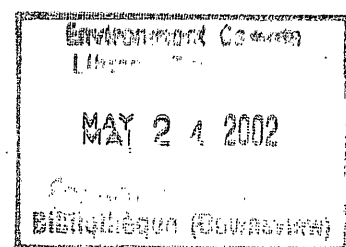


**A REPORT ON
1988 WATER LEVELS
OF THE GREAT LAKES**



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1.0 PURPOSE AND SCOPE

This report summarizes the events that took place in 1988 in connection with water levels on the Great Lakes. Water management actions related to Lake Superior and Lake Ontario regulation, as well as their impacts on lake water levels, are also summarized.

The format of this report is similar to that of previous reports prepared in 1985, 1986 and 1987. All data are in metric units unless stated otherwise. Lake water levels are expressed in metres on the International Great Lakes Datum (1955). The preliminary data used in this report (eg. precipitation) may be subject to future revisions by the agencies issuing these data.

CONDITIONS LEADING TO THE GREAT LAKES WATER LEVELS OF 1988

2.1 GENERAL

In 1985, a new average annual precipitation record of 1017 millimetres was set, exceeding the long-term average of 812 millimetres by about 25 percent. This event, following 18 years of generally above-average precipitation, led to the occurrence of record high water levels on all of the Great Lakes with the exception of Lake Ontario, a condition which continued through 1986 and into early 1987. During 1987 and 1988, water levels on all of the Great Lakes dropped considerably from those record high levels, to levels in the latter months of 1988 that were close to the long term average. The primary reasons for this drop were the return to so called normal annual precipitation conditions in the basin, the time distribution of this annual precipitation, and above average rates of evaporation from the lakes. November 1986 to June 1987 precipitation was 27% below average, but above average rainfall in the autumn months caused total basin precipitation in 1987 to be approximately average. Again, the first part of 1988 was extremely dry, with most of Canada and the United States experiencing a substantial drought. A "wet" fall brought annual precipitation up to the annual "norm." Section 2.2 discusses the precipitation in each of the lake basins in greater detail, while water levels are discussed in Section 2.5.

2.2. Precipitation

The recorded monthly mean precipitation rates over the Great Lakes in 1987 and 1988 are summarized by lake in Table 1. In 1988, precipitation on the Lake Superior basin was above average in March, August, October, November and December, and was below average for the remaining months. From October to December, precipitation was 47% above average for that time period. This more than compensated for the dry period from April to July (25% below average) such that overall precipitation on the Lake Superior basin was 15% above average for the year.

For the first seven months of 1988, precipitation on the Lake Michigan-Huron basin was approximately 17% below average, the lowest month being June, when precipitation was 64% below the monthly mean. In fact, the period from May to July was very dry in the basin, with precipitation for that period falling 41% below average. In August of 1988, precipitation over the Lake Michigan-Huron basin was 45% above average. This above average trend continued from August to November, with precipitation being approximately 48% above the mean for that period. Overall, 1988 precipitation over the Lake Michigan-Huron basin was 8% above average for the year.

On Lake Erie, overall 1988 precipitation was 9% below average for the year. This was due primarily to the dry period from March to June when precipitation was 52% below average for that period. From July to December, precipitation has been 22% above average, with precipitation in October being 72% above the mean for that month.

As with the other lakes, the period of March to June 1988 was very dry in the Lake Ontario basin and precipitation for that period was 29% below average. January and December were also dry, with precipitation being 36% and 37% respectively below average. February and October were the only particularly wet months and saw monthly precipitation values that were 30% and 35% respectively above average. Overall, precipitation on Lake Ontario in 1988 was 12% below the long term average.

