.0	249	148	12.5	0.37	1.4	.....	.....	21	....	63.1	268	441	24	1.077	+0.7	6.8	29
.....	.....	.....	.....	.....	.....	.....	46.5	9.0	.....	.....	268	154	13.3	0.34	0.9	.....	.....	28	....	71.1	291	478	25	1.186	+0.8	6.6	30
.....	0.00	.....	0.00	0.05	.....	.....	46.5	8.7	0.1	0.0	276	157	13.4	0.41	1.7	0.6	.....	23	....	67.4	294	483	25	1.181	+0.8	6.6	31
.....	.....	.....	.....	.....	.....	.....	49.0	7.9	.....	0.0	289	162	14.5	0.37	0.9	.....	.....	16	....	66.1	304	492	25	1.224	+0.8	6.5	32
.....	.....	.....	.....	.....	.....	.....	55.0	8.0	.....	0.0	313	182	16.4	0.38	0.8	.....	.....	18	....	80.8	337	544	25	1.303	+0.9	6.3	33
.....	0.02	.....	0.00	0.04	.....	.....	56.5	9.2	0.0	0.0	311	186	15.1	0.39	2.0	0.4	.....	17	....	88.0	343	551	26	1.327	+1.1	6.1	34
.....	.....	.....	.....	.....	.....	.....	66.0	11.4	.....	.....	376	232	19.3	0.49	4.8	.....	.....	26	....	112	421	681	25	1.400	+1.2	5.9	35
.....	Trace	.....	0.00	0.05	.....	.....	63.0	9.2	0.1	0.0	376	238	18.2	0.47	3.2	0.4	.....	23	....	126	434	685	24	1.316	+0.7	6.3	36
.....	.....	.....	.....	.....	.....	.....	77.5	11.2	.....	0.0	470	300	22.4	.....	0.1	.....	.....	28	0.00	155	541	850	23	1.450	+1.0	5.8	37
.....	0.01	.....	0.00	0.06	.....	.....	19.0	6.5	0.1	0.0	119	68.9	3.4	0.24	2.2	0.6	.....	9.4	....	30.0	128	211	23	0.732	−0.4	8.4	38
.....	0.02	.....	0.00	0.03	.....	.....	33.5	7.1	0.0	0.0	196	121	8.4	0.29	3.7	0.3	.....	13	....	60.5	221	356	24	0.980	+0.6	7.0	39
.....	.....	.....	.....	.....	.....	.....	34.0	6.7	.....	0.0	197	130	8.8	0.27	Trace	.....	.....	17	....	66.9	229	367	24	0.979	+0.4	7.2	40
.....	.....	.....	.....	.....	.....	.....	40.8	7.5	.....	0.0	230	158	9.8	0.33	1.0	.....	.....	19	....	78.1	266	437	24	1.088	+0.6	6.9	41
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	230	.....	13.5	.....	.....	.....	.....	.....	....	90.8	280	.....	.....	.....	.....	.....	42
.....	.....	.....	.....	.....	.....	.....	45.5	7.9	.....	0.0	233	168	11.6	0.36	1.5	.....	.....	25	....	79.3	270	463	26	1.202	+0.1	7.3	43
0.61	0.01	0.15	0.00	0.13	.....	.....	41.8	7.9	0.0	0.0	247	146	9.4	0.36	0.1	0.7	.....	25	....	68.7	272	442	24	1.104	+0.3	7.1	44
.....	.....	.....	.....	.....	.....	.....	40.0	7.8	0.0	0.0	252	156	5.0	.....	2.2	.....	.....	22	....	71.2	278	469	25	1.043	+0.6	6.8	45
.....	.....	.....	.....	.....	.....	.....	43.0	8.2	.....	0.0	266	153	10.7	0.37	1.3	.....	.....	27	....	68.8	287	469	24	1.11	+1.0	6.3	46
.....	.....	.....	.....	.....	.....	.....	43.0	8.2	.....	0.0	271	150	10.8	0.37	1.0	.....	.....	35	....	59.9	282	474	24	1.11	+0.9	6.4	47
.....	0.02	.....	0.00	0.10	.....	.....	45.0	8.6	0.1	10.6	248	141	10.4	0.31	2.1	0.8	.....	39	....	57.1	278	470	25	1.18	+1.2	6.2	48
.....	.....	.....	.....	.....	.....	.....	43.4	8.7	.....	12.0	244	148	11.7	0.36	2.1	.....	.....	34	....	62.7	283	472	24	1.12	+1.2	6.2	49
.....	.....	.....	.....	.....	.....	.....	43.4	9.7	.....	0.0	258	154	12.1	0.36	2.7	.....	.....	30	....	75.3	287	471	24	1.12	+0.7	6.7	50
.....	0.02	.....	0.00	0.10	.....	.....	46.5	9.1	.....	0.0	261	161	12.8	0.26	1.9	0.5	.....	29	....	69.2	284	480	26	1.20	+0.8	6.6	51
.....	0.02	.....	0.00	.....	.....	.....	46.5	9.6	.....	0.0	269	164	13.0	0.36	1.6	0.4	.....	24	.....	71.0	291	484	25	1.19	+0.6	6.8	52

TABLE 1 (cont'd)

Chemical Analyses of Surface Waters in the Souris, Pembina and Red River Drainage Systems in Canada

No.	Date of collection	Storage period (Days)	Stream discharge (Second-feet) On sampling date	Stream discharge (Second-feet) Monthly mean	Water temperature (°F.)	Oxygen consumed by $KMnO_4$	Carbon dioxide (calculated) (CO_2)	pH	Colour (Hazen) (Units)	Turbidity (Units)	Redox potential (mV)	Suspended matter Dried at 105°C.	Suspended matter Ignited at 550°C.	Residue on evaporation dried at 105°C. (Dissolved solids) P.P.M.	Residue on evaporation dried at 105°C. (Dissolved solids) Tons per acre-foot	Residue on evaporation dried at 105°C. (Dissolved solids) Tons per day	Loss on ignition at 550°C.	Specific conductance K × 10⁶ at 25°C.	Calcium (Ca)	Magnesium (Mg)
																			STATION NO. 8 – ROSEAU RIVER*	
1	May 17/60	13:22	723	654	16.7	.....	3	8.0	75	50	.....	.....	.....	.....	.....	.....	.....	345	44.1	16.8
2	May 10/62	60:64	1,210	1,500	50.8	10.9	18	7.2	65	20	.....	96.0	76.7	202	0.273	656	52.8	312	41.6	15.6
																			STATION NO. 9 – ROSEAU RIVER	
1	Aug. 16/60	50:233	26.8	44.5	75	20.0	1	8.5	80	10	.....	14.1	10.8	280	0.380	20.2	210	412	49.1	22.3
2	Sept. 13	157:205	20.5	20.1	64	.....	2	8.3	45	10	.....	.....	.....	.....	.....	.....	.....	388	41.0	23.1
3	Oct. 19	99:141	8.9	12.7	36	.....	4	8.1	55	8	.....	.....	.....	.....	.....	.....	.....	430	47.4	22.3
4	Nov. 16	61:166	90.3	73.6	33	16.2	2	8.3	120	2	.....	.....	.....	317	0.432	77.2	66.4	469	52.3	29.4
5	Jan. 9/61	10:99	6.2	5.0	33	.....	10	7.9	100	4	.....	.....	.....	.....	.....	.....	.....	759	89.2	41.8
6	Feb. 18	17:65	0.6	1.5	33	.....	4	8.3	80	6	.....	.....	.....	.....	.....	.....	.....	732	88.9	38.9
7	Mar. 18	17:100	1.8	00.9	33	16.0	7	8.0	50	7	.....	17.1	4.0	463	0.630	2.25	78.4	700	81.6	35.9
8	Apr. 15	16:72	163	392	34	.....	3	8.1	40	8	.....	.....	.....	.....	.....	.....	.....	340	41.2	16.4
9	May 14	22:64	366	275	50	.....	2	8.3	40	6	.....	.....	.....	.....	.....	.....	.....	343	45.3	17.5
10	June 20	34:42	17.6	39.4	73	14.8	3	8.1	40	2	.....	.....	.....	274	0.373	13.0	78.8	388	46.5	24.2
11	July 19	22:27	8.6	9.4	71	.....	4	7.9	50	10	.....	.....	.....	.....	.....	.....	.....	320	29.2	21.4
12	Aug. 15	28:56	3.0	3.6	72	10.8	0.8	8.6	35	3	.....	.....	.....	243	0.330	1.96	88.0	323	28.4	24.3
13	Sept. 19	24:106	4.2	30.8	66	.....	6	7.9	35	6	.....	.....	.....	.....	.....	.....	.....	508	45.5	28.3
14	Oct. 18	47:84	67.6	74.1	44	.....	3	8.1	50	15	.....	.....	.....	.....	.....	.....	.....	385	49.1	19.6
15	Nov. 15	30:75	37.4	38.0	34	12.4	8	7.8	50	4	.....	1.8	0.0	358	0.486	36.0	72.8	526	66.2	27.1
16	Dec. 13	23:64	10.2	14.0	33	.....	9	7.9	50	3	.....	.....	.....	.....	.....	.....	.....	642	86.5	32.3
17	Jan. 23/62	41:51	12.7	12.2	33	.....	6	8.1	30	10	.....	.....	.....	.....	.....	.....	.....	719	90.2	36.1
18	Feb. 20	34:87	10.5	12.3	33	11.8	7	7.6	30	8	.....	11.0	6.7	448	0.610	12.7	173	703	84.6	36.0
19	Mar. 14	42:56	3.5	4.6	32	.....	3	8.3	35	3	.....	.....	.....	.....	.....	.....	.....	635	79.6	32.5
20	Apr. 11	41:64	138	628	35	8.2	22	7.3	25	2	.....	.....	.....	321	0.436	119	126	492	55.1	26.4
21	May 15	50:59	1,350	1,430	52	.....	7	7.6	80	4	.....	.....	.....	.....	.....	.....	.....	338	43.0	16.5
22	June 13	91:98	2,290	2,080	71	19.5	9	7.6	100	2	.....	.....	.....	267	0.363	1,650	79.2	373	46.6	1.9
23	July 18	69:77	1,140	1,090	76	.....	20	7.3	130	10	.....	.....	.....	.....	.....	.....	.....	452	58.1	23.8
24	Aug. 15	47:58	918	829	72	19.5	15	7.3	100	3	.....	11.1	3.6	230	0.313	570	101	317	41.5	16.4
25	Sept. 12	23:35	380	360	56	.....	8	7.7	100	15	.....	.....	.....	.....	.....	.....	.....	815	51.0	21.9
26	Oct. 10	16:36	8.0	10.4	50	.....	3	8.1	80	15	.....	.....	.....	.....	.....	.....	.....	430	55.2	22.5
27	Nov. 14	14:27	.....	.....	36	17.8	7	7.8	60	3	.....	.....	.....	307	0.418	.....	141	452	54.8	24.7
																			STATION NO. 10 – ROSEAU RIVER	
1	May 9/62	61:64	1,310	1,430	49	11.7	4	7.8	55	2	.....	.....	.....	.....	.....	.....	.....	303	41.6	13.6
2	Sept. 19	16:48	200	306	55	21.5	5	7.8	80	9	.....	8.5	1.5	267	0.362	144	99.2	378	51.2	19.1
3	Oct. 17	21:29	0.0	10.4	50	.....	2	8.3	65	4	.....	.....	.....	.....	.....	.....	.....	431	55.8	23.6
4	Nov. 15	13:18	.....	.....	36	.....	4	8.0	60	2	.....	.....	.....	.....	.....	.....	.....	460	55.6	25.7
5	Dec. 13	54:82	.....	.....	32	19.4	3	8.3	60	3	.....	.....	.....	351	0.478	.....	90.0	518	67.6	27.9
6	Jan. 16/63	26:68	.....	.....	33	.....	.....	8.1	60	4	.....	.....	.....	.....	.....	.....	.....	791	101	47.5
7	Feb. 14	12:39	.....	.....	34	.....	26	7.6	60	8	.....	.....	.....	.....	.....	.....	.....	1,015	128	59.0
8	Mar. 14	34:40	.....	.....	36	.....	5	8.3	40	10	.....	.....	.....	.....	.....	.....	.....	834	102	46.8
9	Apr. 18	36:53	1,470	1,280	44	16.4	5	7.7	90	10	−439	20.3	13.8	205	0.279	815	67.2	290	34.7	14.2
10	May 2	40:48	1,370	715	50	18.0	4	7.9	60	10	−442	3.9	1.6	225	0.306	830	102	322	40.8	16.5
11	May 16	28:50	505	715	50	.....	6	7.8	60	6	−429	.....	.....	.....	.....	.....	.....	369	46.8	18.0
12	June 11	34:91	902	824	65	22.5	6	7.8	75	25	−448	53.6	45.8	272	0.370	660	88.8	383	49.4	20.4
13	June 13	25:56	980	824	60	.....	13	7.4	75	15	−446	.....	.....	.....	.....	.....	.....	392	49.8	21.1
14	July 18	67:84	98.0	286	73	23.2	3	8.2	80	15	−451	18.8	11.3	305	0.415	80.6	80.8	418	53.0	24.4
15	Aug. 15	90:95	27.0	52.1	68	.....	4	8.0	45	7	−451	.....	.....	.....	.....	.....	.....	403	50.8	23.1
16	Sept. 12	64:76	6.0	8.8	58	.....	2	8.4	45	6	−442	.....	.....	.....	.....	.....	.....	442	50.8	26.3

* Spot sampling

TABLE 1 (cont'd)

Chemical Analyses of Surface Waters in the
Souris, Pembina and Red River Drainage Systems in Canada

Iron (Fe)		Manganese (Mn)					Alkalis									Phosphate (PO_4)				Hardness as $CaCO_3$							No.
Total	Dissolved	Total	Dissolved	Aluminum (Al)	Copper (Cu)	Zinc (Zn)	Sodium (Na)	Potassium (K)	Ammonia (NH_3)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulphate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Total	Dissolved	Silica (colorimetric) (SiO_2)	Boron (B)	Non-carbonate	Total	Sum of constituents	Per cent sodium	Sodium absorption ratio	Saturation index	Stability index	
at DOMINION CITY																											
1.00	0.02	0.00	0.00	0.00	0.00	0.00	3.0	4.1	.....	0.0	198	18.0	2.5	0.0	0.4	<0.1	.....	7.6	....	16.0	178	194	3.4	.....	+0.4	7.2	1
0.70	0.03	0.00	0.00	0.00	0.20	0.00	2.6	3.6	0.1	0.0	172	27.7	2.1	0.27	2.2	0.4	.....	11	....	26.7	168	192	3.2	0.057	−0.5	8.2	2
at ARBAKKA																											
0.44	0.03	0.00	0.00	0.00	0.00	0.00	9.2	1.3	.....	7.6	243	16.4	4.4	0.32	1.6	0.2	0.2	11	....	3.0	215	242	8.5	.....	+1.0	6.5	1
.....	.....	.....	.....	.....	.....	.....	9.1	2.2	.....	0.0	235	15.3	4.7	.....	1.6	.....	.....	8.9	....	5.0	197	221	9.0	.....	+0.7	6.9	2
.....	.....	.....	.....	.....	.....	.....	12	4.4	0.2	0.0	262	17.9	6.0	.....	1.6	.....	.....	4.9	....	0.0	211	245	10	.....	−0.6	6.9	3
0.12	0.03	0.05	0.00	0.00	Trace	0.00	7.4	2.1	0.1	0.0	259	44.7	3.1	0.32	0.4	0.1	<0.1	5.6	....	39.2	252	273	6.0	.....	+0.9	6.5	4
.....	.....	.....	.....	.....	.....	.....	19.0	3.1	0.2	0.0	473	26.2	12.8	.....	2.4	.....	.....	21	....	7.3	395	448	9.4	.....	+0.9	6.1	5
.....	.....	.....	.....	.....	.....	.....	20.0	3.1	.....	0.0	471	24.8	12.5	.....	5.0	.....	.....	12	....	0.0	382	437	10	.....	+1.3	5.7	6
1.86	0.02	0.4	0.00	0.00	0.03	0.00	22.8	3.0	0.2	0.0	420	29.9	12.1	0.32	6.0	1.3	1.2	23	....	6.5	351	423	12	.....	+1.0	6.0	7
.....	.....	.....	.....	.....	.....	.....	4.4	3.8	0.2	0.0	182	27.4	2.6	.....	1.6	.....	.....	9.8	....	21.2	170	197	5.2	.....	+0.4	7.3	8
.....	.....	.....	.....	.....	.....	.....	4.2	2.2	0.1	0.0	210	16.8	2.1	.....	0.8	.....	.....	7.4	....	13.2	185	199	4.6	.....	+0.7	6.9	9
0.21	0.03	0.04	Trace	0.05	0.00	0.00	7.6	1.9	0.1	0.0	254	16.7	2.6	0.32	0.9	0.2	.....	11	0.26	7.4	216	237	7.0	.....	+0.6	6.9	10
.....	.....	.....	.....	.....	.....	.....	8.4	1.0	0.0	0.0	184	19.2	2.3	.....	1.3	.....	.....	11	....	10.2	161	184	10	.....	+0.1	7.7	11
0.17	0.00	0.05	0.0	0.04	0.00	0.00	8.5	1.1	0.1	8.0	176	17.5	2.7	0.35	2.1	0.24	0.18	5.9	....	12.8	171	186	9.7	.....	+0.8	7.0	12
.....	.....	.....	.....	.....	.....	.....	22.0	2.8	0.0	0.0	283	24.3	16.1	.....	0.9	.....	.....	8.7	....	0.0	230	288	17	.....	+0.5	6.9	13
.....	.....	.....	.....	.....	.....	.....	6.2	2.6	0.2	0.0	238	17.5	4.3	.....	0.0	.....	.....	9.4	....	7.8	203	226	6.1	.....	+0.6	6.9	14
1.23	0.03	0.00	0.00	0.00	0.00	0.00	9.2	2.2	0.2	0.0	310	34.2	5.1	0.32	0.3	<0.1	.....	9.2	....	22.6	277	306	6.7	.....	+0.5	6.8	15
.....	.....	.....	.....	.....	.....	.....	11.5	2.5	0.1	0.0	400	34.0	5.8	.....	0.0	.....	.....	15	....	21.2	349	384	6.6	.....	+0.9	6.1	16
.....	.....	.....	.....	.....	.....	.....	17.7	3.2	0.1	0.0	444	29.2	9.6	.....	3.0	.....	.....	29	....	9.7	374	437	9.3	.....	+1.1	5.9	17
2.13	0.14	0.82	0.00	0.00	0.00	0.00	17.5	2.9	0.2	0.0	432	24.4	11.6	0.39	3.6	0.8	0.8	24	....	5.0	359	418	9.5	.....	+0.6	6.4	18
.....	.....	.....	.....	.....	.....	.....	19.0	3.0	0.05	0.0	407	23.5	12.2	.....	5.3	.....	.....	28	....	0.0	333	404	11	.....	+1.3	5.7	19
0.37	0.09	0.21	0.00	0.03	0.00	0.00	11.5	3.9	0.0	0.0	288	24.4	7.7	0.27	4.7	0.37	0.37	16	....	10.2	246	293	9.0	.....	0.0	7.3	20
.....	.....	.....	.....	.....	.....	.....	3.1	3.1	0.1	0.0	182	29.9	2.0	.....	1.9	.....	.....	11	....	26.3	176	200	3.6	0.102	0.0	7.6	21
.....	Trace	0.00	0.00	0.00	.....	.....	2.9	3.0	0.3	0.0	219	16.7	1.7	0.36	1.0	0.7	.....	17	....	20.0	199	229	3.0	0.089	+0.1	7.4	22
.....	.....	.....	.....	.....	.....	.....	3.8	2.2	.....	0.0	358	29.1	1.7	.....	1.8	.....	.....	11	....	24.5	243	262	3.3	0.106	−0.1	7.5	23
.....	0.00	0.00	0.00	0.02	.....	.....	2.2	2.1	0.0	0.0	238	23.4	2.1	0.26	0.5	.....	.....	14	....	27.3	171	189	2.7	0.073	−0.4	7.3	24
.....	.....	.....	.....	.....	.....	.....	3.9	1.8	.....	0.0	232	24.2	2.3	.....	2.3	.....	.....	14	....	27.3	218	235	3.7	0.115	+0.3	7.1	25
.....	.....	.....	.....	.....	.....	.....	5.5	2.1	.....	0.0	256	18.4	3.1	.....	2.0	.....	.....	13	....	20.3	231	248	4.9	0.157	+0.7	6.7	26
.....	0.00	0.00	0.00	0.07	.....	.....	6.6	1.7	0.0	0.0	268	20.5	4.5	0.29	4.6	<0.1	.....	9.6	....	18.8	239	259	5.6	0.186	+0.4	7.0	27
at GARDENTON																											
.....	.....	.....	.....	.....	.....	0.00	2.5	3.7	0.1	0.0	165	27.3	1.8	.....	1.2	.....	.....	11	....	24.8	160	184	3.2	0.086	+0.1	7.6	1
.....	Trace	.....	0.00	0.06	.....	.....	3.3	1.1	0.0	0.0	227	15.3	2.3	0.27	1.3	0.1	.....	12	....	19.8	206	218	3.3	0.100	+0.3	7.2	2
.....	.....	.....	.....	.....	.....	.....	6.1	2.1	.....	0.0	265	19.0	3.8	.....	1.9	.....	.....	9.9	....	18.8	237	253	5.3	0.173	+0.9	6.5	3
.....	.....	.....	.....	.....	.....	.....	6.8	1.9	.....	.....	273	21.9	3.6	.....	1.6	.....	.....	9.4	....	20.2	245	261	5.7	0.189	+0.6	6.8	4
.....	0.02	.....	0.00	0.04	.....	.....	7.0	2.0	0.1	0.0	326	21.5	5.0	0.37	1.4	0.1	.....	16	....	16.4	284	310	5.1	0.181	−1.1	6.1	5
.....	.....	.....	.....	.....	.....	.....	12.0	3.5	.....	0.0	492	53.9	6.6	.....	3.2	.....	.....	21	....	44.6	449	491	5.5	0.247	+1.2	5.7	6
.....	.....	.....	.....	.....	.....	.....	14.7	6.0	.....	0.0	614	78.4	8.1	.....	11.	.....	.....	22	....	58.9	562	629	5.3	0.270	+0.8	6.0	7
.....	.....	.....	.....	.....	.....	.....	20.0	3.4	.....	0.0	530	34.0	12.4	.....	6.3	.....	.....	30	....	13.3	448	516	8.8	0.411	+1.4	5.5	8
.....	0.01	.....	0.00	0.02	.....	.....	2.6	4.5	0.0	0.0	146	28.6	2.9	0.23	0.4	<0.1	.....	7.0	....	25.5	145	167	3.7	0.094	−0.1	7.9	9
.....	0.01	.....	0.00	0.07	.....	.....	3.6	3.9	0.2	0.0	177	26.3	2.8	0.26	0.5	<0.1	.....	3.7	....	24.5	170	186	4.3	0.121	+0.2	7.5	10
.....	.....	.....	.....	.....	.....	.....	4.6	2.5	.....	0.0	206	22.5	2.3	.....	0.4	.....	.....	3.8	....	22.0	191	202	4.9	0.145	+0.2	7.4	11
.....	.....	.....	0.00	0.09	0.02	0.00	3.9	1.4	0.1	0.0	227	19.9	0.2	0.32	1.7	0.2	.....	12	....	21.4	208	221	3.9	0.118	+0.3	7.2	12
.....	.....	.....	.....	.....	.....	.....	4.7	1.6	.....	0.0	231	24.3	0.3	.....	0.5	.....	.....	8.7	....	21.4	211	225	4.6	0.141	−0.1	7.6	13
.....	0.03	.....	0.00	0.09	.....	.....	5.0	1.4	0.1	0.0	260	19.8	1.3	0.32	0.4	0.5	.....	11	....	19.7	233	245	4.4	1.143	+0.8	6.6	14
.....	.....	.....	.....	.....	.....	.....	5.0	1.5	.....	0.0	254	13.6	1.9	.....	1.6	.....	.....	8.7	....	13.5	222	231	4.7	0.147	+0.6	6.8	15
.....	.....	.....	.....	.....	.....	.....	7.8	1.8	.....	6.7	263	14.9	2.8	.....	1.5	.....	.....	4.8	....	8.6	235	247	6.7	0.221	+1.0	6.4	16