Table 1
Precipitation Data For The Great Lakes:
1987, 1988 and Previous Recorded Means

	(Millimetres)					
	Jan	Feb	Mar	Apr	May	Jun
Superior						
Mean	47.0	36.1	44.2	49.8	68.6	84.1
1987	34.0	17.3	24.1	22.4	75.4	47.0
% of Mean	72.3	47.9	54.5	44.8	109.6	55.8
1988	44.7	33.0	57.2	24.6	58.2	63.8
% of Mean	95.1	91.5	129.3	49.5	84.8	75.8
Huron/Michigan						
Mean	52.0	43.7	54.5	64.5	75.0	78.5
1987	37.8	17.8	38.9	50.2	61.0	69.9
% of Mean	72.9	40.9	71.5	78.1	81.1	88.5
1988	50.5	54.0	54.8	72.2	34.9	28.5
% of Mean	97.0	123.7	100.5	112.2	46.6	36.3
Erie						
Mean	61.2	52.3	69.6	77.7	81.5	85.6
1987	51.3	10.7	60.5	54.4	59.9	114.8
% of Mean	83.4	20.5	86.5	69.7	73.1	132.9
1988	30.7	58.9	45.0	59.9	38.9	18.5
% of Mean	50.2	112.7	64.6	77.1	47.7	21.7
Ontario						
Mean	67.8	60.5	67.1	71.1	75.7	77.5
1987	64.8	23.1	59.9	75.7	39.1	97.0
% of Mean	95.2	38.4	89.1	106.5	51.5	124.6
1988	43.2	78.5	41.4	69.1	55.1	40.6
% of Mean	63.7	129.7	61.7	97.2	72.8	52.4
Great Lakes						
Mean	53.8	45.0	55.1	63.8	74.2	81.0
1987	41.7	17.3	40.4	46.2	62.2	72.8
% of Mean	77.4	38.5	73.3	72.6	83.6	89.3
1988	45.5	48.8	52.6	57.4	44.2	38.1
% of Mean	84.5	108.4	95.4	90.0	59.6	47.0

-Source: National Oceanic and Atmospheric Administration, and
U.S. Army Corps of Engineers.
-Mean data are calculated for the period 1900-1988 inclusive.
-August to December 1988 data are preliminary.

Table 1
(continued)

Precipitation Data for the Great Lakes:
1987, 1988 and Previous Recorded Means
(Millimetres)

	Jul	Aug	Sep	Oct	Nov	Dec	Tot
Superior							
Mean	81.8	81.0	89.4	67.6	62.5	49.0	761.1
1987	120.4	99.6	79.0	73.4	88.9	44.7	726.2
% of Mean	147.2	122.9	88.4	108.6	142.2	91.2	95.3
1988	67.8	171.7	88.1	80.5	122.9	60.5	873.0
% of Mean	82.9	212.0	98.6	119.1	196.7	123.4	114.7
Huron/Michigan							
Mean	74.8	77.6	87.0	69.8	67.9	58.5	804.3
1987	67.5	126.3	85.5	76.5	83.7	74.5	789.6
% of Mean	90.3	162.8	98.2	109.5	123.3	127.3	98.2
1988	71.5	112.8	90.4	115.1	128.5	56.4	869.6
% of Mean	95.5	145.3	103.9	164.8	189.3	96.4	108.0
Erie							
Mean	81.8	79.8	78.5	67.8	70.1	66.0	873.8
1987	88.9	136.4	75.2	72.4	98.8	84.1	907.4
% of Mean	108.7	170.9	95.8	106.8	141.0	127.4	103.8
1988	98.0	100.3	61.7	116.8	104.4	60.7	793.8
% of Mean	119.6	125.7	78.6	172.3	148.9	92.0	90.8
Ontario							
Mean	79.0	78.0	80.0	75.2	76.7	73.2	882.6
1987	89.4	82.3	120.4	71.9	128.0	64.0	915.6
% of Mean	113.2	105.5	143.1	95.6	166.9	87.4	103.7
1988	86.4	73.9	55.9	101.9	81.8	45.7	773.5
% of Mean	109.3	94.8	69.9	135.4	106.6	62.5	87.6
Great Lakes							
Mean	78.0	78.7	85.6	69.3	68.1	58.4	811.8
1987	87.4	115.3	86.4	74.4	92.5	66.5	803.1
% of Mean	112.0	146.5	100.9	107.4	135.8	114.0	98.9
1988	75.7	122.4	82.0	104.4	118.4	56.6	846.1
% of Mean	97.0	155.6	95.8	150.6	173.8	97.0	104.2

Source: National Oceanic and Atmospheric Administration, and
U.S. Army Corps of Engineers.

Mean data are calculated for the period 1900-1988 inclusive.
August to December 1988 data are preliminary.

For the first seven months of 1988, precipitation over the entire Great Lakes basin was approximately 20% below average. Severe low precipitation values were set in May and June when total basin precipitation was 40% and 53% respectively below average. From August to December, precipitation over the entire basin was 34% above average, causing the total Great Lakes basin precipitation for 1988 to be 4% above the long term average.

2.3 Runoff

Preliminary streamflow data from a number of Canadian tributaries draining into the Great Lakes are summarized in Table 2. These tributaries were selected as being representative of the total runoff to the Great Lakes from Canada.

Runoff conditions in the Canadian portion of the Great Lakes basin, from January to November of 1988, were approximately 13% below average. Two months of note were June and July, when total basin runoff was 42% and 56% respectively below average. This reflects the drought conditions that were experienced over the basin throughout early 1988, as well as the lack of any significant snowmelt or spring freshet in the spring of 1988. In response to heavy fall precipitation, runoff increased substantially in October and November of 1988, when total basin runoff was 18% and 51% respectively above average. On Lake Michigan-Huron, November runoff was 110% above the average amount for the month. December runoff data was not available, but it is also expected to be above average.

2.4 Other Factors

a) Evaporation

Lake evaporation data for 1988 from the Atmospheric Environment Service (AES) of Environment Canada were examined to assess the extent this process affected lake water levels. The results are summarized in

Table 2

1986, 1987 and 1988 Runoff Conditions in the Canadian Portion

of the Great Lakes Basin

(Expressed as a Percentage of the Mean for Period 1969-1984)

	Lake Superior			Lake Huron			Lake St Clair			Lake Erie			Lake Ontario			Total Basin		
	'86	'87	'88	'86	'87	'88	'86	'87	'88	'86	'87	'88	'86	'87	'88	'86	'87	'88
Jan	121	92	82	100	86	92	163	100	60	118	113	125	97	103	79	111	93	86
Feb	116	88	83	81	82	93	72	30	84	63	57	122	87	70	89	94	78	89
Mar	117	88	76	100	92	85	150	80	69	145	110	104	106	88	69	115	91	80
Apr	109	77	55	90	56	128	55	84	46	52	93	60	73	119	84	87	77	92
May	93	40	64	61	28	94	75	36	53	101	58	61	62	35	63	75	35	77
Jun	82	34	52	78	35	71	154	66	32	117	74	52	191	66	36	91	39	58
Jul	91	47	43	102	45	44	137	73	55	142	141	76	83	56	37	96	50	44
Aug	90	52	70	160	50	81	112	69	60	168	120	77	35	41	40	109	54	72
Sep	91	54	90	176	36	91	346	63	44	632	89	63	373	69	47	161	51	84
Oct	84	54	132	170	31	123	586	61	109	427	108	81	405	58	40	166	48	118
Nov	91	48	111	99	44	210	108	105	149	125	106	148	124	82	88	100	54	151
Dec	99	54		82	81		129	161		115	159		112	128		96	86	
Total	98	60	*77	98	56	106	133	82	69	144	101	88	118	86	70	104	64	87

* 1988 Totals to November

Source: Water Resources Branch - Ontario Region, Environment Canada.
December 1988 Data Not Yet Available

Table 3. For comparison purposes, the data for 1987 and the long-term averages for the period 1965-1987 are included.