TABLE 1 (cont'd)

Chemical Analyses of Surface Waters in the
Souris, Pembina and Red River Drainage Systems in Canada

No.	Date of collection	Storage period (Days)	Stream discharge (Second-feet): On sampling date	Stream discharge (Second-feet): Monthly mean	Water temperature (°F.)	Oxygen consumed by $KMnO_4$	Carbon dioxide (calculated) (CO_2)	pH	Colour (Hazen) (Units)	Turbidity (Units)	Redox potential (mV)	Suspended matter: Dried at 105°C.	Suspended matter: Ignited at 550°C.	Residue on evaporation dried at 105°C. (Dissolved solids): P.P.M.	Residue on evaporation dried at 105°C. (Dissolved solids): Tons per acre-foot	Residue on evaporation dried at 105°C. (Dissolved solids): Tons per day	Loss on ignition at 550°C.	Specific conductance $K \times 10^6$ at 25°C.	Calcium (Ca)	Magnesium (Mg)
STATION NO. 11 – ANTLER RIVER*																				
1	May 16/62	98:111	.....	.....	54	4.5	4	8.0	15	0.8	.....	.....	.....	.....	.....	.....	.....	592	51.6	37.7
2	June 6/63	71:94	47.2	27.1	73	21.6	10	7.7	80	8	-474	59.3	43.0	445	0.605	56.5	148	940	65.8	46.4
* Spot sampling																				
STATION NO. 12 – ANTLER RIVER																				
1	May 16/62	93:105	0.0	0.0	53	8.4	2	8.3	.....	1	.....	.....	.....	.....	.....	.....	.....	532	40.8	31.6
2	Mar. 29/63	20:25	0.0	0.0	38	23.8	18	7.0	90	6	-415	4.4	0.0	238	0.324	0.0	104	311	27.8	13.9
3	Apr. 5	13:18	0.0	0.0	34	.....	14	7.3	90	2	-402	.....	.....	.....	.....	.....	.....	426	27.1	29.7
4	Apr. 12	53:81	0.0	0.0	43	19.7	15	7.2	90	0.5	-298	.....	.....	287	0.390	0.0	78.8	417	40.3	29.1
5	Apr. 19	26:34	0.0	0.0	42	.....	6	7.7	80	0.7	-442	.....	.....	.....	.....	.....	.....	470	47.7	24.0
6	Apr. 29	39:53	0.0	0.0	42	20.9	5	7.8	70	0.7	-437	.....	.....	389	0.528	0.0	133	535	51.8	28.6
7	May 7	31:41	0.0	0.0	68	.....	5	7.9	70	4	-425	.....	.....	.....	.....	.....	.....	564	56.3	30.8
8	May 13	28:39	0.0	0.0	44	17.5	8	7.7	50	2	-439	.....	.....	275	0.374	0.0	41.2	513	54.5	27.6
9	May 24	26:28	0.0	0.0	59	.....	8	7.7	35	0.3	-442	.....	.....	.....	.....	.....	.....	531	56.1	28.7
10	June 16	33:65	33.5	27.1	72	16.0	13	7.5	55	5	-458	.....	.....	.....	.....	.....	.....	485	40.9	28.4
STATION NO. 13 – ANTLER RIVER*																				
1	May 16/62	85:105	0.0	0.0	55	.....	10	7.6	80	.....	.....	.....	.....	.....	.....	.....	.....	1,019	89.3	55.0
2	June 15/63	33:66	33.5	27.1	70	16.2	11	7.5	45	3	-456	8.1	7.4	271	0.368	24.4	111	424	35.1	24.7
* Spot sampling																				
STATION NO. 14 – GAINSBOROUGH CREEK*																				
1	June 16/63	33:60	.....	.....	72	17.5	9	7.7	45	75	-470	.....	.....	.....	.....	.....	.....	617	52.0	39.8
* Spot sampling																				
STATION NO. 15 – GAINSBOROUGH CREEK*																				
1	June 15/63	34:61	0.0	0.0	83	16.0	8	7.8	40	5	-446	14.1	6.7	318	0.433	0.0	229	495	52.5	25.9
* Spot sampling																				

TABLE 1 (cont'd)

Chemical Analyses of Surface Waters in the Souris, Fembina and Red River Drainage Systems in Canada

Iron (Fe)		Manganese (Mn)					Alkalis									Phosphate (PO_4)				Hardness as $CaCO_3$							No.
Total	Dissolved	Total	Dissolved	Aluminum (Al)	Copper (Cu)	Zinc (Zn)	Sodium (Na)	Potassium (K)	Ammonia (NH_3)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulphate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Total	Dissolved	Silica (colorimetric) (SiO_2)	Boron (B)	Non-carbonate	Total	Sum of constituents	Per cent sodium	Sodium absorption ratio	Saturation index	Stability index	
near CARNDUFF																											
0.00	.....	0.00	.....	.....	....	0.00	16.6	5.2	.....	0.0	273	71.9	18.0	0.30	2.0	.....	.....	4.3	....	59.8	284	342	11	0.429	+0.7	6.6	1
.....	0.01	.....	.....	0.09	0.007	0.00	58.0	12.5	.....	0.0	316	102	91.7	0.25	2.0	0.44	.....	12	....	95.8	355	546	25	1.34	+0.4	6.9	2
near LYLETON																											
0.13	.....	0.00	.....	.....	.....	.....	15.6	13.2	.....	.....	208	91.9	9.7	0.33	3.2	.....	.....	2.0	....	61.1	232	311	12	0.445	−0.7	9.0	1
.....	0.04	.....	0.00	0.07	.....	.....	3.4	15.0	.....	0.0	109	52.9	6.2	0.27	1.6	1.7	.....	7.8	....	37.2	127	184	4.8	0.131	−1.0	9.0	2
.....	.....	.....	.....	.....	.....	.....	5.3	18.2	.....	0.0	158	78.8	7.9	.....	2.2	.....	.....	13	....	60.3	190	260	5.1	0.167	−0.6	8.5	3
.....	0.03	.....	0.00	0.07	.....	.....	5.6	15.5	0.0	0.0	151	73.2	7.3	0.28	7.6	0.5	.....	14	....	65.0	189	268	5.5	0.177	−0.5	8.2	4
.....	.....	.....	.....	.....	.....	.....	6.4	15.0	.....	0.0	181	85.3	7.6	.....	1.0	.....	.....	16	....	69.4	218	292	5.5	0.189	+0.1	7.5	5
.....	0.01	.....	0.00	0.04	.....	.....	8.1	16.0	0.0	0.0	209	94.2	8.6	0.35	1.7	0.2	.....	13	....	75.8	247	326	6.2	0.861	+0.3	7.2	6
.....	.....	.....	.....	.....	.....	.....	9.3	15.0	.....	0.0	241	88.8	7.2	.....	2.9	.....	.....	9.7	....	69.6	268	339	6.6	0.248	+0.5	6.9	7
.....	0.03	.....	0.00	0.10	.....	.....	8.3	11.3	0.0	0.0	227	78.6	4.9	0.26	1.4	0.2	.....	9.3	....	63.4	250	308	6.4	0.234	+0.3	7.1	8
.....	.....	.....	.....	.....	.....	.....	8.3	10.5	.....	0.0	235	80.6	5.2	.....	1.4	.....	.....	2.1	....	67.0	260	308	6.2	0.225	+0.3	7.1	9
.....	0.01	.....	0.00	0.09	0.015	0.00	14.2	8.0	0.0	0.0	236	50.0	7.2	0.29	0.2	0.36	.....	12	....	25.6	219	277	12	0.417	0.0	7.5	10
near COULTER																											
0.28	.....	0.00	.....	.....	.....	.....	36.3	46.1	.....	.....	279	319	20.5	0.68	7.3	.....	.....	11	....	221	450	722	13	0.750	+0.4	6.8	1
.....	0.01	.....	0.00	0.06	Trace	0.00	11.6	7.9	0.0	0.0	204	43.2	5.6	0.25	0.2	0.3	.....	11	....	21.7	189	257	11	0.367	−0.2	7.9	2
at GAINSBOROUGH																											
.....	0.01	0.00	.....	0.10	.....	.....	13.6	10.6	0.1	0.0	292	88.4	3.8	0.29	1.4	0.17	.....	5.3	....	54.1	294	349	8.8	0.345	+0.3	7.1	1
near COULTER																											
.....	Trace	0.00	.....	0.05	0.00	0.00	9.4	10.3	0.0	0.0	281	29.1	5.1	0·20	0.2	<0.1	.....	13	.....	7.7	238	279	7.5	0.266	+0.4	7.0	1

TABLE 1 (cont'd)

Chemical Analyses of Surface Waters in the
Souris, Pembina and Red River Drainage Systems in Canada

No.	Date of collection	Storage period (Days)	Stream discharge (Second-feet) On sampling date	Stream discharge (Second-feet) Monthly mean	Water temperature (°F.)	Oxygen consumed by $KMnO_4$	Carbon dioxide (calculated) (CO_2)	pH	Colour (Hazen) (Units)	Turbidity (Units)	Redox potential (mV)	Suspended matter Dried at 105°C.	Suspended matter Ignited at 550°C.	Residue on evaporation dried at 105°C. (Dissolved solids) P.P.M.	Residue on evaporation dried at 105°C. (Dissolved solids) Tons per acre-foot	Residue on evaporation dried at 105°C. (Dissolved solids) Tons per day	Loss on ignition at 550°C.	Specific conductance K × 10⁶ at 25°C.	Calcium (Ca)	Magnesium (Mg)
																			STATION NO. 16 -SOURIS RIVER	
1	Sept. 1/60	167:221	3.3	1.6	69	9.6	3	8.3	30	6	.....	21.1	8.1	606	0.825	5.4	102	927	40.1	34.8
2	Oct. 1	145:191	0.2	1.4	50	.....	3	8.4	20	4	.....	.....	.....	.....	.....	.....	.....	959	55.3	36.4
3	Nov. 5	80:128	1.8	1.9	40	.....	5	8.2	35	1	.....	.....	.....	.....	.....	.....	.....	1,037	56.1	40.5
4	Dec. 3	37:177	2.1	1.6	32	9.0	5	8.3	30	3	.....	.....	.....	714	0.970	4.0	129	1,287	65.8	51.5
5	Jan. 4/61	8:103	0.8	0.7	32	.....	13	8.0	45	4	.....	.....	.....	.....	.....	.....	.....	1,681	99.4	58.3
6	Feb. 3	24:87	0.1	0.4	32	.....	15	8.0	20	5	.....	.....	.....	.....	.....	.....	.....	2,095	122	66.7
7	Mar. 2	0:110	1.0	34.0	32	18.3	9	8.3	30	5	.....	25.6	17.5	1,411	1.92	3.8	184	2,343	129	79.9
8	Apr. 4	9:70	30.0	17.5	32	.....	4	8.1	60	4	.....	.....	.....	.....	.....	.....	.....	803	31.8	18.6
9	May 4	28:55	5.9	7.7	53	.....	5	8.2	25	2	.....	.....	.....	.....	.....	.....	.....	1,147	51.8	31.1
10	June 3	17:44	2.6	5.1	77	12.4	3	8.5	25	3	.....	.....	.....	760	1.03	5.3	81.2	1,112	50.7	36.4
11	July 3	17:32	0.2	0.1	65	.....	3	8.4	35	4	.....	.....	.....	.....	.....	.....	.....	1,409	62.6	45.2
12	Aug. 1	17:23	0.0	0.0	71	.....	13	7.8	50	13	.....	.....	.....	.....	.....	.....	.....	1,420	45.5	45.1
13	Sept. 1	18:40	0.0	0.0	75	20.7	2	8.6	120	38	.....	35.8	19.9	983	1.34	0.0	103	1,504	35.2	41.0
14	Oct. 2	17:94	0.0	0.0	50	.....	12	7.8	80	8	.....	.....	.....	.....	.....	.....	.....	1,390	42.5	43.7
15	Nov. 8	36:77	0.0	0.0	36	.....	12	7.9	20	4	.....	.....	.....	.....	.....	.....	.....	1,167	90.4	44.2
16	Dec. 2	26:103	0.0	0.0	33	8.9	14	7.9	25	3	.....	.....	.....	724	0.985	0.0	118	1,364	92.2	57.2
17	Jan. 2/62	13:63	0.0	0.0	32	.....	41	7.5	50	4	.....	.....	.....	.....	.....	.....	.....	1,677	110	69.0
18	Feb. 2	38:52	0.0	0.0	32	.....	58	7.5	50	10	.....	.....	.....	.....	.....	.....	.....	2,130	158	99.3
19	Mar. 3	41:95	0.0	0.0	32	15.4	16	8.1	50	8	.....	91.6	82.3	1,420	1.93	0.0	275	2,428	126	111
20	Mar. 31	47:53	320	24.3	32	.....	20	7.4	90	20	.....	.....	.....	.....	.....	.....	.....	1,038	26.2	17.8
21	May 1	51:66	5.1	25.8	55	.....	13	7.5	40	2	.....	.....	.....	.....	.....	.....	.....	717	35.2	7.2
22	May 17	97:110	4.8	25.8	52	7.8	8	7.9	35	0.8	.....	.....	.....	.....	.....	.....	.....	1,017	38.6	29.8
23	June 1	103:110	29.0	65.4	56	.....	3	8.3	50	4	.....	.....	.....	.....	.....	.....	.....	851	35.2	16.9
24	July 2	65:67	22.0	10.9	73	7.9	7	7.9	35	3	.....	.....	.....	546	0.744	32.4	109	835	37.0	24.7
25	Aug. 2	35:40	2.0	1.5	68	.....	8	8.0	30	3	.....	.....	.....	.....	.....	.....	.....	1,133	41.1	29.5
26	Sept. 1	17:24	0.4	0.1	65	.....	4	8.3	45	6	.....	.....	.....	.....	.....	.....	.....	1,120	41.1	31.5
27	Oct. 1	22:36	0.0	0.2	60	10.6	6	8.1	35	4	.....	1.6	0.0	746	1.02	0.0	144	1,124	49.8	36.7
28	Nov. 3	13:23	0.8	0.8	39	.....	7	8.1	30	4	.....	.....	.....	.....	.....	.....	.....	1,174	44.7	31.8
29	Dec. 4	45:64	1.6	0.6	36	.....	12	7.9	30	3	.....	.....	.....	.....	.....	.....	.....	1,364	48.4	40.4
30	Jan. 1/63	37:92	0.0	0.0	36	11.6	12	8.0	35	15	.....	32.1	22.3	1,015	1.38	0.0	148	1,645	63.6	60.4
31	Feb. 2	16:51	8.0	0.0	33	.....	27	7.9	100	6	.....	.....	.....	.....	.....	.....	.....	3,032	159	109
32	Mar. 9	44:53	0.0	64.9	32	.....	15	8.1	60	20	-397	.....	.....	.....	.....	.....	.....	2,714	126	104
33	Apr. 1	52:63	40.0	41.5	32	18.0	2	8.3	75	10	-417	45.7	36.6	510	0.694	55.0	95.2	756	30.9	18.1
34	May 2	35:39	.....	25.2	53	.....	5	8.0	50	5	-417	.....	.....	.....	.....	.....	.....	983	37.3	23.2
35	June 1	20:66	.....	77.0	72	.....	9	7.8	45	4	-445	.....	.....	.....	.....	.....	.....	971	35.6	23.2
36	June 16	32:91	.....	.....	74	19.4	12	7.6	120	25	-467	.....	.....	.....	.....	.....	.....	1,000	38.1	27.7
37	June 16	33:92	.....	.....	75	19.7	3	8.3	128	45	-432	51.7	41.3	666	0.905	.....	106	979	30.5	20.6
38	Aug. 1	55:82	26.0	34.0	73	12.0	11	7.5	60	20	-517	42.0	35.2	498	0.676	34.3	93.2	744	27.6	21.6
39	Oct. 2	49:61	3.6	.....	58	9.9	6	8.0	40	2	-500	.....	.....	718	0.975	.....	124	2,000	48.9	31.8