From January to November of 1988, evaporation was above average on all lakes. On the middle lakes, evaporation was 30% (19.5 cm) higher than average on Lake Erie and 21% (9.0 cm) and 18% (7.3 cm) higher on Lake Huron and Georgian Bay respectively. For Lakes Ontario and Superior, evaporation was 5% (2.4 cm) and 6% (2.3 cm) respectively above average for that time period. On an overall basis, evaporation from January to November of 1988 has been approximately 16% higher than average and approximately 6% higher than that for the same period in 1987.

Evaporation was particularly high during the early summer of 1988 reflecting the dry conditions that prevailed. The higher evaporation during 1988, was a major contributing factor to the lower levels of the lakes.

b) Welland Canal

During 1987 this diversion averaged 215 cms which was slightly lower than the 1986 diversion. In 1988 to date, flows between January and November have averaged 240 cms (Table 4), which is 7% higher than the average of 233 cms for that time period. New records were set in January and February of 1988.

c) Niagara River Flows

Table 5 contains the Niagara River flow data for 1986, 1987 and 1988 and draws comparisons with previous records. From January to November of 1988, flows have averaged 5903 cms which is about 1% above the average for that time period and about 13% below that for the same period in 1987.

Table 3
Evaporation from the Great Lakes in 1987 and 1988
and Long-Term Mean Data

	January to December			January to November		
	Mean 1965-1986	1987	% of Mean	Mean 1965-1987	1988	% of Mean
Superior	530	525	99	396	419	106
Huron	536	582	109	433	523	121
Georgian Bay	521	589	113	416	489	118
Erie	733	755	103	646	841	130
Ontario	578	564	98	484	508	105
Michigan	-	-	-	-	605	-

Note: All figures are in millimetres.

December Data Not Yet Available.

Table 4

Welland Canal Diversions in 1986, 1987 and 1988

and Comparison with Previous Record

Welland Canal Diversion (cms)*

	1986	1987	1988	Mean 1950-1987	Previous Recorded Maxima and year of Occurrence
Jan	241	233	247R	201	241 (1983, 1986)
Feb	225	199	244R	199	238 (1976,1980)
Mar	227	215	239	205	249 (1977,1979)
Apr	241	246	234	228	278 (1977)
May	181	247	259	234	275 (1979)
Jun	202	234	257	231	272 (1973,1979,1981)
Jul	173	241	248	225	286 (1979)
Aug	225	228	231	232	280 (1979)
Sep	237	250	232	235	272 (1973,1978)
Oct	249	247	224	235	275 (1976)
Nov	246	252	226	233	278 (1976,1981)
Dec	238	240		223	269 (1976)
Annual	224	215	240**	223	263 (1979)

* Figures include the 20 cms of water that is discharged from the Canal to the Welland River.

** To November 1988

R denotes new record.

Table 5
Niagara River Flows in 1986, 1987 and 1988

and Comparison with Previous Records

Niagara River Flows at Buffalo (cms)

	1986	1987	1988	Mean 1860-1987	Previous Recorded Maxima and year of Occurrence
Jan	6340	7192R	6088	5576	6940 (1973)
Feb	6650	6852R	6032	5401	6770 (1863)
Mar	7250R	6796	6003	5570	7110 (1973)
Apr	7190	7051	6088	5820	7450 (1974)
May	7480	6965	6230	6137	7500 (1974)
Jun	7590R	6824	6003	6185	7420 (1973)
Jul	7500R	6881	5748	6076	7330 (1973)
Aug	7190R	6655	5862	5995	7050 (1973)
Sep	6910R	6541	5607	5875	6910 (1861)
Oct	7192R	6371	5635	5765	6940 (1861)
Nov	7022R	6145	5635	5763	6910 (1861)
Dec	7305	6315		5764	7390 (1985)
Ann.	7134R	6716	5903*	5827	6990 (1973)

R Denotes new record

* To November 1988

2.5 Lake Water Levels

Figures 1 to 5 are hydrographs of monthly water levels on the Great Lakes. Table 6 presents a comparison of 1987 and 1988 levels with previous recorded maximums. The general trend for the levels of the middle lakes in 1988 has been downward. Lakes Ontario and Superior have tended to follow the seasonal cycle, although at slightly below average levels. The below average amounts of winter precipitation, high evaporation and the drought conditions experienced in the spring and summer of 1988, kept all lakes from experiencing their normal seasonal rise in level and also helped to accelerate the normal seasonal decline. Heavy precipitation in the fall of 1988 caused the levels of all lakes (except Ontario) to rise slightly in November and December, a time when levels are usually declining. The net result however, is that levels on all the lakes have fallen well below the record levels that were set in 1986. In addition, the levels of the middle lakes have also fallen below those levels recorded in 1987.

Levels on Lake Superior were below average for the first eleven months of 1988, but rose to average levels in December. In January 1988 Lake Huron's levels were 32 centimetres above average, but by August the levels had dropped slightly below the long term monthly average. This marked the first time in almost eleven years that Lake Huron levels had fallen below average. By December of 1988, levels were 5 cm above the long term average, but were 24 cm below the levels of a year earlier and approximately 82 cm below the December record level set in 1986.

On Lake St. Clair, 1988 water levels dropped below the 1961-1988 average in May and continued on a downward trend such that by December of 1988, the average levels of Lake St. Clair were 15 cm below the 1961-1988 long term average and 33 cm lower than the levels recorded in December of 1987.

Lake Erie levels also continued to decline, but remained slightly above the long term average. By December of 1988, Lake Erie was 8 cm above it's long term average for the month, 34 cm below the levels recorded in December of

Table 6

Great Lakes Water Levels: 1987, 1988 and Previous Recorded Maxima

(METRES)						
	Jan	Feb	Mar	Apr	May	Jun
<hr/>						
Superior (at Thunder Bay)						
1988	182.88	182.82	182.78	182.81	182.85	182.88
1987	183.19	183.11	183.05	183.03	183.04	183.09
Previous Record	183.31	183.25	183.23	183.29	183.36	183.44
(year)	1986	1986	1986	1986	1986	1916
Michigan-Huron (at Goderich)						
1988	176.45	176.44	176.37	176.48	176.50	176.48
1987	176.99*	176.89	176.84	176.87	176.85	176.87
Previous Record	176.96	176.91	176.93	177.03	177.08	177.13
(year)	1986	1986	1986	1986	1986	1986
St. Clair (at Belle River)						
1988	175.11	175.06	175.03	175.12	175.12	175.08
1987	175.56	175.40	175.35	175.50	175.44	175.44
Previous Record	175.57	175.59	175.59	175.61	175.62	175.70
(year)	1986	1986	1986	1986	1986	1986
Erie (at Port Colborne)						
1988	174.24	174.19	174.17	174.27	174.24	174.21
1987	174.72*	174.56*	174.51	174.61	174.59	174.59
Previous Record	174.56	174.54	174.71	174.82	174.77	174.85
(year)	1973	1986	1986	1985	1986	1986
Ontario (at Kingston)						
1988	74.37	74.42	74.41	74.56	74.69	74.74
1987	74.82	74.85	74.80	75.00	74.95	74.84
Previous Record	75.03	75.12	75.22	75.47	75.58	75.61
(year)	1946	1952	1952	1952	1952	1952

All elevations are in metres above sea level on the International Great Lakes Datum (1955) as recorded at one Canadian location on each lake. These data are slightly different from those used in lake regulation purposes, where data are used from a number of Canadian and United States stations on each lake.

* Denotes a new record maximum set in 1987.