TABLE 1 (cont'd)

Chemical Analyses of Surface Waters in the Souris, Pembina and Red River Drainage Systems in Canada

Iron (Fe)		Manganese (Mn)					Alkalis									Phosphate (PO_4)				Hardness as $CaCO_3$							
Total	Dissolved	Total	Dissolved	Aluminum (Al)	Copper (Cu)	Zinc (Zn)	Sodium (Na)	Potassium (K)	Ammonia (NH_3)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulphate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Total	Dissolved	Silica (colorimetric) (SiO_2)	Boron (B)	Non-carbonate	Total	Sum of constituents	Per cent sodium	Sodium absorption ratio	Saturation index	Stability index	No.
at GLEN EWEN, SASK.																											
0.23	0.02	0.10	0.00	0.00	0.00	0.00	110	10.5	0.1	0.0	334	172	27.4	0.42	10	1.7	1.6	11	....	0.0	243	583	48	.....	+0.8	6.7	1
.....	.....	.....	.....	.....	.....	.....	105	10.7	.....	3.0	401	148	30.9	.....	0.8	.....	.....	11	....	0.0	288	599	43	.....	+1.2	6.0	2
.....	.....	.....	.....	.....	.....	.....	116	9.8	0.3	0.0	425	161	39.0	.....	3.0	.....	.....	8.9	....	0.0	307	644	44	.....	+1.0	6.2	3
0.18	0.01	0.00	0.00	0.00	0.01	0.00	150	12.3	.....	0.0	537	190	64.6	0.37	2.0	0.1	0.1	6.1	....	0.0	376	807	45	.....	+1.2	5.9	4
.....	.....	.....	.....	.....	.....	.....	212	11.6	.....	0.0	735	233	89.0	.....	2.0	.....	.....	14	....	0.0	488	1,081	48	.....	+1.2	5.6	5
.....	.....	.....	.....	.....	.....	.....	276	12.0	0.1	0.0	917	284	113	.....	5.2	.....	.....	20	....	0.0	580	1,350	50	.....	+1.4	5.2	6
1.41	0.05	2.40	0.01	0.03	0.00	0.00	349	14.5	0.5	0.0	1,056	332	150	0.62	0.2	0.2	.....	24	....	0.0	651	1,599	53	.....	+1.7	4.9	7
.....	.....	.....	.....	.....	.....	.....	117	8.5	0.4	0.0	286	158	19.5	.....	2.0	.....	.....	7.3	....	0.0	156	504	60	.....	+0.5	7.1	8
.....	.....	.....	.....	.....	.....	.....	164	9.5	0.1	0.0	445	192	50.2	.....	4.0	.....	.....	2.8	....	0.0	257	723	57	.....	+1.0	6.2	9
0.20	0.02	0.00	0.10	0.00	0.00	0.00	166	11.0	0.1	10.2	440	177	62.3	0.46	1.8	0.8	0.8	7.8	....	0.0	276	741	55	.....	+1.3	5.9	10
.....	.....	.....	.....	.....	.....	.....	198	12.5	0.3	10.8	487	243	86.1	.....	3.1	.....	.....	19	....	0.0	342	920	55	.....	+1.3	5.8	11
.....	.....	.....	.....	.....	.....	.....	208	12.6	0.4	0.0	482	225	90.7	.....	3.9	.....	.....	19	....	0.0	299	887	59	.....	+0.5	6.8	12
0.39	0.02	0.08	0.0	0.00	0.00	0.00	239	14.1	5.0	29.6	427	211	114	0.79	0.4	2.4	1.1	17	....	0.0	257	913	65	.....	+1.2	6.2	13
.....	.....	.....	.....	.....	.....	.....	213	14.1	0.4	0.0	498	207	102	.....	8.1	.....	.....	13	....	0.0	286	889	60	.....	+0.5	6.8	14
.....	.....	.....	.....	.....	.....	.....	108	10.0	.....	0.0	556	135	49.5	.....	3.0	.....	.....	19	....	0.0	408	732	36	.....	+1.0	5.9	15
0.23	0.00	0.3	0.0	0.14	Trace	0.00	150	13.5	0.3	0.0	637	163	65.1	0.35	0.8	<0.1	<0.1	13	....	0.0	457	868	41	.....	+1.0	5.9	16
.....	.....	.....	.....	.....	.....	.....	173	14.6	4.0	0.0	813	186	82.1	.....	0.3	.....	.....	18	0.00	0.0	559	1,052	39	.....	+0.8	5.9	17
.....	.....	.....	.....	.....	.....	.....	243	20.5	0.2	0.0	1,124	249	114	.....	17	.....	.....	30	....	0.0	802	1,483	39	.....	+1.1	5.3	18
0.78	Trace	2.53	0.02	0.17	Trace	0.00	292	23.8	0.0	0.0	1,170	272	139	0.72	11	2.0	1.4	37	....	0.0	773	1,589	44	4.57	+1.6	4.9	19
.....	.....	.....	.....	.....	.....	.....	182	9.5	0.4	0.0	344	235	16.0	0.47	6.2	.....	.....	8.1	....	0.0	139	670	72	.....	−0.2	7.8	20
.....	.....	.....	.....	.....	.....	.....	910	7.5	0.3	0.0	247	113	37.0	.....	2.9	.....	.....	4.3	....	0.0	168	420	53	9.63	−0.1	7.7	21
0.11	.....	0.03	.....	.....	.....	0.00	146	9.7	0.1	0.0	369	149	56.8	0.41	2.5	.....	.....	3.3	....	0.0	219	618	58	2.957	+0.5	6.9	22
.....	.....	.....	.....	.....	.....	.....	132	9.5	0.1	0.0	324	156	16.5	.....	0.8	.....	.....	5.1	....	0.0	157	413	63	4.573	+0.8	6.7	23
.....	0.00	.....	0.00	0.00	0.00	0.00	104	11.2	0.1	0.0	344	128	18.2	0.36	0.8	0.98	.....	7.8	0.11	0.0	194	503	52	3.247	+0.4	7.1	24
.....	.....	.....	.....	.....	.....	.....	170	11.4	0.1	0.0	466	171	37.4	.....	2.7	.....	.....	17	....	0.0	224	709	61	4.944	+0.7	6.6	25
.....	.....	.....	.....	.....	.....	.....	164	11.4	0.1	0.0	488	143	42.9	.....	2.0	.....	.....	18	....	0.0	232	694	59	4.685	−1.0	9.3	26
.....	0.00	.....	0.00	0.12	.....	.....	155	12.4	0.0	0.0	505	142	41.3	0.40	3.9	0.9	.....	14	....	0.0	276	704	54	4.047	+0.9	6.3	27
.....	.....	.....	.....	.....	.....	.....	171	11.2	.....	0.0	489	152	53.8	.....	3.1	.....	.....	9.9	....	0.0	243	718	59	4.767	+0.9	6.3	28
.....	.....	.....	.....	.....	.....	.....	200	13.3	.....	0.0	548	176	80.2	0.45	4.0	.....	.....	7.3	....	0.0	287	839	59	3.387	+0.8	6.3	29
.....	Trace	.....	0.00	0.07	.....	.....	248	15.0	0.0	0.0	676	207	122	0.43	1.5	<0.1	.....	12	....	0.0	394	1,063	57	5.428	+1.0	6.0	30
.....	.....	.....	.....	.....	.....	.....	423	15.5	.....	0.0	1,285	354	275	.....	5.3	.....	.....	27	....	0.0	848	2,000	52	6.320	+1.5	4.9	31
.....	.....	.....	.....	.....	.....	.....	375	27.5	.....	0.0	1,119	316	233	.....	4.2	.....	.....	26	....	0.0	744	1,762	51	5.983	+1.6	4.9	32
.....	0.05	.....	0.00	0.00	.....	.....	100	12.0	0.1	0.0	252	134	26.6	0.37	6.6	1.0	.....	8.9	....	0.0	152	462	57	3.537	+0.6	7.1	33
.....	.....	.....	.....	.....	.....	.....	146	10.0	.....	0.0	315	185	43.6	.....	1.6	.....	.....	5.5	....	0.0	189	608	61	4.629	+0.5	7.0	34
.....	.....	.....	.....	.....	.....	.....	150	10.5	.....	0.0	356	180	24.7	.....	2.4	.....	.....	7.3	....	0.0	185	609	62	4.814	+0.3	7.2	35
.....	0.01	.....	0.00	0.01	Trace	0.00	145	9.4	0.05	0.0	317	227	22.8	0.48	2.1	0.7	.....	12	....	0.0	209	640	59	4.371	+0.1	7.4	36
.....	0.11	.....	0.00	0.08	0.01	0.00	160	8.6	0.2	0.0	328	212	12.9	0.47	3.7	0.8	.....	13	....	0.0	161	624	67	4.320	+0.7	6.9	37
.....	0.03	.....	0.00	0.05	.....	.....	93.0	9.1	0.1	0.0	224	142	29.7	0.32	3.0	1.0	.....	9.3	....	0.0	158	446	54	3.224	−0.3	8.1	38
.....	0.01	.....	0.00	0.03	.....	.....	148	10.5	0.1	0.0	403	176	54.0	0.38	2.7	0.7	.....	16	....	0.0	253	687	55	4.05	+0.7	6.6	39

TABLE 1 (cont'd)

Chemical Analyses of Surface Waters in the
Souris, Pembina and Red River Drainage Systems in Canada

No.	Date of collection	Storage period (Days)	Stream discharge (Second-feet) On sampling date	Stream discharge (Second-feet) Monthly mean	Water temperature (°F.)	Oxygen consumed by $KMnO_4$	Carbon dioxide (calculated) (CO_2)	pH	Colour (Hazen) (Units)	Turbidity (Units)	Redox potential (mV)	Suspended matter Dried at 105°C.	Suspended matter Ignited at 550°C.	Residue on evaporation dried at 105°C. (Dissolved solids) P.P.M.	Residue on evaporation dried at 105°C. (Dissolved solids) Tons per acre-foot	Residue on evaporation dried at 105°C. (Dissolved solids) Tons per day	Loss on ignition at 550°C.	Specific conductance $K \times 10^6$ at 25°C.	Calcium (Ca)	Magnesium (Mg)
																			STATION NO. 17 – SOURIS RIVER	
1	May 19/60	8:22	415	843	59	.....	4	8.1	55	30	.....							714	51.2	32.8
2	Aug. 23	176:230	11	13.7	75	18.1	6	7.9	60	35	.....	29.4	13.6	536	0.735	16.0	124	779	23.7	25.9
3	Aug. 30	169:217	36	13.7	72	.....	6	7.9	60	35	.....							772	21.1	27.8
4	Sept. 8	166:216	34	33.0	62	27.1	7	7.9	80	10	.....	23.7	10.7	561	0.770	51.9	107	832	23.5	28.7
5	Sept. 15	155:201	37	33.0	65	.....	10	7.8	55	35	.....							872	27.9	32.9
6	Sept. 22	141:208	31	33.0	58	23.2	6	8.1	80	15	.....	24.9	15.2	626	0.857	52.6	128	914	27.9	36.2
7	Sept. 29	141:193	29	33.0	52	.....	2	8.5	High	6.3	.....							954	30.9	44.4
8	Oct. 13	106:204	26	23.6	44	21.6	16	7.7	100	20	.....	33.0	23.5	747	1.02	52.5	158	1,063	35.3	47.3
9	Oct. 20	98:140	21	23.6	38	.....	3	8.4	100	15	.....							1,060	35.1	46.0
10	Oct. 26	84:187	19	23.6	35	24.0	6	8.2	100	25	.....	31.4	21.0	776	1.06	40.0	218	1,133	42.5	49.3
11	Nov. 3	82:132	9.1	5.1	37	.....	12	7.9	120	35	.....							1,138	43.5	48.7
12	Sept. 21/61	25:109	7.9	9.7	56	19.8	28	7.5	50	20	.....	33.9	26.4	928	1.27	19.9	163	1,315	25.0	51.5
13	Sept. 28	18:98	9.2	9.7	46	.....	5	8.1	80	20	.....							1,329	23.0	53.2
14	Oct. 27	46:89	14.0	11.1	42	.....	13	7.8	40	15	.....							1,920	85.8	91.3
15	Nov. 2	40:83	6.1	3.4	38	.....	12	7.8	40	10	.....							1,890	83.0	92.3
16	May 16/62	93:97	6.6	4.9	51	9.5	21	7.4	30	15	.....	12.2	10.2	1,161	1.59	20.8	222	1,559	63.7	81.5
17	June 17	45:80	5.5	4.8	78	8.1	16	7.2	70	15	.....	24.6	17.9	290	0.398	4.4	56.4	438	30.9	19.5
18	June 26	30:37	5.3	4.8	82	.....	17	7.2	55	15	.....							439	29.9	19.3
19	June 29	21:33	4.8	4.8	70	.....	2	8.2	70	15	.....							646	39.3	28.8
20	July 5	15:64	6.3	6.5	72	10.4	2	8.4	70	15	.....	9.8	2.6	462	0.634	7.9	98.8	621	38.5	29.7
21	July 25	41:44	7.0	6.5	78	.....	0.6	9.5	45	6	.....							1,013	35.4	51.2
22	Aug. 1	34:37	5.7	10.4	75	.....	0.6	9.5	45	8	.....							1,030	36.0	51.1
23	Aug. 16	19:22	12	10.4	70	16.4	3	8.2	65	4	.....	5.2	2.2	790	1.08	25.7	160	1,076	43.4	47.1
24	Aug. 23	12:15	10	10.4	68	.....	2	8.3	65	4	.....							1,095	37.4	50.6
25	Aug. 31	28:47	7.8	10.4	68	.....	200	6.3	80	20	.....							1,155	38.0	54.7
26	Sept. 10	18:37	6.8	10.4	56	.....	65	6.8	80	15	.....							1,126	38.2	53.6
27	Apr. 7/63	38:44	2.2	1.6	58	28.1	12	7.9	50	7	-418	33.8	10.2	1,785	2.44	10.7	416	2,231	99.8	125
28	Apr. 14	31:37	2.1	1.6	62	.....	11	7.9	50	15	-433							2,218	101	123
29	May 2	43:70	0.8	0.9	66	8.0	2	8.0	10	5	-413	21.4	19.3	272	0.373	0.59	52.0	398	25.2	13.8
30	May 9	36:57	0.7	0.9	68	.....	8	7.9	.....	10	-416							1,760	50.3	89.7
31	May 16	29:50	0.5	0.9	72	.....	23	7.4	50	25	-419							1,750	55.9	90.0
32	June 15	24:81	47.5	160	70	19.7	15	7.5	80	20	-444	27.6	20.1	555	0.760	71.5	124	797	47.8	37.2
33	June 17	65:109	51.5	160	71	17.8	7	7.8	60	10	-461	20.1	11.7	531	0.729	74.4	132	766	46.5	36.3
34	June 24	59:60	446	.....	64	.....	17	7.4	40	9	-486							1,023	41.3	51.6
35	July 2	51:52	292	54.3	67	.....	13	7.6	60	8	-469							903	36.5	42.2
36	July 9	44:92	25.1	54.3	74	24.7	32	7.2	80	15	-481	11.8	6.1	623	0.855	42.5	135	911	36.3	40.8
37	July 16	37:38	22.7	54.3	67	.....	28	7.2	80	20	-477							805	22.1	39.2
38	July 22	30:31	25.9	54.3	74	.....	8	7.8	80	28	-379							873	22.3	41.0
39	July 29	24:72	28.7	54.3	80	23.0	22	7.3	80	20	-472	34.0	21.6	598	0.828	46.5	133	837	23.7	35.0
40	Aug. 6	16:28			72	.....	15	7.5	90	20	-360							860	23.5	33.1
41	Aug. 13	92:97			64	25.9	5	7.9	65	20	-451							829	21.3	32.8
42	Aug. 19	7	23.1	24.0	78	.....	.....	8.3	150	.....	-469							831	19.6	30.8
43	Aug. 27	80:97	25.5	24.0	64	18.6	22	7.3	60	20	-496	22.5	10.7	562	0.770	38.4	113	812	21.5	30.0
44	Sept. 2	74:91	20.3	20.7	64	22.1	20	7.3	60	25	-487	29.4	16.1	578	0.791	31.8	120	825	28.5	31.8
45	Sept. 10	66:78	27.5	20.7	69	.....	21	7.3	65	9.3	-479							870	21.7	31.8
46	Sept. 17	62:69	19.1	20.7	54	23.0	30	7.2	70	30	-498							891	23.5	34.6
47	Sept. 24	56:62	12.8	20.7	57	.....	25	7.3	70	15	-521							882	25.1	34.6
48	Oct. 1	49:55	12.8	19.7	56	.....	13	7.6	70	15	-502							949	29.1	38.3

Note – Gauge station changed from near Westhope to Coulter dam between September 10/62 and April 7/63

TABLE 1 (cont'd)

Chemical Analyses of Surface Waters in the
Souris, Pembina and Red River Drainage Systems in Canada

Iron (Fe)		Manganese (Mn)					Alkalis									Phosphate (PO_4)				Hardness as $CaCO_3$						
Total	Dissolved	Total	Dissolved	Aluminium (Al)	Copper (Cu)	Zinc (Zn)	Sodium (Na)	Potassium (K)	Ammonia (NH_3)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulphate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Total	Dissolved	Silica (colorimetric) (SiO_2)	Boron (B)	Non-carbonate	Total	Sum of constituents	Per cent sodium	Sodium absorption ratio	Saturation index	Stability index	No.
at COULTER																											
0.90	0.03	0.20	Trace	0.00	Trace	0.00	52.8	11.6	.....	0.0	317	105	12.7	0.00	1.2	0.2	....	8.8	....	1.2	261	433	29	.....	+0.7	6.7	1
0.31	0.04	0.00	0.00	0.00	0.00	0.00	104	12.0	0.1	0.0	276	132	20.9	0.55	14	1.1	1.1	22	....	0.0	166	491	55	.....	+0.1	7.7	2
.....	.....	.....	.....	.....	.....	....	103	12.5	.....	0.0	281	134	20.1	.....	16	.....	.....	22	....	0.0	167	495	55	.....	+0.1	7.7	3
0.78	0.03	0.10	0.00	0.00	Trace	0.00	108	11.6	.....	0.0	308	122	22.8	0.54	24	1.0	1.0	29	....	0.0	177	522	55	.....	+0.2	7.5	4
.....	.....	.....	.....	.....	.....	....	114	13.3	.....	0.0	349	132	22.4	.....	16	.....	.....	24	....	0.0	205	555	53	.....	+0.2	7.4	5
0.21	0.06	0.00	0.00	0.00	0.00	0.00	120	12.2	0.1	0.0	383	128	24.7	0.58	16	1.0	1.0	25	....	0.0	219	581	53	.....	+0.5	7.1	6
.....	.....	.....	.....	.....	.....	....	129	13.7	.....	14.6	425	143	26.7	.....	10	.....	.....	24	....	0.0	260	646	50	.....	+1.1	6.3	7
0.48	0.03	0.00	0.00	0.00	0.00	0.30	137	13.8	0.2	0.0	471	151	27.3	0.75	6.0	0.0	0.0	17	....	0.0	282	667	50	.....	+0.3	7.1	8
.....	.....	.....	.....	.....	.....	....	137	13.8	0.2	2.0	482	152	27.6	.....	12	.....	.....	19	....	0.0	279	682	50	.....	+1.0	5.8	9
0.85	0.02	0.15	0.00	0'00	Trace	0.00	145	12.8	.....	0.0	508	158	29.7	0.56	16	0.6	0.6	18	....	0.0	309	723	49	.....	+0.9	6.4	10
.....	.....	.....	.....	.....	.....	....	143	14.0	0.1	0.0	513	163	29.9	.....	14	.....	.....	17	....	0.0	309	725	49	.....	+0.6	6.7	11
0.21	0.01	0.04	0.00	0.02	0.00	0.00	185	18.5	4.0	0.0	379	297	55.5	0.69	20	1.3	1.3	5.1	0.00	0.0	275	846	57	.....	-0.2	7.9	12
.....	.....	.....	.....	.....	.....	....	195	18.6	5.0	0.0	379	300	61.3	.....	17.5	.....	.....	5.1	....	0.0	274	860	59	.....	+0.4	7.3	13
.....	.....	.....	.....	.....	.....	....	220	24.5	ppt	0.0	464	590	74.5	.....	9.9	.....	.....	5.4	....	209	590	1,330	44	.....	+0.7	6.4	14
.....	.....	.....	.....	.....	.....	....	220	24.5	ppt	0.0	456	588	73.0	.....	9.5	.....	.....	5.0	....	213	587	1,319	44	.....	+0.7	6.4	15
.....	0.01	.....	0.00	0.05	0.00	0.00	156	20.9	0.0	0.0	315	512	47.2	0.98	7.0	0.6	.....	4.0	....	236	494	1,048	39	3.033	+0.1	7.2	16
.....	Trace	.....	0.00	0.00	0.00	0.00	25.6	11.1	0.1	0.0	173	69.4	8.1	0.32	4.2	1.3	.....	20	....	15.8	157	275	35	0.888	-0.6	8.4	17
.....	.....	.....	.....	.....	.....	....	25.0	11.5	0.1	0.0	174	68.6	7.2	.....	4.0	.....	.....	20	....	11.1	154	272	24	0.876	-0.6	8.4	18
.....	.....	.....	.....	.....	.....	....	55.0	12.5	0.1	0.0	213	150	16.8	.....	3.1	.....	.....	18	....	41.9	217	429	34	1.624	+0.5	7.2	19
.....	0.08	.....	0.00	0.01	Trace	0.00	53.5	12.5	0.1	3.6	209	146	16.0	0.39	4.0	1.1	.....	19	0.06	40.7	218	428	33	1.574	+0.7	7.0	20
.....	.....	.....	.....	.....	.....	....	107	15.5	0.1	56.2	123	306	32.4	.....	2.2	.....	.....	13	....	105	299	679	42	2.692	+1.8	5.9	21
.....	.....	.....	.....	.....	.....	....	107	15.5	0.1	51.7	132	302	32.5	.....	2.1	.....	.....	13	....	106	300	676	42	2.689	+1.9	5.7	22
.....	Trace	.....	0.00	0.02	Trace	0.00	115	15.0	0.1	0.0	245	313	34.7	0.70	3.5	1.0	.....	18	....	101	302	712	44	2.879	+0.6	7.0	23
.....	.....	.....	.....	.....	.....	....	114	15.0	0.1	0.0	244	316	34.4	.....	3.4	.....	.....	.....	....	102	302	583	44	2.857	+0.7	6.9	24
.....	.....	.....	.....	.....	.....	....	125	16.0	.....	0.0	329	348	37.3	.....	8.9	.....	.....	2.3	....	119	320	750	44	3.041	-1.3	8.9	25
.....	.....	.....	.....	.....	.....	....	125	16.0	.....	0.0	335	336	36.9	.....	8.2	.....	.....	3.1	....	112	316	740	45	3.061	-0.8	8.4	26
.....	0.01	.....	0.00	0.18	.....	....	237	22.5	.....	0.0	561	729	68.0	0.36	7.4	0.7	.....	10	....	305	765	1,577	39	3.730	+1.0	5.9	27
.....	.....	.....	.....	.....	.....	....	235	22.5	.....	0.0	551	740	68.1	.....	6.0	.....	.....	11	0.0	306	758	1,577	39	3.710	+1.0	5.9	28
.....	0.00	.....	0.00	0.01	.....	....	33.8	5.2	0.0	0.0	98.6	102	6.0	0.26	1.9	0.1	.....	7.3	....	38.9	120	242	37	1.355	-0.1	8.2	29
.....	.....	.....	.....	.....	.....	....	213	22.0	.....	0.0	373	578	62.1	.....	1.0	.....	.....	[illegible]	....	189	495	1,718	47	4.160	+0.6	6.7	30
.....	.....	.....	.....	.....	.....	....	216	21.0	.....	0.0	361	581	60.6	.....	8.1	.....	.....	17	....	214	510	1,224	46	4.098	+0.1	7.2	31
.....	Trace	.....	0.00	0.09	.....	....	63.5	13.6	0.0	0.0	277	171	15.0	0.42	2.5	0.82	.....	21	0.08	45.1	797	509	32	1.673	+0.1	7.3	32
.....	0.01	.....	0.00	0.08	.....	....	59.0	14.8	0.0	0.0	286	153	13.0	0.39	3.8	1.7	.....	20	....	31.0	265	487	31	1.578	+0.3	7.2	33
....	.....	.....	.....	.....	.....	....	99.0	13.8	.....	0.0	284	263	27.8	.....	9.7	.....	.....	15	....	83.0	316	660	39	2.426	-0.1	7.6	34
.....	.....	.....	.....	.....	.....	....	90.5	14.4	.....	0.0	318	169	25.6	.....	12	.....	.....	23	....	4.2	265	569	41	2.408	0.0	7.5	35
.....	0.01	.....	0.0	0.09	.....	....	92.5	13.6	0.0	0.0	338	152	26.5	0.44	16	2.7	.....	32	....	0.0	258	577	42	2.510	-0.3	7.7	36
.....	.....	.....	.....	.....	.....	....	100	13.5	.....	0.0	284	160	27.1	.....	18	.....	.....	25	....	0.0	217	545	48	2.955	-0.5	8.2	37
.....	.....	.....	.....	.....	.....	....	101	13.5	.....	0.0	320	159	28.0	.....	1.2	.....	.....	28	....	0.0	224	551	48	2.815	+0.1	7.6	38
.....	0.01	.....	0.0	0.07	.....	....	100	12.4	1.0	0.0	290	138	26.3	0.49	21	1.9	.....	32	....	0.0	203	532	50	3.055	-0.5	8.3	39
.....	.....	.....	.....	.....	.....	....	107	12.8	.....	0.0	312	147	29.0	.....	14	.....	.....	30	....	0.0	195	550	53	3.337	-0.2	7.9	40
.....	0.01	.....	0.00	0.08	.....	....	108	12.3	0.1	0.0	277	145	28.6	0.46	18	1.2	.....	29	....	0.0	188	534	54	2.77	+0.1	7.7	41
.....	.....	.....	.....	.....	.....	....	.....	.....	.....	0.0	286	.....	29.1	.....	.....	.....	.....	.....	....	0.0	176	.....	.....	.....	.....	.....	42
.....	0.01	.....	0.00	0.03	.....	....	105	12.2	0.1	0.0	277	135	29.2	0.36	16	1.3	.....	28	....	0.0	177	514	54	3.42	-0.5	8.3	43
.....	0.02	.....	0.00	0.03	.....	....	111	12.2	0.1	0.0	296	138	30.6	0.44	11	0.9	.....	28	....	0.0	182	530	55	3.58	-0.5	8.3	44
.....	.....	.....	.....	.....	.....	....	115	12.8	.....	0.0	299	144	32.2	.....	18	.....	.....	28	....	0.0	185	551	55	3.67	-0.4	8.1	45
.....	0.01	.....	0.00	0.07	.....	....	115	13.2	0.1	0.0	310	149	33.3	0.47	16	1.6	.....	26	....	0.0	201	565	53	3.54	-0.5	8.2	46
.....	.....	.....	.....	.....	.....	....	113	12.5	.....	0.0	324	144	32.3	.....	6.4	.....	.....	26	....	0.0	205	553	53	3.42	-0.4	8.1	47
.....	.....	.....	.....	.....	.....	....	115	13.0	.....	0.0	338	155	34.1	.....	18	.....	.....	28	....	0.0	230	596	50	3.30	0.0	7.6	48

TABLE 1 (cont'd)

Chemical Analyses of Surface Waters in the Souris, Pembina and Red River Drainage Systems in Canada

No.	Date of sampling	Storage period (Days)	Stream discharge (Second-feet) On sampling date	Stream discharge (Second-feet) Monthly meao	Water temperature (°F.)	Oxygen consumed by $KMnO_4$	Carbon dioxide (calculated) (CO_2)	pH	Colour (Hazen) (Units)	Turbidity (Units)	Redox potential (mV)	Suspended matter Dried at 105°C.	Suspended matter Ignited at 550°C.	Residue on evaporation dried at 105°C. (Dissolved solids) P.P.M.	Residue on evaporation dried at 105°C. (Dissolved solids) Tons per acre-foot	Residue on evaporation dried at 105°C. (Dissolved solids) Tons per day	Loss on ignition at 550°C.	Specific conductance $K \times 10^6$ at 25°C.	Calcium (Ca)	Magnesium (Mg)
																		STATION NO. 18 – RED RIVER		
1	May 18/60	14:23	4,000	5,210	61	.....	4	8.0	35	310	.....							636	61.8	29.8
2	May 18	14:23	4,000	5,210	61.5	.....	4	8.0	45	325	.....							632	61.3	29.9
3	May 18	14:23	4,000	5,210	61.5	.....	4	8.0	.....	310	.....							634	61.5	30.0
4	Aug. 15	143:147	522	589	68	7.4	3	8.1	25	12	.....							838	60.8	36.7
5	Aug. 22	175:225	526	589	74	.....	4	8.1	15	20	.....							738	56.1	38.6
6	Aug. 29	170:224	508	589	66	6.0	3	8.1	10	15	.....	26.7	18.0	432	0.586	590	91.2	694	45.9	34.2
7	Sept. 5	163:211	841	619	75	.....	2	8.3	15	30	.....							732	52.9	36.9
8	Sept. 12	151:218	710	619	62	6.0	3	8.2	10	20	.....	28.2	23.1	399	0.544	765	81.2	649	48.7	33.2
9	Sept. 21	153:197	492	619	64	.....	3	8.2	15	.....	.....							643	54.3	35.0
10	Sept. 26	126:204	403	619	57	6.8	6	7.9	35	20	.....	27.4	23.0	458	0.623	496	80.4	727	561	34.7
11	Oct. 3	129:189	370	342	52	.....	3	8.2	30	15	.....							757	56.7	36.1
12	Oct. 11	108:212	276	342	53	7.8	8	7.8	25	30	.....	19.2	12.9	611	0.831	454	97.6	1,038	58.9	35.2
13	Oct. 17	101:143	315	342	50	.....	2	8.5	30	25	.....							699	53.5	34.0
14	Oct. 24	91:195	380	342	43	6.8	3	8.2	30	20	.....	19.5	14.0	484	0.658	495	79.6	775	57.5	34.7
15	Oct. 31	85:133	417	342	44	.....	5	8.0	30	20	.....							757	52.1	36.0
16	Nov. 7	70:175	640	555	38	9.2	4	8.1	45	15	.....	30.1	22.4	567	0.772	978	89.6	934	59.3	35.9
17	Nov. 14	61:127	739	555	35	.....	7	7.9	35	10	.....							1,639	80.6	43.9
18	Nov. 21	49:189	541	555	35	8.0	4	8.1	25	8	.....	19.3	11.0	1,184	1.61	1,730	173	1,972	86.6	47.5
19	Nov. 28	46:120	568	555	34	.....	9	7.8	35	10	.....							1,713	80.8	49.8
20	Dec. 5	32:175	417	379	34	9.4	5	8.1	30	5	.....	14.9	8.6	791	1.075	890	104	1,299	84.8	47.1
21	Dec. 12	29:100	328	379	34	.....	14	7.7	35	5	.....							1,032	78.8	44.3
22	Dec. 19	24:119	448	379	34	.....	17	7.6	35	4	.....							803	72.0	40.0
23	Dec. 27	9:13	382	379	35	11.4	8	7.9	45	3	.....							843	80.8	41.9
24	Jaa. 4/61	19:148	320	345	34	11.6	9	7.9	45	6	.....	6.7	0.0	586	0.796	505	192	915	81.2	44.5
25	Jan. 9	10:99	353	345	34	.....	7	8.0	100	5	.....							850	79.0	43.9
26	Jan. 16	25:136	370	345	34	8.8	5	8.2	30	6	.....	2.6	0.0	566	0.770	565	189	890	82.6	45.4
27	Jan. 23	17:91	344	345	34	.....	6	8.1	45	4	.....							885	81.8	44.9
28	Jaa. 31	27:127	311	345	34	12.1	5	8.2	15	4	.....	6.4	0.6	544	0.740	456	96.8	875	84.8	44.8
29	Feb. 6	21:79	280	293	34	.....	5	8.2	20	2	.....							836	85.4	45.1
30	Feb. 13	22:60	336	293	34	.....	5	8.2	20	1	.....							951	78.9	43.5
31	Feb. 20	15:113	268	293	34	10.3	5	8.2	40	3	.....			622	0.845	450	82.8	1,024	78.2	43.7
32	Feb. 27	17:67	272	293	34	.....	6	8.1	25	4	.....							934	75.0	41.4
33	Mar. 6	10:58	370	1,720	34	.....	5	8.2	20	3	.....							949	72.1	43.7
34	Mar. 13	22:105	908	1,720	34	10.4	3	8.4	10	2	.....			577	0.784	1,405	87.2	927	68.5	38.9
35	Mar. 20	15:46	2,120	1,720	34	.....	2	8.3	30	6	.....							707	51.3	29.8
36	Mar. 27	17:78	3,660	1,720	35	.....	9	7.5	35	30	.....							626	43.8	22.7
37	Apr. 3	10:71	4,080	2,590	35	11.6	3	8.0	35	45	.....	65.0	54.1	478	0.650	5,250	65.6	761	46.7	25.5
38	Apr. 10	21:77	3,270	2,590	36	.....	3	8.0	30	50	.....							679	66.2	12.8
39	Apr. 17	14:64	1,660	2,590	36	.....	4	8.0	35	350	.....							834	59.0	30.0
40	Apr. 24	36:65	1,640	2,590	46	.....	3	8.1	15	60	.....							797	61.4	28.5
41	May 1	22:71	2,840	2,400	48	9.0	2	8.4	20	300	.....	291	254	425	0.578	3,260	84.4	612	60.8	29.7
42	May 8	28:64	2,300	2,400	52	9.2	2	8.4	40	60	.....	148	117	428	0.582	2,655	125	632	63.5	32.1
43	May 15	21:63	2,080	2,400	54	.....	2	8.4	25	50	.....							707	67.4	35.8
44	May 23	20:58	2,880	2,400	62	.....	2	8.5	35	250	.....							729	69.6	39.4
45	May 29	14:52	2,220	2,400	64	.....	2	8.4	35	90	.....							748	73.8	39.2
46	Juoe 5	31:45	1,540	1,110	66	10.6	7	7.9	25	45	.....	112	100	518	0.705	2,140	139	742	66.9	41.2
47	June 12	24:50	1,110	1,110	75	.....	4	8.1	25	25	.....							793	63.7	42.6
48	June 19	25:39	1,010	1,110	70	7.1	3	8.3	15	40	.....	73.9	66.2	450	0.610	1,220	83.2	711	59.9	39.2
49	June 26	18:29	724	1,110	70	.....	3	8.3	15	45	.....							638	51.3	36.5
50	July 3	23:32	483	441	68	.....	3	8.2	20	40	.....							650	58.4	31.3
51	July 10	16:29	422	441	72	.....	3	8.3	15	30	.....							650	57.4	32.7
52	July 17	23:38	430	441	72	6.5	2	8.3	20	25	.....	54.4	43.1	437	0.593	505	136	645	51.4	33.6
53	July 24	16:18	426	441	74	.....	2	8.3	40	550	.....							820	56.4	32.0
54	July 31	36:63	414	441	73	.....	3	8.2	15	40	.....							887	53.9	36.4
55	Aug. 8	28:43	355	275	74	.....	2	8.4	10	35	.....							1,156	56.4	39.7
56	Aug. 14	35:57	272	275	72	3.8	4	8.1	10	20	.....	36.1	32.4	700	0.953	514	100	1,166	57.8	38.2
57	Aug. 21	29:45	232	275	68	.....	3	8.2	15	25	.....							984	49.3	36.3
58	Aug. 28	28:128	166	275	70	4.6	.....	8.3	15	25	.....	42.0	32.8	482	0.655	216	86.0	790	45.5	34.0
59	Sept. 4	21:65	138	267	63	.....	3	8.2	15	30	.....							954	46.5	35.4
60	Sept. 11	17:119	150	267	62	3.0	3	8.2	20	30	.....	69.2	63.8	691	0.940	280	98.4	1,142	50.9	38.7
61	Sept. 18	28:112	348	267	61	.....	3	8.1	10	35	.....							1,123	50.9	40.5
62	Sept. 25	65:105	446	267	55	.....	7	7.7	10	50	.....							794	37.9	31.7
63	Oct. 2	58:100	504	594	48	4.6	9	7.6	10	60	.....	79.6	62.8	411	0.559	558	104	686	38.0	30.0
64	Oct. 10	55:92	403	594	50	.....	6	7.8	10	101	.....							684	42.0	29.6
65	Oct. 16	49:86	620	594	53	0.2	7	7.7	15	116	.....	102	82.3	507	0.690	846	113	822	46.5	31.3
66	Oct. 23	46:88	746	594	48	.....	8	7.7	10	110	.....							1,283	61.7	42.6
67	Oct. 30	39:81	504	594	42	.....	5	7.9	20	90	.....							826	50.1	31.5
68	Nov. 6	42:84	359	411	36	5.0	9	7.7	20	45	.....	66.6	57.4	508	0.690	491	78.4	821	53.9	32.8
69	Nov. 13	35:72	347	411	35	.....	8	7.8	20	20	.....							1,546	78.2	42.7

TABLE 1 (cont'd)

Chemical Analyses of Surface Waters in the
Souris, Pembina and Red River Drainage Systems in Canada