Table 6
(continued)

Great Lakes Water Levels: 1987, 1988 and Previous Recorded Maxima

(METRES)						
	Jul	Aug	Sep	Oct	Nov	Dec
<hr/>						
Superior (at Thunder Bay)						
1988	182.89	183.00	183.05	183.01	183.07	183.06
1987	183.12	183.16	183.13	183.06	183.00	182.97
Previous Record	183.53	183.52	183.54	183.53	183.50	183.40
(year)	1916	1916	1916	1985	1985	1985
Michigan-Huron (at Goderich)						
1988	176.43	176.39	176.30	176.26	176.23	176.25
1987	176.85	176.79	176.71	176.62	176.52	176.49
Previous Record	177.18	177.21	177.18	177.29	177.20	177.07
(year)	1986	1986	1986	1986	1986	1986
St. Clair (at Belle River)						
1988	175.03	174.98	174.88	174.79	174.77	174.77
1987	175.44	175.38	175.30	175.15	175.08	175.10
Previous Record	175.71	175.69	175.63	175.74	175.60	175.57
(year)	1986	1986	1986	1986	1986	1986
Erie (at Port Colborne)						
1988	174.14	174.09	173.96	173.95	173.93	173.93
1987	174.59	174.47	174.41	174.31	174.20	174.27
Previous Record	174.84	174.76	174.64	174.76	174.69	174.76
(year)	1986	1986	1986	1986	1986	1986
Ontario (at Kingston)						
1988	74.69	74.64	74.51	74.40	74.37	74.29
1987	74.75	74.57	74.44	74.35	74.26	74.37
Previous Record	75.52	75.44	75.27	75.09	75.04	75.06
(year)	1947	1947	1947	1945	1945	1945

All elevations are in metres above sea level on the International Great Lakes Datum (1955) as recorded at one Canadian location on each lake. These data are slightly different from those used in lake regulation purposes, where data are used from a number of Canadian and United States stations on each lake.

* Denotes a new record maximum set in 1987.

1987 and 83 cm below the highest ever December levels of 1986.

Lake Ontario levels throughout 1988 remained slightly below the long term average. From April to August, Lake Ontario levels were approximately 15-20 cm below average, and by December the lake was 9 cm below its long term monthly average.

3.0 EFFECTS OF GREAT LAKES WATER LEVELS

3.1 General

While a number of small storms passed over the Great Lakes Basin in 1988, prompting the Atmospheric Environment Service to issue storm watches and storm warnings, none were major in terms of severe wind speeds, duration or shoreline damages. No significant damage occurred anywhere along the Canadian Great Lakes shoreline in 1988.

3.2 Lower Water Effects

The significant decrease in water levels throughout 1987 and 1988, especially on the middle lakes, has led to a number of "low water" problems, despite the fact that these lakes are very close to their long term averages. The majority of concern has been expressed by marina operators and recreational boaters, who have suddenly observed water depths much shallower than what they had become accustomed to. While no significant "low water damages" were reported, some small craft harbours (eg. Meaford, Ontario) ran into major problems with boats running aground and there were a increased incidents of propeller and hull damage to boats.

4.0 WATER MANAGEMENT ACTIONS TAKEN RELATED TO HIGH LAKE WATER LEVELS

4.1 Lake Superior Regulation

In January of 1988 it was decided that the emergency storage accumulated on Lake Superior in 1985 be eliminated. Outflows were thus increased, and by April of 1988, all of the emergency storage had been eliminated (See Table 7). As of the elimination of the emergency storage, flows have been in accordance with Plan 1977.

Table 7A lists the Lake Superior net basin supplies and outflows for the year. Total supplies to the Lake Superior basin in 1988 have been 2% higher than average, with actual outflows averaging approximately 1850 cms, which is 15% below average and, due to the discharge of the emergency storage, 4% higher than the flows called for by Plan 1977. It is expected that outflows throughout the first part of 1989 will remain in accordance with Plan 1977.

4.2 Lake Ontario Regulation

Total water supplies to Lake Ontario in 1987 were about 15 percent higher than average with actual outflows also being about 21 percent above average (Table 8). Water supplies to Lake Ontario in 1988, were essentially average, with Lake Ontario outflows averaging approximately 7000 cms, which is 1% lower than the flows called for by Plan 1958-D and approximately 2% higher than the long term average outflows. Compared to 1987, supplies to Lake Ontario in 1988 have decreased by 13%, while outflows have decreased by 16%.

Mild, dry weather this past spring and summer, along with favourable ice conditions on the St. Lawrence River during the winter months of 1988, allowed outflows from Lake Ontario to remain close to those called for by regulation Plan 1958-D. By the end of 1988, Lake Ontario was 28 cm lower than it would have been without the benefit of regulation.

Table 7

Computed Effects of Emergency Actions Regarding

Lake Superior Regulation on Great Lakes Water Levels

	L. Superior Outflow (cms)	End of Month	End of Month Lowering Effects (m)		
	Actual Outflow	Cumulative Storage on L. Superior (m)	Huron/ Michigan	St. Clair	Erie
1987					
January	2 010	0.024	0.006	0.009	0.009
February	1 980	0.024	0.009	0.009	0.009
March	2 010	0.024	0.009	0.009	0.009
April	2 010	0.024	0.009	0.009	0.009
May	2 410	0.024	0.009	0.009	0.009
June	2 180	0.024	0.009	0.009	0.006
July	1 590	0.024	0.009	0.006	0.006
August	1 560	0.024	0.009	0.006	0.006
September	1 560	0.024	0.009	0.006	0.006
October	1 670	0.024	0.009	0.006	0.006
November	1 560	0.024	0.009	0.006	0.006
December	1 560	0.024	0.009	0.006	0.006
1988					
January	1 780	0.018	0.006	0.006	0.006
February	1 780	0.009	-0.006*	0.000	0.006
March	1 780	0.003	0.000	0.000	0.003
April	1 780	ALL EMERGENCY STORAGE ELIMINATED			

Note: No impact on Lake Ontario due to the operation of Lake Ontario's regulation plan.

All flows are in cubic metres per second. Water levels are in metres to three decimal places.

* Indicates a rise in Lake Michigan-Huron's Level.

Table 7A

Lake Superior Regulation Summary

	<u>Net Basin Supplies</u>		<u>Outflows</u>			<u>Water Levels</u>	
	(cms)		(cms)			(m)	
	1988	1900-1987 Mean	Plan 1977	1988	1900-1987 Mean	Superior	Mich.Huron
1988							
Jan	-707*	-396	1557	1756	1954	182.91	176.41
Feb	-538	311	1557	1784	1897	182.84	176.39
Mar	1869	1274	1557	1756	1869	182.79	176.35
Apr	3002	4248	1557	1756	1954	182.83	176.46
May	3625	5295	1982	1982	2124	182.86	176.49
June	2265	4474	1897	1897	2209	182.88	176.46
July	1841	3710	1557	1557	2294	182.89	176.37
Aug	6286	2832	1557	1557	2379	183.00	176.36
Sep	2180	2095	1982	1982	2379	183.06	176.27
Oct	850	1076	1897	1897	2322	183.04	176.21
Nov	4955	481	1557	1557	2294	183.09	176.22
Dec	-425	-651	2294	2293	2067	183.08	176.20

* Negative net basin supply indicates a loss of water from the basin.