Iron (Fe)		Manganese (Mn)					Alkalis									Phosphate (PO_4)				Hardness as $CaCO_3$							
Total	Dissolved	Total	Dissolved	Aluminum (Al)	Copper (Cu)	Zinc (Zn)	Sodium (Na)	Potassium (K)	Ammonia (NH_3)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulphate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Total	Dissolved	Silica (colorimetric) (SiO_2)	Boron (B)	Non-carbonate	Total	Sum of constituents	Per cent sodium	Sodium absorption ratio	Saturation index	Stability index	No.
at EMERSON																											
3.3	0.00	0.60	.....	0.00	0.00	0.05	27.0	6.5	.....	0.0	242	105	22.6	0.00	1.6	0.3	.....	15	....	76.6	275	389	17	.....	+0.7	6.6	1
3.6	0.03	0.80	0.00	0.00	Trace	0.05	26.1	6.5	.....	0.0	239	103	21.9	0.00	1.0	0.3	.....	19	....	78.6	274	387	17	.....	+0.7	6.6	2
3.2	0.01	0.70	0.02	0.03	Trace	0.05	26.0	6.6	.....	0.0	240	104	21.3	0.00	1.0	0.3	.....	21	....	78.8	275	402	17	.....	+0.6	6.8	3
0.37	Trace	0.05	Trace	0.12	0.00	0.00	60.5	7.0	.....	0.0	273	113	72.0	0.00	1.0	0.4	.....	17	....	78.7	303	503	30	.....	+0.7	6.7	4
.....	.....	.....	.....	.....	.....	.....	42.7	6.5	.....	0.0	273	109	44.1	.....	1.6	.....	.....	18	....	68.0	299	451	23	.....	+0.7	6.7	5
0.34	0.02	Trace	0.00	0.10	0.00	0.00	45.8	6.2	0.0	0.0	243	83.2	54.2	0.33	1.6	0.3	0.3	15	....	55.7	255	407	27	.....	+0.6	6.9	6
.....	.....	.....	.....	.....	.....	.....	43.4	6.2	.....	0.0	270	96.2	49.3	.....	2.4	.....	.....	16	....	62.7	284	436	24	.....	+0.9	6.5	7
0.03	0.03	0.05	0.00	0.11	0.00	0.00	35.1	6.0	0.05	0.0	264	73.6	37.2	0.31	2.0	0.4	0.4	12	....	42.1	258	378	22	.....	+0.7	6.8	8
.....	.....	.....	.....	.....	.....	.....	37.0	6.5	0.0	0.0	262	93.0	42.7	.....	2.0	.....	.....	15	....	64.6	280	414	22	.....	+0.8	6.6	9
0.04	0.04	0.05	0.00	0.12	0.00	0.00	44.3	6.5	0.1	0.0	276	91.2	50.5	0.37	2.0	0.4	0.4	15	....	56.5	283	437	25	.....	+0.5	6.9	10
.....	.....	.....	.....	.....	.....	.....	48.3	6.4	.....	0.0	292	91.0	54.8	.....	2.4	.....	.....	14	....	50.6	290	453	26	.....	+0.8	6.2	11
0.58	0.00	0.00	0.00	0.05	0.00	0.00	98.6	7.0	0.1	0.0	280	79.2	145	0.40	0.2	0.5	0.3	9.8	....	62.3	292	573	42	.....	+0.4	7.0	12
.....	.....	.....	.....	.....	.....	.....	42.7	6.6	0.1	11.0	267	73.6	47.2	.....	2.6	.....	.....	11	....	26.4	274	413	25	.....	+1.1	6.3	13
0.60	0.09	0.10	0.00	0.17	0.00	0.00	51.3	6.9	0.0	0.0	294	76.7	61.2	0.33	2.4	0.5	0.5	13	....	45.6	287	449	27	.....	+0.8	6.6	14
.....	.....	.....	.....	.....	.....	.....	50.0	6.6	0.0	0.0	291	69.0	62.2	.....	2.0	.....	.....	8.0	....	39.2	278	429	28	.....	+0.6	6.8	15
0.54	0.01	0.00	0.00	0.00	0.00	0.00	77.8	7.0	.....	0.0	294	78.2	111	0.35	0.6	0.6	0.1	5.9	....	55.2	296	521	36	.....	+0.7	6.7	16
.....	.....	.....	.....	.....	.....	.....	188	9.4	.....	0.0	310	122	304	.....	0.8	.....	.....	5.8	....	127	382	907	51	.....	+0.7	6.5	17
0.28	0.01	0.00	0.00	0.00	0.00	0.00	245	11.2	.....	0.0	312	158	387	0.60	4.0	0.6	0.6	12	....	156	412	1,106	57	.....	+0.9	6.3	18
.....	.....	.....	.....	.....	.....	.....	199	11.8	0.1	0.0	352	137	310	.....	4.0	.....	.....	10	....	118	407	975	51	.....	+0.6	6.6	19
0.32	0.03	0.00	0.00	0.00	0.04	0.00	119	9.3	0.3	0.0	385	119	170	0.38	6.0	0.6	0.6	11	....	90.0	406	756	38	.....	+1.0	6.1	20
.....	.....	.....	.....	.....	.....	.....	73.6	8.4	.....	0.0	389	92.2	94.2	.....	5.0	.....	.....	12	....	60.5	379	600	29	.....	+0.6	6.5	21
.....	.....	.....	.....	.....	.....	.....	39.5	8.5	0.3	0.0	373	74.3	39.4	.....	8.0	.....	.....	18	....	38.7	344	483	20	.....	+0.4	6.8	22
0.40	0.10	0.90	0.02	0.10	0.00	0.00	38.0	8.0	.....	0.0	415	82.6	32.6	0.00	0.1	0.9	0.9	11	....	33.8	374	500	18	.....	+0.8	6.4	23
0.65	0.02	0.80	0.00	0.06	.....	.....	48.4	8.1	.....	0.0	409	103	42.6	0.43	6.0	1.8	1.6	14	....	50.7	386	551	21	.....	+0.8	6.3	24
.....	.....	.....	.....	.....	.....	.....	38.5	7.3	.....	0.0	406	81.6	32.2	.....	5.0	.....	.....	14	....	45.0	378	501	18	.....	+0.9	6.2	25
0.24	0.01	0.60	0.00	0.09	0.00	0.00	41.8	7.9	0.1	0.0	426	88.6	33.6	0.42	6.0	1.4	1.3	16	....	43.2	393	533	18	.....	+1.1	6.0	26
.....	.....	.....	.....	.....	.....	.....	39.7	8.4	.....	0.0	437	76.4	31.3	.....	8.0	.....	.....	18	....	30.5	389	523	18	.....	+1.0	6.1	27
0.42	0.13	0.40	0.00	0.00	0.01	0.00	37.2	8.2	0.0	0.0	453	70.7	25.9	0.43	6.0	0.4	0.4	20	....	24.2	396	522	17	.....	+1.2	5.8	28
.....	.....	.....	.....	.....	.....	.....	45.3	9.0	.....	0.0	461	72.2	36.9	.....	6.8	.....	.....	20	....	20.5	399	548	19	.....	+1.2	5.8	29
.....	.....	.....	.....	.....	.....	.....	60.5	9.1	.....	0.0	438	73.8	59.1	.....	6.0	.....	.....	20	....	16.8	376	566	25	.....	+1.1	6.0	30
0.20	0.20	0.40	0.01	0.06	0.00	0.00	71.3	9.0	.....	0.0	422	80.0	78.5	0.54	8.0	2.0	2.0	19	....	29.2	375	598	29	.....	+1.1	6.0	31
.....	.....	.....	.....	.....	.....	.....	62.0	8.5	3.0	0.0	427	70.0	68.5	.....	7.2	.....	.....	19	....	23.0	358	552	27	.....	+1.0	6.1	32
.....	.....	.....	.....	.....	.....	.....	59.7	1.0	3.0	0.0	422	64.2	69.1	.....	9.6	.....	.....	19	....	13.5	360	546	27	.....	+1.1	6.0	33
0.29	0.00	0.20	0.00	0.04	0.00	0.00	69.5	7.4	0.1	8.0	342	69.6	84.9	0.39	12	1.8	1.8	22	....	36.2	331	551	31	.....	+1.2	6.0	34
.....	.....	.....	.....	.....	.....	.....	45.4	7.7	.....	0.0	253	75.3	50.2	.....	5.2	.....	.....	17	....	42.8	251	407	27	.....	+0.8	6.7	35
.....	.....	.....	.....	.....	.....	.....	62.0	7.9	0.2	0.0	173	75.6	89.8	.....	8.0	.....	.....	14	....	61.3	203	409	39	.....	−0.2	7.9	36
1.1	0.09	0.10	0.00	0.05	Trace	0.00	65.3	6.7	0.4	0.0	189	78.8	96.4	0 29	4.0	0.8	0.6	13	....	66.6	221	431	38	.....	+0.4	7.2	37
.....	.....	.....	.....	.....	.....	.....	50.5	6.2	0·2	0.0	187	82.5	70.0	.....	6.0	.....	.....	14	....	64.6	218	400	33	.....	+0.5	7.0	38
.....	.....	.....	.....	.....	.....	.....	65.8	6.7	0.1	0.0	231	103	88.6	.....	3.0	.....	.....	15	....	81.2	271	485	34	.....	+0.6	6.8	39
.....	.....	.....	.....	.....	.....	.....	58.7	6.8	0.3	0.0	251	102	71.1	.....	3.0	.....	.....	13	....	64.4	271	468	31	.....	+0.7	6.7	40
3.6	0.07	0.20	0.00	0.03	0.00	0.00	27.7	5.5	0.1	1.7	251	93.0	28.0	0.32	3.6	0.4	.....	19	....	65.7	274	392	18	.....	+1.0	6.4	41
2.3	0.05	0.20	0.00	0.00	0·00	0.00	26.0	5.7	0.05	3.1	261	95.3	25.6	0.34	3.2	0.4	0.3	8.0	....	65.2	291	392	16	.....	+1.0	6.4	42
.....	.....	.....	.....	.....	.....	.....	31.5	5.8	0.1	6.0	270	117	26.8	.....	2.1	.....	.....	10	....	84.7	316	435	18	.....	+1.1	6.2	43
.....	.....	.....	.....	.....	.....	.....	27.3	5.8	0.0	9.0	281	127	18.8	.....	3.4	.....	.....	14	....	90·4	336	452	15	.....	+1.3	5.9	44
.....	.....	.....	.....	.....	.....	.....	27.5	5.9	0.0	8.6	286	123	19.4	.....	3·3	.....	.....	17	....	96.7	346	463	15	.....	+1.2	6.0	45
1.5	0.03	0.20	0.00	0.07	Trace	0.00	29.5	6.0	0.1	0.0	310	122	22.7	0.40	3.1	0.4	0.3	14	....	82.3	336	459	16	.....	+0.6	6.7	46
.....	.....	.....	.....	.....	.....	.....	41.9	6.2	0.1	0.0	303	116	42.6	.....	1.5	.....	.....	9.3	....	79.3	335	473	21	.....	+0.8	6.5	47
1.2	0.05	0.21	0.00	0.12	0.01	0.00	34.5	5.8	0.0	0.0	299	92.2	32.5	0.37	1.8	0.3	0.3	5.8	....	65.6	311	420	19	.....	+1.0	6.3	48
.....	.....	.....	.....	.....	.....	.....	30.2	5.5	0.0	0.0	285	68.6	28.2	.....	1.8	.....	.....	6.9	....	44.2	278	369	19	.....	+0.9	6.5	49
.....	.....	.....	.....	.....	.....	.....	30.0	6.1	0.0	0.0	281	72.4	28·9	.....	3.5	.....	.....	14	....	44.5	275	383	19	.....	+0.8	6.6	50
.....	.....	.....	.....	.....	.....	.....	30.8	6.0	0.0	0.0	286	66.4	36.1	.....	3.2	.....	.....	13	....	43.5	278	386	19	.....	+0.9	6.5	51
1.1	0.03	0.04	0.00	0.08	0.01	0.00	32.6	5.6	0.05	0.0	264	62.7	39.4	0.33	2.2	0.5	0.4	13	....	50.0	267	371	20	.....	+0.9	6.5	52
.....	.....	.....	.....	.....	.....	.....	64.5	6.1	0.0	0.0	267	74.3	84.6	.....	3.2	.....	.....	14	....	53.3	273	467	33	.....	+0.9	6.5	53
.....	.....	.....	.....	.....	.....	.....	72.6	6.5	0.2	0.0	273	85.9	102	.....	3.4	.....	.....	15	....	60.5	284	510	35	.....	+0.8	6.6	54
0.70	0.02	0.05	0.00	0.08	Trace	0. 00	117	7.2	0.5	6.0	238	105	181	.....	1.6	.....	.....	13	....	99.0	304	645	45	.....	+0.9	6.6	55
.....	.....	.....	.....	.....	.....	.....	121	7.6	0.0	0.0	249	102	187	0.41	0.7	0.2	0.2	11	....	97.4	301	648	46	.....	+0.6	6.9	56
.....	.....	.....	.....	.....	.....	.....	96.0	6.9	0.0	0.0	258	85.3	134	.....	0.7	.....	.....	10	....	60.8	272	546	43	.....	+0.7	6.8	57
0.78	0.02	0.01	0.00	0.11	Trace	0.00	65.8	6.3	0.1	0.0	245	80.8	88.5	0.37	0.8	0.2	0.2	11	....	52.8	253	454	35	.....	+0.8	6.7	58
.....	.....	.....	.....	.....	.....	.....	90·5	6.3	0.0	0.0	250	83.5	130	.....	0.9	.....	.....	11	....	56.6	262	527	42	.....	+0.7	6.8	59
1.00	0.00	0.02	0.00	0.13	Trace	0.00	124	6.6	0.0	0.0	232	94.7	200	0.39	1.6	0.2	0.2	8.2	....	96.2	286	640	48	.....	+0.7	6.8	60
.....	.....	.....	.....	.....	.....	.....	135	6.8	0.1	0.0	230	95.8	220	.....	1.1	.....	.....	7.6	....	105	294	671	49	.....	+0.6	6.9	61
.....	.....	.....	.....	.....	.....	.....	73.0	5.9	0.3	0.0	218	72.5	101	.....	2.8	.....	.....	5.6	....	46.0	225	438	41	.....	0.0	7.7	62
1.7	0.00	0.10	0.00	0.02	0.01	0.00	54.2	5.3	0.3	0.0	219	64.4	68.2	0.31	2.9	0.3	0.3	9.1	....	38.7	218	381	34	.....	−0.1	7.8	63
.....	.....	.....	.....	.....	.....	.....	50.5	5.7	0.1	0.0	227	71.6	62.5	.....	2.0	.....	.....	7.0	....	40.2	227	383	32	.....	+0.2	7.4	64
2.4	0.00	0.13	0.00	0.04	Trace	0.00	73.0	6.5	0.1	0.0	222	86.3	99.4	0.29	2.4	0.4	0.4	9.0	....	62.5	245	465	39	.....	+0.1	7.5	65
.....	.....	.....	.....	.....	.....	.....	135	8.7	0.05	0.0	242	160	196	.....	2.1	.....	.....	5.4	....	131	329	731	46	.....	+0.2	7.3	66
.....	.....	.....	.....	.....	.....	.....	68.6	7.8	0.05	0.0	224	94.0	95.5	.....	2.6	.....	.....	10	....	71.4	255	470	36	.....	+0.3	7.3	67
0.12	0.03	0.00	0.00	0.04	0.00	0.00	66.0	7.8	0.5	0.0	260	87.6	85.9	0.37	2.8	0.5	0.4	7.8	....	56.4	270	473	34	.....	+0.3	7.1	68
.....	.....	.....	.....	.....	.....	.....	175	10.0	0.5	0.0	294	153	257	.....	2.7	.....	.....	12	....	130	371	876	50	.....	+0.6	6.6	69

TABLE 1 (cont'd)

Chemical Analyses of Surface Waters in the Souris, Pembina and Red River Drainage Systems in Canada

No.	Date of collection	Storage period (Days)	Stream discharge (Second-feet) On sampling date	Stream discharge (Second-feet) Monthly mean	Water temperature (°F.)	Oxygen consumed by $KMnO_4$	Carbon dioxide (CO_2)	pH	Color (Hazen) (Units)	Turbidity (Units)	Redox potential (mV)	Residue on evaporation dried at 105°C. (Dissolved solids) Suspended matter Dried at 105°C.	Suspended matter Ignited at 550°C.	Residue on evaporation dried at 105°C. (Dissolved solids) P.P.M.	Tons per acre-foot	Tons per day	Loss on ignition at 550°C.	Specific conductance $K \times 10^6$ at 25°C.	Calcium (Ca)	Magnesium (Mg)
																			STATION NO. 18 – RED RIVER	
1	Nov. 20/61	31-115	467	411	36		13	7.6	20	15								2,253	89.6	49.7
2	Nov. 27	24-63	418	411	35	6.4	14	7.6	10	20		24.3	19.4	833	1.13	934	102	1,361	73.1	44.1
3	Dec. 4	30-73	314	263	36		16	7.6	20	10								1,237	75.2	43.5
4	Dec. 11	23-94	203	263	35	6.6	17	7.6	20	13		13.9	10.9	774	1.05	590	138	1,202	84.2	43.4
5	Dec. 10	24-73	248	263	35		17	7.6	20	7								1,009	78.0	46.1
6	Dec. 26	16-65	213	263	35		17	7.6	20	10								995	82.0	48.1
7	Jan. 2/62	29-101	201	198	35	6.6	14	7.7	20	8		13	6.8	655	0.890	354	176	1,016	82.0	49.4
8	Jan. 9	22-62	217	198	35		20	7.5	20	10								930	77.6	44.7
9	Jan. 15	49-59	228	198	35		14	7.7	15	8								904	80.4	46.4
10	Jan. 22	44-94	190	198	35	6.2	26	7.4	15	8		7.5	2.6	623	0.846	318	101	971	84.0	48.3
11	Jan. 29	30-51	162	198	34		19	7.6	20	5								985	87.2	48.7
12	Feb. 5	31-49	209	200	34		14	7.7	40	6								946	79.2	46.3
13	Feb. 12	42-73	205	200	34	6.2	26	7.4	15	5		5.2	1.1	580	0.788	320	145	902	76.2	44.9
14	Feb. 19	37-72	178	200	34		40	7.2	15	6								912	76.2	45.6
15	Feb. 26	46-59	213	200	34		8	7.9	20	5								918	70.6	45.0
16	Mar. 5	50-52	228	225	34	6.1	7	7.8	15	5		3.6	0.0	542	0.736	333	167	848	73.0	43.3
17	Mar. 12	49-53	232	225	35		20	7.5	10	5								856	73.6	43.2
18	Mar. 19	42-46	194	225	35		10	7.8	10	3								824	70.4	41.8
19	Mar. 26	35-39	174	225	35		6	8.0	15	4		3.7	2.6	496	0.675	232	96.0	762	66.7	40.4
20	Apr. 2	30-32	504	14,800	35		28	7.3	15	4								749	63.9	40.4
21	Apr. 9	21-25	3,210	14,800	36		25	7.3	20	60								857	61.3	37.4
22	Apr. 16	14-17	13,700	14,000	35		10	7.3	20	380		314	279	265	0.360	9,400	79.3	320	44.0	12.6
23	Apr. 23	6-7	31,500	14,800	38		11	7.3	55	600								340	44.6	12.1
24	Apr. 30	17-43	25,100	14,800	48		11	7.3	55	170								391	36.2	15.8
25	May 7	50-36	9,340	12,000	54	7.9	12	7.4	70	60		86.5	76.1	462	0.628	11,600	115.0	600	60.0	24.3
26	May 9	50-62	6,560	12,000	53	6.0	28	7.1	35	30								744	64.9	26.7
27	May 9	35	6,560	12,000	54			7.3	35									745		
28	May 9	35	6,560	12,000	53			7.9	35									715		
29	May 9	35	6,560	12,000	54			7.3	35									750		
30	May 9	50-62	6,560	12,000	53	6.1	3	8.1	35	25		81.5	65.6	482	0.655	8,525	364	707	61.5	27.8
31	May 9	35	6,560	12,000	53			7.2	35									745		
32	May 9	35	6,560	12,000	53			7.9										724		
33	May 14	23-29	4,630	12,000	55		9	7.6	55	230								698	64.5	31.4
34	May 21	90-106	8,650	12,000	58		4	8.0	35	200								717	67.1	35.0
35	May 20	91-99	20,400	12,000	60	9.6	4	7.9	45	410								594	58.6	27.1
36	June 1 & 2	90-95	24,500	25,400	58.5-59		8	7.6	35									466	51.0	22.9
37	June 4 & 5	87-92	25,500	25,400	60-62.5		6	7.8	55									618	62.0	29.6
38	June 6-9	83-88	25,260	25,400	62-63		8	7.6	55									485	57.8	21.1
39	June 11-14	78-83	23,350	25,400	64-65		6	7.8	65									600	66.1	26.9
40	June 15-20	37-50	26,280	25,400	66-73	9.6	5	7.8	60	55		74.2	68.5	358	0.460	24,000	234	573	85.1	2.6
41	June 20*				68	6.1		7.5	70	30				334	0.455			350	56.0	21.4
42	June 30- July 9	57-64	15,650		72-73.5	10.1	9	7.7	50	25		61.5	49.4	450	0.612	18,950	141	635	65.3	30.6
43	July 16*				72	5.7	2	7.7	120	150				288	0.392				48	23.3
44	July 10-24	38-43	16,515	16,100	70.5-73		8	8.0	35									516	55.1	28.1
45	July 25- Aug. 2	29-34	13,633		69-72.5	7.8	5	7.8	35			139	92.8	378	0.514	13,900	100	442	48.3	23.9
46	Aug. 3-10	32-38	8,704	7,210	70-73.5		4	8.0	50									596	58.9	30.0
47	Aug. 11-25	38-83	6,720	7,210	69-73.5		5	7.9	40									619	57.8	31.3
48	Aug. 26- Sept. 6		4,165		64.5-72	9.4	6	7.8	40	300				440	0.599	4,940	125	649	61.0	32.8
49	Sept. 4*							8.1	65	200				414	0.563			510	64.0	34.0
50	Sept. 7-20	125	5,529	3,370	58-65		3	8.1	40	250		250						605	55.4	31.4
51	Sept. 21- Oct. 5		2,962		58-61.5		3	8.1	40	150								611	57.5	30.0
52	Oct. 6-20		2,460	2,450	53.5-60		3	8.1	30	95								546	52.8	28.6
53	Oct. 21- Nov. 2		2,514		45-54	8.6	3	8.1	25	20		65.1	55.4	352	0.478	2,180	121	533	51.7	26.8
54	Nov. 3-17		2,175	2,490	58-45		15.5	8.0	20	15								739	55.2	30.3
55	Nov. 18-30		2,893	2,490	35.5-39		3.5	8.1	20	15								659	57.7	48.2
56	Dec. 1-15		1,969	1,600	35.5-38	7.9	6	8.0	25	10		28.9	25.6	420	0.570	2,220	123	654	58.8	30.8
57	Dec. 16-31		1,261	1,600	36-37		4	8.1	25	5								693	60.7	35.1
58	Jan. 1-12		1,285	1,260	36-39		4	8.1	20	4								584	59.2	31.0
59	Jan. 17-31		1,185	1,260	35-37	9.9	4	8.1	15	3				384	0.528	1,238	141	590	60.6	31.8
60	Feb. 1-14		1,045	1,065	35.5-37		1	8.7	10	3								522	57.9	30.4
61	Feb. 15-27		1,089	1,065	35.5-38		0.9	8.7	10	3								513	54.3	28.9