Table 8
Lake Ontario Regulation Summary

	Supplies (cms)		Outflows (cms)			Levels (m)	
	1987-88	1900-80 Mean	Plan 1958-D Computed	1987-88	1900-85 Mean	Preproject levels	1987-88
1987							
Jan	8 580	6 570	6 307	8 485R	6 230	75.73	74.83
Feb	7 560	6 510	7 403	8 095	6 260	75.64	74.88
Mar	9 175	7 790	7 930	8 903R	6 540	75.61	74.80
Apr	10 250	8 580	8 693	8 860	7 020	75.76	75.00
May	8 155	7 930	8 495	9 020	7 250	75.73	74.95
Jun	8 155	7 450	8 778	8 882	7 360	75.63	74.84
Jul	7 730	6 880	8 778	8 657	7 310	75.55	74.75
Aug	6 569	6 290	8 087	8 087	7 140	75.37	74.57
Sep	7 504	6 030	7 830	7 804	6 940	75.19	74.44
Oct	6 626	6 030	7 709	7 721	6 770	75.11	74.35
Nov	6 881	6 340	7 034	7 034	6 650	75.00	74.26
Dec	8 127	6 540	7 051	7 555	6 510	75.05	74.37
1988							
Jan	6 655	6 570	6 273	6 682	6 230	75.00	74.37
Feb	7 362	6 510	7 294	7 137	6 260	74.98	74.42
Mar	7 731	7 790	7 405	7 361	6 540	74.99	74.41
Apr	8 325	8 580	7 587	7 163	7 020	75.11	74.56
May	7 816	7 930	7 233	6 760	7 250	75.12	74.69
June	6 739	7 447	7 100	7 100	7 360	75.08	74.74
July	6 626	6 881	6 870	6 870	7 310	74.94	74.69
Aug	6 145	6 286	6 954	6 954	7 140	74.83	74.64
Sep	5 890	6 032	6 873	6 873	6 940	74.70	74.51
Oct	6 116	6 032	6 764	6 764	6 770	74.58	74.40
Nov	6 994	6 343	6 989	6 989	6 650	74.58	74.37
Dec	6 173	6 541	6 878	6 974	6 510	74.57	74.29

Note: Preproject levels are those computed had there been no Lake Ontario regulation taking place.
Supplies and outflows are in cubic metres per second.
Water levels are in metres, IGLD (1955)

R Denotes new record high

As a result of the average supplies to Lake Ontario and the continuance of Plan 1958-D outflows from the lake during 1988, water levels on the St. Lawrence River between Kingston and Cornwall were higher than those that occurred in 1987. While the 1987 situation prompted numerous complaints from shore property owners and recreational boaters, particularly in the Thousand Islands to Morrisburg section of the river, very few concerns were raised in 1988.

4.3 Great Lakes Water Level Communications Centre (GLWLCC)

The Great Lakes Water Level Communications Centre in Burlington, Ontario, continued its communications activities in 1988 by issuing the monthly news release, providing information and responses to inquiries from the public and media, and by participating in meetings and municipal briefings for communities around the Great Lakes. The Centre is also providing support for the International Joint Commission Water Level Reference that is now in progress.

After issuing 7 high water level warnings and 13 high water level watches, primarily in the spring months of 1988, the Water Level Forecast Centre in Toronto decreased its monitoring of lake and weather conditions and discontinued the toll free water level forecast phone number and daily water level forecasts. Marine forecasts are still issued on a daily basis and if conditions warrant it, high water level watches and warnings may still be issued for Lake Erie.

5.0 FINDINGS AND CONCLUSIONS

Despite well below average precipitation in the first seven months of the year, total 1988 basin precipitation was slightly above the long term average. Spring and summer runoff conditions in the basin were well below average and evaporation was well above average on all lakes.

The combination of the drought conditions in the first half of the year, high lake outflows and increased evaporation, led to a continued decrease in the lake levels for the middle three lakes in 1988. Lakes Superior and Ontario, while continuing to remain below their long term averages throughout the year, exhibited relatively normal patterns of seasonal rise and fall of their levels.

It is apparent that with the return of all lakes to near average levels, the latest high water level period is over. While the drought conditions in the summer of 1988 played an important role in the decline of water levels, continued receipt of precipitation like that which has occurred in the last few months of 1988 would see all lakes rise back above their average levels. Continued receipt of near average precipitation in the coming months and year(s) will continue the trend of average water level conditions on all lakes.

6.0 FORECAST OF FUTURE WATER LEVEL CONDITIONS

The latest forecast (Figures 1-5) indicates that under the most probable water supply conditions, Great Lake water levels should remain very close to average levels over the next six months.

Extremely dry conditions over the next six months would see the levels of Lakes Superior, Huron and Erie to fall below average by February and April respectively, while Lakes St. Clair and Ontario would fall further below average.

Extremely wet conditions over the next six months would keep Lakes Superior, Huron and Erie above their long term averages throughout the forecast period, while Lake St. Clair and Ontario would rise above average in April and February respectively.