* Analysis received on this date, supplied by the Environmental Sanitation Laboratory, Dept. of Health, Province of Manitoba.

TABLE 1 (cont'd)

Chemical Analyses of Surface Waters in the Souris, Pembina and Red River Drainage Systems in Canada

Iron (Fe)		Manganese (Mn)					Alkalis									Phosphate (PO_4)				Hardness as $CaCO_3$							No.
Total	Dissolved	Total	Dissolved	Aluminum (Al)	Copper (Cu)	Zinc (Zn)	Sodium (Na)	Potassium (K)	Ammonia (NH_3)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulphate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Total	Dissolved	Silica (colorimetric) (SiO_2)	Boron (B)	Non-carbonate	Total	Sum of constituents	Per cent sodium	Sodium absorption ratio	Saturation index	Stability index	
at EMERSON (cont'd)																											
.....	.....	.....	.....	.....	.....	.....	305	12.5	0.1	0.0	297	191	473	.....	0.0	.....	.....	7.0	....	185	428	1,275	60	.....	+0.4	6.8	1
0.39	0.02	0.00	0.00	0.03	0.00	0.00	145	9.9	0.05	0.0	324	123	209	0.47	4.3	0.9	0.1	5.3	....	98.2	364	775	46	.....	+0.4	6.8	2
.....	.....	.....	.....	.....	.....	.....	116	9.1	0.3	0.0	363	112	150	.....	3.4	.....	.....	6.3	....	68.9	367	694	40	.....	+0.4	6.8	3
0.28	0.01	0.00	0.00	0.18	0.01	0.00	122	9.1	0.2	0.0	374	114	159	0.43	5.4	0.7	0.7	10	....	81.9	389	733	40	.....	+0.5	6.6	4
.....	.....	.....	.....	.....	.....	.....	66.0	8.5	0.1	0.0	401	105	73.5	.....	5.7	.....	.....	11	....	55.8	385	592	27	.....	+0.5	6.6	5
.....	.....	.....	.....	.....	.....	.....	59.0	7.8	0.2	0.0	412	108	63.1	.....	6.6	.....	.....	11	....	64.2	403	588	24	.....	+0.5	6.6	6
0.26	0.01	0.87	0.00	0.05	0.00	0.00	65.5	8.0	0.0	0.0	413	116	66.2	0.49	8.4	1.7	.....	16	0.00	69.9	408	614	26	.....	+0.6	6.5	7
.....	.....	.....	.....	.....	.....	.....	52.5	7.7	0.1	0.0	395	102	52.1	.....	7.1	.....	.....	11	....	54.0	378	549	23	.....	+0.4	6.7	8
.....	.....	.....	.....	.....	.....	.....	51.0	7.3	0.0	0.0	406	102	46.3	.....	8.0	.....	.....	12	....	58.4	392	553	22	.....	+0.6	6.5	9
1.6	0.00	0.69	0.00	0.00	0.00	0.00	54.0	7.4	0.0	0.0	425	108	52.2	0.44	0.6	1.3	1.3	14	....	59.9	408	579	22	.....	+0.3	6.8	10
.....	.....	.....	.....	.....	.....	.....	55.0	7.6	0.0	0.0	445	106	47.5	.....	7.3	.....	.....	14	....	52.7	418	592	22	.....	+0.6	6.4	11
.....	.....	.....	.....	.....	.....	.....	53.0	7.4	0.1	0.0	419	97.9	45.7	.....	8.0	.....	.....	15	....	44.6	388	559	23	.....	+0.6	6.5	12
1.5	0.10	0.70	0.20	0.00	0.00	0.00	51.0	7.3	0.1	0.0	404	88.8	49.2	0.43	0.9	2.2	.....	15	....	43.5	375	533	22	.....	+0.3	6.8	13
.....	.....	.....	.....	.....	.....	.....	50.5	7.3	0.0	0.0	407	84.5	49.1	.....	12	.....	.....	16	....	44.5	378	508	22	.....	+0.1	7.0	14
.....	.....	.....	.....	.....	.....	.....	50.0	7.5	0.0	0.0	422	88.3	45.2	.....	0.8	.....	.....	19	....	35.4	381	542	22	.....	+0.8	6.3	15
1.8	0.00	0.00	0.0	0.00	0.00	Trace	46.0	7.0	0.0	0.0	398	78.0	39.9	0.39	0.9	2.5	1.9	17	....	36.5	363	504	21	.....	+0.7	6.4	16
.....	.....	.....	.....	.....	.....	.....	43.0	6.9	0.0	0.0	398	73.7	40.8	.....	11	.....	.....	18	....	35.3	362	506	20	.....	+0.4	6.7	17
.....	.....	.....	.....	.....	.....	.....	40.4	6.7	0.05	0.0	392	68.4	36.4	.....	10	.....	.....	19	....	26.3	348	492	20	.....	+0.7	6.4	18
0.5	Trace	0.03	0.00	0.05	0.00	0.05	40.0	6.4	0.0	0.0	369	64.5	36.9	0.40	12	3.7	2.3	19	....	30.2	333	471	20	.....	+0.8	6.4	19
.....	.....	.....	.....	.....	.....	.....	33.0	6.0	0.0	0.0	356	64.4	27.2	.....	8.8	.....	.....	18	....	33.7	326	437	18	.....	+0.1	7.1	20
.....	.....	.....	.....	.....	.....	.....	56.0	9.3	5.0	0.0	349	73.3	55.1	.....	9.1	.....	.....	19	....	22.8	309	492	27	.....	+0.1	7.1	21
5.9	0.03	0.25	0.00	0.03	0.00	0.05	8.3	6.3	.....	0.0	132	36.5	7.5	0.23	8.6	0.5	0.5	12	....	28.3	137	192	11	.....	−0.6	8.5	22
.....	.....	.....	.....	.....	.....	.....	14.5	5.4	0.0	0.0	130	38.9	16.3	.....	8.2	.....	.....	12	....	30.4	137	206	18	0.540	−0.6	8.5	23
.....	.....	.....	.....	.....	.....	.....	15.6	5.6	0.0	0.0	136	53.2	17.4	.....	7.1	.....	.....	14	....	44.0	156	231	17	0.544	−0.6	8.5	24
1.2	0.14	0.12	0.00	0.13	Trace	Trace	41.5	7.2	0.1	0.0	209	96.4	54.7	0.23	5.5	0.6	0.6	17	....	78.5	250	409	26	1.142	−0.1	7.6	25
.....	.....	.....	.....	.....	.....	.....	46.8	6.8	0.1	0.0	228	105	61.7	.....	Trace	.....	.....	15	....	84.9	272	440	27	1.24	−0.2	7.5	26
.....	.....	.....	.....	.....	.....	.....	.....	.....	0.0	0.0	224	.....	61.2	.....	.....	.....	.....	.....	....	88.5	272	.....	.....	.....	.....	.....	27
.....	.....	.....	.....	.....	.....	.....	.....	.....	0.0	0.0	226	.....	61.6	.....	.....	.....	.....	.....	....	82.2	267	.....	.....	.....	.....	.....	28
.....	.....	.....	.....	.....	.....	.....	.....	.....	0.1	0.0	225	.....	60.9	.....	.....	.....	.....	.....	....	83.7	268	.....	.....	.....	.....	.....	29
0.98	0.14	0.07	0.00	0.01	Trace	0.00	46.0	6.9	0.1	0.0	223	107	61.9	0.35	1.7	0.34	.....	16	....	84.4	268	440	27	1.22	+0.7	6.7	30
.....	.....	.....	.....	.....	.....	.....	.....	.....	0.1	0.0	227	.....	60.5	.....	.....	.....	.....	.....	....	84.5	271	.....	.....	.....	.....	.....	31
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.0	220	.....	61.2	.....	.....	.....	.....	.....	....	85.5	267	.....	.....	.....	.....	.....	32
.....	.....	.....	.....	.....	.....	.....	342	6.4	0.1	0.0	233	122	38.1	.....	3.1	.....	.....	13	....	98.5	290	428	20	0.875	+0.2	7.2	33
.....	.....	.....	.....	.....	.....	.....	31.1	5.9	0.0	0.0	242	121	39.1	.....	0.8	.....	.....	12	....	113	312	431	17	0.766	+0.6	6.8	34
.....	.....	.....	.....	.....	.....	0.00	24.4	5.7	0.0	0.0	204	108	27.7	.....	0.3	.....	.....	18	....	90.8	258	370	17	0.660	+0.4	7.1	35
2.3	.....	0.02	.....	.....	.....	.....	11.0	5.1	0.3	0.0	185	86.4	7.2	0.32	0.4	.....	.....	28	....	70.2	222	303	9.5	0.319	0.0	7.6	36
0.42	.....	0.0	.....	.....	.....	.....	26.8	6.0	0.3	0.0	226	105	32.0	0.43	2.8	.....	.....	24	....	91.5	277	380	17	0.701	+0.4	7.0	37
0.77	.....	0.02	.....	.....	.....	.....	15.3	5.4	0.3	0.0	192	85.0	14.3	0.37	3.0	.....	.....	23	....	73.7	231	320	12	0.438	+0.1	7.4	38
0.68	.....	0.00	.....	.....	.....	.....	23.1	5.6	0.3	.....	233	102	25.0	0.44	2.9	.....	.....	34	....	84.4	276	401	15	0.606	+0.4	7.0	39
.....	0.05	.....	0.00	0.01	.....	0.00	10.9	5.0	0.1	0.0	201	66.3	8.6	0.35	3.1	0.6	.....	28	0.00	58.5	223	310	9.4	0.318	+0.5	6.8	40
1.2	.....	.....	0.03	.....	.....	.....	13.5	.....	.....	0.0	207	70.8	10.0	0.31	0.0	.....	.....	.....	.....	58.0	228	.....	.....	.....	.....	.....	41
.....	0.11	.....	0.00	Trace	.....	Trace	22.0	5.9	0.1	0.0	261	90.0	21.6	0.26	2.8	1.0	.....	26	....	74.9	289	394	14	0.566	+0.4	6.9	42
1.9	.....	.....	0.00	.....	.....	.....	11.0	.....	.....	0.0	171	48.5	4.5	0.19	0.04	.....	.....	.....	....	76.0	216	.....	.....	.....	.....	.....	43
2.1	.....	0.16	.....	.....	.....	0.00	11.6	5.6	.....	0.0	233	63.0	6.8	0.35	5.0	.....	.....	23	....	62.7	253	313	8.8	1.003	+0.5	7.0	44
.....	0.14	.....	0.14	0.05	Trace	.....	17.3	6.3	.....	0.0	199	81.6	12.5	0.26	3.1	0.9	.....	23	....	55.7	219	315	14	0.509	+0.2	7.4	45
3.5	.....	0.42	.....	.....	.....	.....	21.0	6.3	0.05	0.0	244	92.0	17.6	0.35	3.2	.....	.....	21	....	70.1	271	371	14	0.555	+0.6	6.8	46
.....	.....	.....	.....	.....	.....	.....	21.8	6.3	.....	0.0	317	103	18.1	0.31	3.5	.....	.....	20	....	80.1	273	378	14	0.574	+0.5	6.9	47
.....	Trace	.....	0.01	0.08	.....	.....	26.5	6.4	0.0	0.0	242	110	20.5	0.33	3.5	0.4	.....	19	....	89.1	287	400	16	0.680	+0.4	7.0	48
1.9	.....	.....	0.05	.....	.....	.....	23	.....	.....	0.0	239	110	18.0	0.16	0.25	.....	.....	.....	....	104	300	.....	.....	.....	.....	.....	49
.....	.....	.....	.....	.....	.....	.....	22.5	5.2	.....	0.0	233	95.3	20.8	.....	3.5	.....	.....	20	....	74.9	265	369	15	0.601	+0.7	6.7	50
.....	.....	.....	.....	.....	.....	.....	27.5	5.3	.....	0.0	236	94.2	25.0	0.27	2.6	.....	.....	20	....	72.5	266	378	18	0.733	+0.7	6.7	51
.....	.....	.....	.....	.....	.....	.....	22.0	4.7	.....	0.0	242	68.3	19.9	0.24	1.6	.....	.....	12	....	50.9	249	329	16	0.606	+0.7	6.7	52
.....	0.00	.....	0.00	0.03	.....	.....	22.0	4.5	0.1	0.0	245	57.5	22.0	0.28	1.6	.....	.....	13	....	38.3	240	321	16	0.618	+0.7	6.7	53
.....	.....	.....	.....	.....	.....	.....	50.0	4.9	.....	0.0	250	73.1	69.8	0.28	1.8	.....	.....	7.7	....	57.6	262	416	29	1.334	+0.6	6.8	54
.....	.....	.....	.....	.....	.....	.....	37.5	4.3	.....	0.0	259	66.9	45.1	0.27	1.8	.....	.....	13	....	48.0	260	402	23	1.010	+0.7	6.7	55
.....	0.00	.....	0.00	0.10	.....	.....	34.0	4.5	0.0	0.0	269	69.6	38.9	0.29	1.5	0.13	.....	13	....	52.4	273	385	21	0.894	+0.6	6.8	56
.....	.....	.....	.....	.....	.....	.....	27.8	4.9	.....	0.0	318	83.8	22.8	0.33	2.6	.....	.....	15	....	57.8	319	418	16	0.677	+0.9	6.3	57
.....	.....	.....	.....	.....	.....	.....	19.0	4.4	.....	0.0	289	60.9	14.4	.....	2.1	.....	.....	15	....	40.3	277	349	13	0.497	+0.8	6.5	58
.....	Trace	.....	0.00	0.03	.....	.....	18.0	4.6	0.1	0.0	302	55.5	11.8	0.29	3.4	0.5	.....	17	....	34.1	282	352	12	0.467	+0.8	6.5	59
.....	.....	.....	.....	.....	.....	.....	15.0	4.3	.....	14.4	265	47.3	8.2	0.37	2.2	.....	.....	18	....	28.3	270	328	11	0.397	+1.4	5.9	60
.....	.....	.....	.....	.....	.....	.....	15.0	4.0	.....	15.4	248	39.3	10.2	0.34	2.0	.....	.....	17	....	25.8	255	315	11	0.409	+1.4	5.9	61

TABLE 1 (cont'd)

Chemical Analyses of Surface Waters in the Souris, Pembina and Red River Drainage Systems in Canada

No.	Date of collection	Storage period (Days)	Stream discharge (Second-feet) On sampling date	Stream discharge (Second-feet) Monthly mean	Water temperature (°F.)	Oxygen consumed by $KMnO_4$	Carbon dioxide (calculated) (CO_2)	pH	Colour (Hazen) (Units)	Turbidity (Units)	Redox potential (mV)	Suspended matter Dried at 105°C.	Suspended matter Ignited at 550°C.	Residue on evaporation dried at 105°C. (Dissolved solids) P.P.M.	Residue on evaporation dried at 105°C. (Dissolved solids) Tons per acre-foot	Residue on evaporation dried at 105°C. (Dissolved solids) Tons per day	Loss on ignition at 550°C.	Specific conductance K × 10⁶ at 25°C.	Calcium (Ca)	Magnesium (Mg)
STATION NO. 18 – RED RIVER																				
1	Mar. 2/63-Mar.12	.....	1,147	1,420	35.5-38	9.7	2	8.4	10	0.7	-434	.....	.....	348	0.473	1,072	87.2	511	54.5	29.7
2	Mar. 18-28	.....	1,281	1,420	.....	.....	3	8.1	15	8	-427	.....	.....	.....	.....	.....	.....	472	48.0	27.2
3	Mar. 29-Apr. 6	.....	4,841	.....	38	.....	6.5	7.7	25	55	-432	.....	.....	.....	.....	.....	.....	575	44.9	23.4
4	Apr. 7-17	.....	11,124	7,740	38-46.5	7.9	16	7.3	40	320	-440	422	362	361	0.491	10,850	101	558	51.5	22.8
5	Apr. 18-30	.....	5,905	7,740	46.5	.....	7	7.7	40	220	-435	.....	.....	.....	.....	.....	.....	593	56.8	27.4
6	May 1-15	.....	3,908	3,710	53.5-58	10.8	2	8.3	30	80	-433	164	147	411	0.559	4,350	134	612	58.2	29.1
7	May 16-June 1	.....	3,538	3,710	54-64	.....	3	8.2	25	100	-444	.....	.....	.....	.....	.....	.....	609	61.3	29.6
8	June 2-5	.....	6,155	7,490	64.5-69	.....	.....	7.6	25	900	-461	.....	.....	.....	.....	.....	.....	536	56.3	25.9
9	June 6-20	.....	8,925	7,490	66.5-73	9.5	6	7.8	35	500	-466	507	444	393	0.534	9,400	109	590	59.0	27.0
10	June 11	44:86	10,300	7,490	70	8	5	8.0	30	700	-470	.....	.....	.....	.....	.....	.....	530	52.9	26.8
11	June 11	44:62	10,300	7,490	69	10.2	20	8.0	40	650	-474	.....	.....	.....	.....	.....	.....	558	58.1	26.5
12	June 11	44:91	10,300	7,490	69	9.4	15	7.8	35	700	-464	.....	.....	.....	.....	.....	.....	543	56.1	26.2
13	June 11	44:62	10,300	7,490	69	9.7	8.5	8.0	35	600	-464	.....	.....	.....	.....	.....	.....	550	54.4	26.1
14	June 21-30	.....	6,233	7,490	68-77	.....	4	8.0	30	500	-374	.....	.....	.....	.....	.....	.....	608	59.5	31.0
15	July 1-10	.....	3,676	3,020	74-77	.....	8	7.7	25	450	-489	.....	.....	.....	.....	.....	.....	672	61.6	33.6
16	July 11-20	.....	3,099	3,020	73.5-77	5.7	2.2	8.2	25	550	-476	497	445	394	0.536	3,280	109	576	52.6	28.3
17	July 21-31	.....	2,358	3,020	75-80	.....	5	7.8	35	900	-480	.....	.....	.....	.....	.....	.....	622	52.8	26.0
18	Aug. 1-15	.....	1,526	1,410	69.5-78	.....	2	8.3	20	270	-466	.....	.....	.....	.....	.....	.....	700	55.1	29.8
19	Aug. 16-31	.....	1,279	1,410	67.5-72	6.4	0.8	8.7	20	15	-452	42.6	37.0	406	0.552	1,395	88	590	53.7	28.0
20	Sept. 23	106	1,170	1,320	60	.....	2.1	8.2	5	.....	-431	.....	.....	.....	.....	.....	.....	675	43.5	.....
21	Sept. 1-15	.....	1,369	1,320	62.5-70	.....	3	8.1	10	15	-481	.....	.....	.....	.....	.....	.....	482	46.7	24.2
22	Sept. 16-30	.....	1,263(av.)	1,320	59.5-63	.....	1	8.5	10	15	-424	.....	.....	.....	.....	.....	.....	495	38.7	28.8

TABLE 1 (cont'd)

Chemical Analyses of Surface Waters in the Souris, Pembina and Red River Drainage Systems in Canada

Iron (Fe)		Manganese (Mn)					Alkalis									Phosphate (PO_4)				Hardness as $CaCO_3$							
Total	Dissolved	Total	Dissolved	Aluminum (Al)	Copper (Cu)	Zinc (Zn)	Sodium (Na)	Potassium (K)	Ammonia (NH_3)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulphate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Total	Dissolved	Silica (colorimetric) (SiO_2)	Boron (B)	Non-carbonate	Total	Sum of constituents	Per cent sodium	Sodium absorption ratio	Saturation index	Stability index	No.
at EMERSON (concl'd)																											
.....	0.00	.....	0.00	0.03	.....	.....	14.5	4.2	0.0	11.8	250	45.1	8.6	0.22	1.7	0.3	.....	17	....	33.3	258	311	11	0.392	+1.0	6.4	1
.....	.....	.....	.....	.....	.....	.....	14.5	4.1	.....	0.0	246	46.0	8.8	0.24	2.3	.....	.....	18	....	29.9	232	290	12	0.428	+0.6	6.9	2
.....	.....	.....	.....	.....	.....	.....	35.0	5.8	.....	0.0	191	64.5	45.9	0.28	5.0	.....	.....	11	....	51.9	208	330	26	1.05	+0.1	7.5	3
.....	Trace	.....	0.00	0.08	.....	.....	26.5	7.8	0.0	0.0	183	82.1	31.9	0.27	8.6	0.8	.....	13	....	72.0	222	336	20	0.774	−0.3	7.9	4
.....	.....	.....	.....	.....	.....	.....	23.6	6.4	.....	0.0	206	104	23.8	0.31	4.8	.....	.....	15	....	85.9	255	364	16	0.643	+0.2	7.3	5
.....	0.04	.....	0.01	0.13	.....	.....	27.0	5.5	0.0	0.0	234	93.7	25.8	0.25	2.3	0.3	.....	16	....	73.3	265	373	18	0.721	+0.9	6.5	6
.....	.....	.....	.....	.....	.....	.....	25.0	4.4	.....	0.0	250	88.6	26.2	0.27	0.6	.....	.....	7.3	....	69.9	275	366	16	0.657	+0.9	6.4	7
.....	.....	.....	.....	.....	.....	.....	15.5	4.4	.....	0.0	227	79.5	12.8	0.27	Trace	.....	.....	10	....	60.7	247	317	12	0.429	+0.2	7.2	8
.....	0.02	.....	0.00	0.06	.....	.....	21.6	5.6	0.1	0.0	225	95.1	17.2	0.30	3.7	0.45	.....	22	....	73.7	258	363	15	0.585	+0.4	7.0	9
.....	.....	.....	.....	.....	.....	.....	16.5	4.7	0.0	0.0	217	80.2	14.0	.....	3.5	.....	.....	17	....	64.2	242	322	13	0.461	+0.6	6.7	10
.....	.....	.....	.....	.....	.....	.....	17.2	5.0	0.0	0.0	233	81.8	14.3	.....	0.3	.....	.....	16	....	63.1	254	333	13	0.469	0.0	7.4	11
.....	.....	.....	0.00	0.18	0.04	0.00	17.5	4.9	0.0	0.0	222	81.0	14.1	0.26	2.0	.....	0.3	17	....	65.3	248	296	13	0.484	0.0	7.4	12
.....	.....	.....	.....	.....	.....	.....	18.0	5.2	0.0	0.0	224	80.9	14.2	.....	1.8	.....	.....	16	....	59.6	243	326	14	0.502	+0.1	7.4	13
.....	.....	.....	.....	.....	.....	.....	24.0	5.6	.....	0.0	230	111	20.6	0.30	3.7	.....	.....	22	....	86.4	276	391	16	0.628	+0.6	6.8	14
.....	.....	.....	.....	.....	.....	.....	27.5	5.5	.....	0.0	256	113	24.2	0.30	1.6	.....	.....	27	....	82.5	292	420	17	0.701	+0.3	7.1	15
.....	0.02	.....	0.00	0.08	.....	.....	24.2	5.0	0.1	0.0	230	85.4	21.7	0.27	2.2	0.5	.....	25	....	59.7	248	358	17	0.669	+0.7	6.8	16
.....	.....	.....	.....	.....	.....	.....	34.0	5.5	.....	0.0	218	83.6	39.1	0.31	0.7	.....	.....	33	....	60.4	239	382	23	0.957	+0.3	7.2	17
.....	.....	.....	.....	.....	.....	.....	42.0	5.5	.....	0.0	246	83.0	52.2	0.34	3.5	.....	.....	26	....	58.3	260	419	25	1.13	+0.9	6.5	18
.....	0.01	.....	0.00	0.04	.....	.....	28.5	4.7	0.1	10.1	231	69.1	28.8	0.28	1.9	0.4	.....	19	....	43.6	250	359	20	0.785	+1.3	6.1	19
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.0	235	.....	74.2	.....	.....	.....	.....	.....	....	22.2	215	.....	.....	.....	+0.7	6.8	20
.....	.....	.....	.....	.....	.....	.....	20.0	4.0	.....	0.0	224	55.7	18.0	0.26	0.9	.....	.....	12	....	32.0	216	292	16	0.592	+0.6	6.9	21
.....	Trace	.....	0.00	.....	.....	.....	18.5	4.0	.....	4.6	218	49.2	18.2	0.24	1.1	0.1	.....	8.3	....	30.8	217	279	15	0.547	+0.9	6.7	22

TABLE 1 (cont'd)

Chemical Analyses of Surface Waters in the Souris, Pembina and Red River Drainage Systems in Canada

No.	Date of collection	Storage period (Days)	Stream discharge (Second-feet) On sampling date	Stream discharge (Second-feet) Monthly mean	Water temperature (°F.)	Oxygen consumed by $KMnO_4$	Carbon dioxide (calculated) (CO_2)	pH	Colour (Hazen) (Units)	Turbidity (Units)	Redox potential (mV)	Suspended matter Dried at 105°C.	Suspended matter Ignited at 550°C.	Residue on evaporation dried at 105°C. (Dissolved solids) P.P.M.	Residue on evaporation dried at 105°C. (Dissolved solids) Tons per acre-foot	Residue on evaporation dried at 105°C. (Dissolved solids) Tons per day	Loss on ignition at 550°C.	Specific conductance K x 10⁶ at 25°C.	Calcium (Ca)	Magnesium (Mg)
PEMBINA RIVER																				
STATION NO. 19 – LITTLE PEMBINA RIVER*																				
1	May 14/62	55:66	Low	.....	50	8.4	15	7.2	65	20	.....	32.3	22.8	652	.....	.....	128	842	90.3	33.4
STATION NO. 20 – MARY JANE CREEK*																				
2	May 21/62	73:81	.....	.....	54.5	.....	3	8.0	10	Clear	.....	.....	.....	.....	.....	.....	.....	603	52.0	21.3
STATION NO. 21 – PEMBINA RIVER*																				
3	May 21/62	95:106	165†	122	57	4.9	3	8.1	25	2	.....	.....	.....	.....	.....	.....	.....	647	45.8	35.8
4	June 18/63	105:136	.....	.....	69	8.1	4	7.9	15	5	-494	.....	.....	.....	.....	.....	.....	718	57.9	34.9
STATION NO. 22 – PEMBINA RIVER*																				
5	May 14/62	56:60	Medium	.....	52	.....	4	7.8	25	.....	.....	.....	.....	.....	.....	.....	.....	620	56.7	26.1
6	June 18/63	69:100	143	135	70	10.1	3	8.2	25	10	-469	38.2	30.7	468	0.635	180	102	683	56.9	31.5
STATION NO. 23 – PEMBINA RIVER*																				
7	May 18/60	15:23	976†	1,170	58	.....	3	8.1	45	85	.....	.....	.....	.....	.....	.....	.....	548	49.4	23.9
STATION NO. 24 – PEMBINA RIVER*																				
8	May 29/62	18:23	68.8	95.7	57	8.1	4	8.1	25	5	.....	9.8	3.4	512	0.695	94.5	86.8	754	59.4	34.0
RED RIVER																				
STATION NO. 25 – RED RIVER																				
9	June 11/63	44:91	10,300†	7,490	69	11.4	15	7.4	40	400	-468	368	315	366	0.498	10,160	97.6	528	56.6	24.9
SOURIS RIVER																				
STATION NO. 26 – SOURIS RIVER																				
10	May 20/60	13:31	68	104	61	.....	2	8.2	70	30	.....	.....	.....	.....	.....	.....	.....	563	42.3	18.4
11	May 17/62	97:110	Normal	.....	53	8.4	3	7.9	45	2	.....	.....	.....	.....	.....	.....	.....	547	32.5	13.4
12	June 16/63	71:81	.....	.....	74	16.8	22	7.4 (8.2)†	100	180	-494	.....	.....	.....	.....	.....	.....	1,020	35.1	21.7
STATION NO. 27 – SOURIS RIVER																				
13	May 20/60	13:31	Low	.....	60	.....	2	8.2 (8.4)†	55	20	.....	.....	.....	.....	.....	.....	.....	606	43.4	18.9

* Locally known by this name and sampled at No. 3 highway crossing. - spot sampling

* Locally known by this name and sampled at No. 3 highway crossing - spot sampling

* Sampled at highwoy crossing southeast of Glenora - spot sampling
† Records near Pilot Mound, Man.

* Sampled at No. 3 highway crossing - spot sampling

* Sampled at No. 3 highway crossing - spot sampling
† High; records near Kaleida

* Sample collected and forwarded by United States Geological Survey, Lincoln, Nebraska.

† Records at Emersan - spot sampling

* Sample collected at bridge crossing south of Oxbow - spot sampling
† Field results

* Sample collected at bridge crossing north of Northgate, - spot sampling
† Field results

TABLE 1 (cont'd)

Chemical Analyses of Surface Waters in the Souris, Pembina and Red River Drainage Systems in Canada

Iron (Fe)		Manganese (Mn)					Alkalis										Phosphate (PO_4)				Hardness as $CaCO_3$						
Total	Dissolved	Total	Dissolved	Aluminum (Al)	Copper (Cu)	Zinc (Zn)	Sodium (Na)	Potassium (K)	Ammonia (NH_3)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulphate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)		Total	Dissolved	Silica (colorimetric) (SiO_2)	Boron (B)	Non-carbonate	Total	Sum of constituents	Per cent sodium	Sodium absorption ratio	Saturation index	Stability index	No.
SYSTEM																												
near LA RIVIERE																												
0.85	0.09	0.00	0.00	0.0	0.00	0.00	39.0	4.8	0.1	0.0	143	306	14.5	0.50	1.0	0.1	.....	14	....		246	363	574	19	0.890	−0.2	7.6	1
at LA RIVIERE																												
0.06	Trace	0.00	0.00	Trace	Trace	0.00	46.0	6.6	0.1	0.0	160	173	7.6	0.44	3.3	0.3	.....	24	....		86.1	217	413	31	1.368	+0.3	7.4	2
below ROCK LAKE																												
0.04	.....	.....	0.05	.....	.....	0.00	40.2	8.5	0.0	0.0	212	164	10.7	0.38	1.5	.....	.....	11	....		87.3	262	423	24	1.082	+0.5	7.1	3
.....	.....	.....	.....	.....	.....	.....	40.5	7.8	.....	0.0	230	178	8.7	0.33	0.2	.....	.....	18	....		100	288	459	23	1.038	+0.4	7.1	4
at LA RIVIERE																												
.....	.....	.....	.....	.....	.....	.....	32.8	6.5	0.0	0.0	177	167	9.0	0.39	2.1	.....	.....	18	....		104	249	405	22	0.904	+0.3	7.2	5
.....	0.01	.....	0.00	0.07	.....	.....	40.3	7.7	.....	0.0	245	151	9.0	0.34	0.2	0.7	.....	14	....		71.3	272	431	24	1.064	+0.8	6.6	6
at DARLINGFORD																												
1.5	Trace	0.60	0.00	0.00	Trace	0.00	27.4	7.6	.....	0.0	206	102	8.0	0.3	0.8	0.3	.....	17	....		51.1	220	337	21	.....	+0.6	6.9	7
near WALHALLA, NORTH DAKOTA, U.S.A.																												
0.11	Trace	Trace	0.00	0.09	0.01	0.18	47.0	8.8	0.0	0.0	265	157	13.1	0.40	1.0	0.4	.....	18	0.0		71.2	288	471	26	1.202	+0.7	6.7	8
SYSTEM																												
at No. 100 highway crossing, south of WINNIPEG																												
.....	.....	.....	0.00	0.40	Trace	0.00	14.2	5.0	0.0	0.0	227	74.2	8.6	0.20	2.2	0.28	.....	15	....		57.7	244	314	11	0.396	0.0	7.4	9
SYSTEM																												
near OXBOW, SASK.																												
9.0	0.02	0.15	0.00	Trace	Trace	0.00	47.0	9.6	.....	0.0	222	97.8	7.1	0.0	0.8	0.3	.....	9.9	....		0.0	180	343	35	.....	+0.6	7.0	10
Trace	.....	0.00	.....	.....	.....	0.00	57.5	10.3	0.1	0.0	166	121	10.7	0.32	0.4	.....	.....	1.2	....		0.0	137	329	46	2.337	+0.1	7.7	11
....	.....	.....	.....	.....	.....	.....	160	9.1	.....	0.0	339	231	15.6	.....	3.0	.....	.....	10	....		0.0	177	653	65	5.235	−0.2	7.8	12
near NORTHGATE, SASK.																												
0.73	0.01	0.15	0.00	0.06	Trace	0.00	55.5	9.2	.....	0.0	243	97.6	9.4	0.0	1.0	0.3	.....	12	....		0.0	185	367	38	.....	+0.7	6.8	13

TABLE 1 (cont'd)

Chemical Analyses of Surface Waters in the Souris, Pembina and Red River Drainage Systems in Canada

No.	Date of collection	Storage period (Days)	Stream discharge (Second-feet) On sampling date	Stream discharge (Second-feet) Monthly mean	Water temperature (°F.)	Oxygen consumed by $KMnO_4$	Carbon dioxide (calculated) (CO_2)	pH	Colour (Hazen) (Units)	Turbidity (Units)	Redox potential (mV)	Suspended matter Dried at 105°C.	Suspended matter Ignited at 550°C.	Residue on evaporation dried at 105°C. (Dissolved solids) P.P.M.	Residue on evaporation dried at 105°C. (Dissolved solids) Tons per acre-foot	Residue on evaporation dried at 105°C. (Dissolved solids) Tons per day	Loss on ignition at 550°C.	Specific conductance $K \times 10^6$ at 25°C.	Calcium (Ca)	Magnesium (Mg)
																			SOURIS RIVER	
																		STATION NO. 28 –	SOURIS RIVER*	
1	May 18/60	15:33	518†	843	59	.....	4	8.1	55	30	.....	.....	.....	.....	.....	.....	.....	716	52.5	32.1
2	May 19/60	14:22	415†	843	59	.....	4	8.1	55	35	.....	.....	.....	.....	.....	.....	.....	716	51.4	33.3
3	May 16/62	93:105	6.6††	4.9	54	9.9	11	7.7	30	3	.....	.....	.....	.....	.....	.....	.....	1,510	50.8	75.4
																		STATION NO. 29 –	SOURIS RIVER*	
4	May 16/62	93:97	6.6†	4.9	54.5	14.2	18	7.6	35	4	.....	16.0	7.8	1,179	1.60	20.9	236	1,657	39.6	78.0
5	June 15/63	34:95	47.5††	160	73	17.2	8.0	7.7	60	4	-449	13.7	4.8	358	0.485	45.8	121	534	40.6	28.3
																		STATION NO. 30 –	SOURIS RIVER*	
6	June 16/63	40:57	48.5	160	72	16.8	18	7.4	60	6	-456	.....	.....	.....	.....	.....	.....	577	46.0	29.9
																		STATION NO. 31 –	SOURIS RIVER*	
7	June 14/63	34:83	.....	.....	69	17.2	6	7.8	60	15	-454	.....	.....	.....	.....	.....	.....	558	39.1	29.7
																		STATION NO. 32 –	SOURIS RIVER*	
8	July 9/62†	.....	.....	.....	70	6.3	14	7.7	110	15	.....	22	.....	444	.....	.....	.....	490	48	33
9	June 14/63	44:88	.....	.....	69	14.0	21	7.3	40	9	-475	60.0	46.9	440	.....	.....	127	628	43.5	35.8

* Sample collected at Mallo crossing bridge, below Antler Creek mouth. - spot sampling
† Records at Coulter dam
†† Records at Westhope, North Dakota, U.S.A.

† Records near Westhope, North Dakota, U.S.A.
†† Records at Coulter Dam
* Spot sampling

* Sampled at No. 3 highway crossing - spot sampling

* Spot sampling

† Analysis submitted by the Environmental Health Laboratory, Dept. of Health, Manitoba.
* Spot sampling

TABLE I (concl'd)

Chemical Analyses of Surface Waters in the Souris, Pembina and Red River Drainage Systems in Canada

Iron (Fe)		Manganese (Mn)					Alkalis									Phosphate (PO_4)				Hardness as $CaCO_3$						No.
Total	Dissolved	Total	Dissolved	Aluminum (Al)	Copper (Cu)	Zinc (Zn)	Sodium (Na)	Potassium (K)	Ammonia (NH_3)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulphate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Total	Dissolved	Silica (colorimetric) (SiO_2)	Boron (B)	Non-carbonate	Total	Sum of constituents	Per cent sodium	Sodium absorption ratio	Saturation index	Stability index	
SYSTEM																											
near COULTER																											
0.74	0.01	0.20	0.01	0.03	Trace	0.00	52.5	11.8	.....	0.0	320	104	12.8	0.0	0.2	0.3	.....	11	...	0.0	262	434	29	.....	+0.8	6.5	1
0.70	Trace	0.20	0.00	0.00	Trace	0.00	52.4	11.6	.....	0.0	319	104	11.7	0.0	1.2	0.2	.....	9.2	...	3.2	265	432	29	.....	+0.7	6.7	2
0.11	.....	0.12	.....	.....	.....	0.00	160	20.6	0.00	0.0	317	473	49.5	0.80	4.9	.....	.....	2.1	...	177	437	990	43	3.370	+0.3	7.1	3
at COULTER DAM																											
.....	0.01	.....	0.00	0.02	0.00	0.05	208	22.5	0.1	0.0	416	443	70.3	1.1	7.2	1.0	.....	4.2	...	78.7	420	1,080	50	4.416	+0.2	7.2	4
.....	0.01	.....	0.00	0.08	.....	.....	23.5	11.6	0.1	0.0	236	66.7	12.3	0.22	0.5	0.6	.....	14	...	24.4	218	315	18	0.693	+0.1	7.5	5
near MELITA																											
.....	Trace	.....	0.00	.....	.....	0.00	24.3	11.2	0.1	0.0	258	66.4	17.1	0.27	3.0	.....	.....	18	...	25.9	238	344	17	0.686	-0.1	7.6	6
at HARTNEY																											
.....	0.02	.....	0.00	0.03	0.00	0.00	29.0	7.5	0.1	0.0	228	90.2	8.2	0.27	0.2	<0.1	.....	19	...	33.0	220	335	22	0.852	+0.2	7.4	7
at SOURIS																											
0.54	.....	.....	0.05	.....	.....	.....	43	.....	.....	0.0	278	89.0	16.5	0.76	0.1	.....	.....	.....	...	28.0	256	.....	.....	.....	.....	...	8
.....	.....	.....	0.00	0.06	Trace	0.00	38.0	8.4	0.1	0.0	246	116	10.8	0.29	0.7	<0.1	.....	16	...	50.0	252	390	24	1.043	-0.2	7.7	9

TABLE 2

Cross Section Sampling
Red, Roseau, Souris and Pembina Rivers

No.	Sampling point	Storage period (Days)	Water temperature (°F.)	Oxygen consumed by $KMnO_4$	Carbon dioxide (calculated) (CO_2)	pH	Colour (Hazen) (Units)	Turbidity (Units)	Redox potential (mV)	Suspended matter: Dried at 105°C.	Suspended matter: Ignited at 550°C.	Residue on evaporation dried at 105°C. (Dissolved solids): P.P.M.	Residue on evaporation dried at 105°C. (Dissolved solids): Tons per acre-foot	Loss on ignition at 550°C.	Specific conductance $K \times 10^6$ at 25°C.	Calcium (Ca)	Magnesium (Mg)
	STATION NO. 18 –RED RIVER																
	May 9/62																
1	70 feet from left bank, integrated depth sample	35	54	.....	.....	7.3	35	.....	.....	.....	.....	.....	.....	.....	745	.....	.....
2	120 feet from left bank, integrated depth sample	35	53.5	.....	.....	7.3	35	.....	.....	.....	.....	.....	.....	.....	750	.....	.....
3	190 feet from left bank, integrated depth sample	35	53	.....	.....	7.2	35	.....	.....	.....	.....	.....	.....	.....	745	.....	.....
4	150 feet from left bank, mid depth sample	58:62	53	6.1	3	8.1	35	25	.....	81.5	65.6	482	0.655	364	707	61.5	27.8
5	70 feet from left bank, surface sample	35	53	.....	.....	7.9	35	.....	.....	.....	.....	.....	.....	.....	715	.....	.....
6	190 feet from left bank, surface sample	35	52.8	.....	.....	7.9	.....	.....	.....	.....	.....	.....	.....	.....	724	.....	.....
	June 11/63																
7	70 feet from left bank, surface sample	44:62	69	10.3	20	7.4	40	650	−474	.....	.....	.....	.....	.....	558	58.1	26.5
8	142 feet from left bank, surface sample	44:91	69	9.4	15	7.4	35	700	−464	.....	.....	.....	.....	.....	543	56.1	26.2
9	212 feet from left bank, surface sample	44:62	69	9.7	8	7.6	35	600	−464	.....	.....	.....	.....	.....	550	54.4	26.1

* Width of river at this point is approximately 285 feet

	STATION NO. 10 – ROSEAU RIVER																
	May 10/62																
10	20 feet from left bank, mid depth sample	55	49	.....	.....	7.3	.....	.....	.....	.....	.....	.....	.....	.....	305	.....	.....
11	center of river width, mid depth sample	61:64	49	11.7	4	7.8	55	2	.....	.....	.....	.....	.....	.....	303	41.6	13.6
12	60 feet from left bank, mid depth sample	55	49	.....	.....	7.3	.....	.....	.....	.....	.....	.....	.....	.....	309	.....	.....
	June 11/63																
13	17 feet from left bank, mid depth sample	34:91	65	23.3	2	8.3	75	.....	−430	.....	.....	.....	.....	.....	369	49.2	20.0
14	51 feet from left bank, mid depth sample	34:91	65	22.5	6	7.8	75	25	−448	53.6	45.8	272	0.370	88.8	383	49.4	20.4

* Width of river at this point is approximately 81 feet

TABLE 2 (cont'd)

Cross Section Sampling
Red, Roseau, Souris and Pembina Rivers

Iron (Fe)		Manganese (Mn)					Alkalis									Phosphate (PO_4)				Hardness as $CaCO_3$						
Total	Dissolved	Total	Dissolved	Aluminum (Al)	Copper (Cu)	Zinc (Zn)	Sodium (Na)	Potassium (K)	Ammonia (NH_3)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulphate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Total	Dissolved	Silica (colorimetric) (SiO_2)	Boron (B)	Non-carbonate	Total	Sum of constituents	Per cent sodium	Sodium absorption ratio	Saturation index	Stability index	No.
at EMERSON*																											
.....	.....	.....	.....	.....	.....	.....	.....	.....	0.0	0.0	224	.....	61.2	.....	.....	.....	.....	.....	...	88.5	272	.....	.....	.....	.....	.....	1
.....	.....	.....	.....	.....	.....	.....	.....	.....	0.1	0.0	225	.....	60.9	.....	.....	.....	.....	.....	...	83.7	268	.....	.....	.....	.....	.....	2
.....	.....	.....	.....	.....	.....	.....	.....	.....	0.1	0.0	227	.....	60.5	.....	.....	.....	.....	.....	...	84.5	271	.....	.....	.....	.....	.....	3
0.88	0.14	0.07	0.00	0.01	Trace	0.00	46.0	6.9	0.1	0.0	223	107	61.9	0.35	1.7	0.3	.....	16	...	84.4	268	440	27	1.22	+0.7	6.7	4
.....	.....	.....	.....	.....	.....	.....	.....	.....	0.0	0.0	226	.....	61.6	.....	.....	.....	.....	.....	...	82.2	267	.....	.....	.....	.....	.....	5
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.0	220	.....	61.2	.....	.....	.....	.....	.....	...	85.5	267	.....	.....	.....	.....	.....	6
.....	.....	.....	.....	.....	.....	.....	17.2	5.0	0.0	0.0	233	81.8	14.3	.....	0.3	.....	.....	16	...	63.1	254	333	13	0.469	0.0	7.4	7
.....	.....	.....	0.0	0.18	0.04	0.00	17.5	4.9	0.0	0.0	222	81.0	14.1	0.26	2.0	0.3	.....	17	...	65.3	248	296	13	0.484	0.0	7.4	8
.....	.....	.....	.....	.....	.....	.....	18.0	5.2	0.0	0.0	224	80.9	14.2	.....	1.8	.....	.....	16	...	59.6	243	326	14	0.502	+0.1	7.4	9
at GARDENTON*																											
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.0	164	.....	2.1	.....	.....	.....	.....	.....	...	26.2	161	.....	.....	.....	.....	.....	10
.....	.....	.....	.....	.....	.....	0.00	2.5	3.7	0.1	0.0	165	27.3	1.8	.....	1.2	.....	.....	11	...	24.8	160	184	3.2	0.086	+0.1	7.6	11
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.0	166	.....	1.8	.....	.....	.....	.....	.....	...	25.2	161	.....	.....	.....	.....	.....	12
.....	.....	.....	0.00	0.07	Trace	0.03	3.6	1.4	0.0	0.0	223	23.9	0.3	0.36	0.5	0.12	.....	9.8	...	22.3	205	219	3.7	0.110	+0.8	6.7	13
.....	.....	.....	0.00	0.09	0.02	0.00	3.9	1.4	0.1	0.0	227	19.9	0.2	0.32	1.7	0.2	.....	12	...	21.4	208	221	3.9	0.118	+0.3	7.2	14

TABLE 2 (cont'd)

Cross Section Sampling
Red, Roseau, Souris and Pembina Rivers

No.	Sampling point	Storage period (Days)	Water temperature (^{0}F.)	Oxygen consumed by $KMnO_4$	Carbon dioxide (calculated) (CO_2)	pH	Colour (Hazen) (Units)	Turbidity (Units)	Redox potential (mV)	Suspended matter: Dried at 105^{0}C.	Suspended matter: Ignited at 550^{0}C.	Residue on evaporation dried at 105^{0}C. (Dissolved solids): P.P.M.	Residue on evaporation dried at 105^{0}C. (Dissolved solids): Tons per acre-foot	Loss on ignition at 550^{0}C.	Specific conductance K × 10^6 at 25^{0}C.	Calcium (Ca)	Magnesium (Mg)
	STATION NO. 8 – ROSEAU RIVER																
	May 10/62																
1	¼ river width from left bank, mid depth sample	54	51	.....	.....	7.9	.....	.....	.....	.....	.....	.....	.....	.....	308	.....	.....
2	center of river, mid depth sample	60:64	50.8	10.9	18	7.2	65	20	.....	96.0	76.7	202	0.274	52.8	312	41.6	15.6
3	¼ river width from left bank, mid depth sample	54	51.8	.....	.....	7.3	.....	.....	.....	.....	.....	.....	.....	.....	314	.....	.....
	STATION NO. 17 – SOURIS RIVER																
	June 15/63																
4	21 feet from left bank, mid depth sample	33:95	70	22.8	13	7.6	75	25	-453	.....	.....	.....	.....	.....	801	47.3	38.0
5	39 feet from left bnnk,† mid depth sample	24:81	70	19.7	15	7.5	80	20	-444	27.6	20.1	555	0.760	124	797	47.8	37.2

* Width nf river at this polnt is apprnximately 63 feet.
† Maximum flow observed at this location.

	STATION NO. 33 – SOURIS RIVER*																
	May 17/62																
6	Left baak	56:64	51.4	.....	11	7.6	.....	.....	.....	.....	.....	.....	.....	.....	516	42.5	15.9
7	Right bank	56:64	51.4	.....	13	7.5	.....	.....	.....	.....	.....	.....	.....	.....	517	43.2	16.5

* Spnt sampling

	STATION NO. 30 – SOURIS RIVER†																
	May 16/62																
8	Left side of river, integrated sample	93:103	55	.....	6	7.8	20	3	.....	.....	.....	.....	.....	.....	708	31.9	31.0
9	Right side of river, integrated sample	93:105	55	.....	15	7.4	20	.....	.....	.....	.....	.....	.....	.....	701	32.9	30.8

† River low with very little flow

TABLE 2 (cont'd)

Cross Section Sampling
Red, Roseau, Souris and Pembina Rivers

Iron (Fe)		Manganese (Mn)					Alkalis									Phosphate (PO_4)				Hardness as $CaCO_3$						
Total	Dissolved	Total	Dissolved	Aluminium (Al)	Copper (Cu)	Zinc (Zn)	Sodium (Na)	Potassium (K)	Ammonia (NH_3)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulphate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Total	Dissolved	Silica (colorimetric) (SiO_3)	Boron (B)	Non-carbonate	Total	Sum of constituents	Per cent sodium	Sodium absorption ratio	Saturation index	Stability index	No.
at DOMINION CITY																											
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.0	170	.....	2.4	.....	.....	.....	.....	.....	.....	25.5	165	.....	.....	.....	.....	.....	1
0.70	0.03	0.00	0.00	0.00	0.20	0.00	2.6	3.6	0.1	0.0	172	27.7	2.1	0.27	2.2	0.4	.....	11	...	26.7	168	192	3.2	0.057	−0.5	8.2	2
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.0	172	.....	.....	.....	.....	.....	.....	.....	...	31.1	172	.....	.....	.....	.....	.....	3
at COULTER*																											
.....	0.01	.....	0.00	0.07	.....	.....	66.0	13.6	0.1	0.0	283	169	13.5	0.32	4.6	1.2	.....	21	...	42.5	275	492	33	1.733	+0.1	7.4	4
.....	Trace	.....	0.00	0.09	.....	.....	63.5	13.6	0.0	0.0	277	171	15.0	0.42	2.3	0.8	.....	21	...	45.1	273	509	32	1.673	+0.1	7.3	5
below LONG CREEK MOUTH																											
.....	.....	.....	.....	.....	.....	.....	39.0	12.0	.....	0.0	246	62.3	4.3	.....	0.6	.....	.....	0.6	...	0.0	172	298	31	1.29	+0.1	7.4	6
.....	.....	.....	.....	.....	.....	.....	39.0	12.0	.....	0.0	243	62.8	4.8	.....	1.1	.....	.....	0.6	...	0.0	174	300	31	1.29	0.0	7.5	7
near MELITA, No. 3 highway crossing																											
.....	.....	.....	.....	.....	.....	.....	66.2	11.5	0.0	0.0	238	134	23.1	.....	3.6	.....	.....	5.2	...	12.1	207	424	39	2.000	+0.1	7.6	8
.....	.....	.....	.....	.....	.....	.....	65.5	11.1	0.0	0.0	241	138	23.5	.....	3.0	.....	.....	5.2	...	16.3	209	425	39	1.978	−0.3	8.0	9

TABLE 2 (cont'd)

Cross Section Sampling
Red, Roseau ,Souris and Pembina Rivers

No.	Sampling point	Storage period (Days)	Water temperature (°F.)	Oxygen consumed by $KMnO_4$	Carbon dioxide (calculated) (CO_2)	pH	Colour (Hazea) (Units)	Turbidity (Units)	Redox potential (mV)	Suspended matter: Dried at 105°C.	Suspended matter: Ignited at 550°C.	Residue on evaporation dried at 105°C. (Dissolved solids): P.P.M.	Residue on evaporation dried at 105°C. (Dissolved solids): Tons per acre-foot	Loss on ignition at 550°C.	Specific conductance $K \times 10^6$ at 25°C.	Calcium (Ca)	Magnesium (Mg)
	STATION NO. 6 – PEMBINA RIVER																
	May 14/62																
1	Left side of river, mid depth sample	57	51.6	.....	18	7.1	.....	.....	.....	.....	.....	.....	.....	.....	467	.....	.....
2	Right side of river, mid depth sample	57:67	51.6	6.7	.....	7.5	25	8	.....	22.3	12.8	308	.....	64.8	463	36.1	19.4
	STATION NO. 7 – PEMBINA RIVER																
	May 22/62																
3	14 feet from left bank, integrated sample	72:99	56.8	4.6	6	7.7	25	8	.....	28.1	22.2	435	0.592	92	556	53.8	24.5
4	38 feet from left bank, integrated sample	72:80	56.8	.....	2	8.3	25	.....	.....	.....	.....	.....	.....	.....	592	55.2	25.0
	June 18/63																
5	12 feet from left bank, mid depth sample	64:79	75	8.5	21	7.3	25	220	-479	.....	.....	.....	.....	.....	689	59.7	29.5
6	25 feet from left bank, mid depth sample	21:58	75	9.1	8	7.7	40	210	-439	216	198	474	0.645	80	691	57.1	31.3
7	36 feet from left bank, mid depth sample	64:79	75	8.3	14	7.5	25	160	-472	.....	.....	.....	.....	.....	690	59.1	29.6

* Width of river at this point is approximately 51 feet

TABLE 2 (concl'd)

Cross Section Sampling
Red, Roseau, Souris and Pembina Rivers

Iron (Fe)		Manganese (Mn)					Alkalis									Phosphate (PO_4)				Hardness as $CaCO_3$						
Total	Dissolved	Total	Dissolved	Aluminum (Al)	Copper (Cu)	Zinc (Zn)	Sodium (Na)	Potassium (K)	Ammonia (NH_3)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulphate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Total	Dissolved	Silica (colorimetric) (SiO_2)	Boron (B)	Non-carbonate	Total	Sum of constituents	Per cent sodium	Sodium absorption ratio	Saturation index	Stability index	No.
near SWAN LAKE																											
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.0	147	.....	.....	.....	.....	.....	.....	.....	.....	49.7	170	.....	.....	.....	.....	.....	1
0.28	Trace	0.15	0.00	0.00	0.00	0.00	26.2	6.3	0.0	0.0	147	102	7.8	0.29	0.2	0.2	.....	9.0	....	49.1	170	280	24	0.874	−0.3	8.1	2
near WINDYGATES*																											
0.49	0.02	.....	0.00	0.01	0.02	0.00	38.0	6.8	0.2	0.0	188	155	10.4	0.38	0.1	0.5	.....	16	....	81.4	235	397	25	1.079	+0.1	7.5	3
0.61	Trace	0.14	0.00	0.05	0.01	0.00	38.1	6.9	0.0	0.0	187	161	9.4	0.41	0.6	0.2	.....	16	....	87.2	241	405	25	1.068	+0.6	7.0	4
.....	.....	.....	.....	.....	.....	.....	39.0	7.6	0.0	0.0	246	146	9.5	.....	0.5	.....	.....	23	....	68.3	270	436	23	1.027	−0.1	7.5	5
0.61	0.01	0.15	0.00	0.13	.....	.....	41.8	7.9	0.0	0.0	247	146	9.4	0.36	0.1	0.7	.....	25	....	68.7	272	442	24	1.104	+0.3	7.1	6
.....	.....	.....	.....	.....	.....	.....	39.0	7.5	0.0	0.0	247	145	9.4	.....	1.1	.....	.....	22	....	66.8	269	434	23	1.035	+0.1	7.3	7

APPENDIX A

Surface Water Sampling Station