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National Oceanic and Atmospheric Administration  
National Ocean Survey

## Lake Superior Beginning -of- Month Water Levels and Monthly Rates of Storage Changes

Lake Survey  
Center

DETROIT, MICH.

February 1974

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and  
MONTHLY RATES OF STORAGE CHANGES

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## CONTENTS

Abstract . . . . .	1
Introduction . . . . .	1
Methodology . . . . .	2
Basic and Computed Data . . . . .	3
Results . . . . .	3
Effect of Gage Network Size . . . . .	3
Effect of Weighting Factors . . . . .	5
Gage Network Selection . . . . .	7
Lake Superior Beginning-of-Month Levels . . . . .	8
Rates of Change in Storage . . . . .	8
Conclusions . . . . .	8
Acknowledgements . . . . .	9
References . . . . .	9

## TABLES

Table 1.	Water Level Gages and Period of Record . . . . .	3
Table 2.	Gage Networks and Weighting Factors . . . . .	4
Table 3.	Effect of Network Size on Beginning-of-Month Levels . . . . .	5
Table 4.	Annual Mean Level Differences . . . . .	6
Table 5.	Differences of Weighted and Average Beginning-of-Month Levels . . . . .	7
Table 6.	Gage Networks Used for Lake Superior Beginning-of-Month Levels . . . . .	8
Tables 7-15.	Beginning-of-Month Water Levels for Individual Gages . . . . .	10-24
Table 16.	Lake Superior Beginning-of-Month Levels . . . . .	26
Table 17.	Lake Superior Rates of Storage Changes . . . . .	29

## FIGURES

Figure 1.	Water Level Gage Location . . . . .	32
Figures 2-6.	Polygon Networks . . . . .	33-37
Figure 7.	Plot Demonstrating the Trend of Subsidence of Duluth Relative to Thunder Bay (Port Arthur) . . . . .	38



41

42

43

44



LAKE SUPERIOR BEGINNING-OF-MONTH WATER LEVELS  
AND MONTHLY RATES OF STORAGE CHANGES

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ABSTRACT. This report describes results from a study of Lake Superior beginning-of-month levels and rates of storage changes. These are listed for the period 1900-1972 of sufficient quality for scientific and planning studies. Also it indicates that the number and distribution of water level gages in the presently existing gage network are adequate for an accurate determination of beginning-of-month water levels.

INTRODUCTION

The Thiessen polygon procedure was used to compute the beginning-of-month lake levels. This is the technique commonly used by hydrologists to obtain a weighted average (a representative basin value) of point source measurements of precipitation within a basin. It provides a better overall representative lake level than straight averaging and at the same time standardizes a procedure for computing these levels.

The beginning-of-month lake levels computed are necessary for studies of: lake hydrology, beach and shore erosion, navigation and hydro-electric power and lake regulation. The monthly rates of lake storage changes which are computed from the beginning-of-month levels are utilized in water budget studies, such as the determination of lake evaporation rates and net groundwater influx into the lakes.

Initial consideration was given to the 1950-1970 time base, since it contains a sufficient number of water level gages to analyze the effect of the gage network size on the beginning-of-month levels determination. This period is also significant as it includes the modern record high lake levels of 1952 as well as the record lows of 1964.

Results of the initial study revealed that the Thiessen polygon procedure was adequate and should be used in quantifying the data

for the years prior to 1950, i.e., for the 1900-1949 period. Further, it showed that the presently existing gage network is adequate for updating future data. Therefore, this study has quantified beginning-of-month levels and rates of lake storage changes for the period 1900-1972, as presented in the results section.

#### METHODOLOGY

The beginning-of-month water levels were computed using a water level gage network located on the periphery of the lake. Ideally, these levels should represent the instantaneous levels at the beginning of the months. Practically, however, representative instantaneous true water levels are difficult, if not impossible, to measure because of the effect of short term fluctuations in wind speed and direction and changes in barometric pressure over very small time periods. These fluctuations could cause considerable error in computing a true instantaneous level for the lake. The error is lessened by specifying that the beginning-of-month level for each gage shall be equal to the average of the daily mean water levels of the first day of the month and the last day of the previous month.

The computational procedure was set forth by Quinn (1971) and consists of applying weighting factors to each water level gage in the network. The weighting factors were computed from Thiessen polygon networks drawn from the various water level gage networks. This is expressed mathematically as

$$L_o = W_1 L_1 + W_2 L_2 + W_3 L_3 + \dots + W_n L_n$$

$$\text{for } W_1 + W_2 + W_3 + \dots + W_n = 1.0$$

where

$L_o$  is the weighted Lake Superior beginning-of-month water level,

$L_1 - L_n$  are the beginning-of-month levels at the various gage locations,

$W_1 - W_n$  are the Thiessen polygon weighting factors for gage locations 1 to n,

n is the number of water level gages in the network.

## BASIC AND COMPUTED DATA

The basic data used consist of daily mean water levels for the first and last days of the months for each operating water level gage. The gages used in the study together with their period of record is given in Table 1; locations are shown in Figure 1. The beginning-of-month water levels were computed for each gage as described and are tabulated on Tables 7-15. Occasional missing gage data were interpolated from existing gages.

Table 1. Water Level Gages and Period of Record

Gage Location	Period of Record (daily means)
Point Iroquois	1930-Date
Marquette	1891-Date
Ontonagon	1959-Date
Duluth	1885-Date
Two Harbors	1941-Date
Grand Marais	1966-Date
Thunder Bay (Port Arthur)	1912-Date
Michipicoten Harbor	1915-Date
Rosspport	1967-Date

In the initial analysis five different gage networks were developed for the 1950-1970 period to determine the optimum network size as well as to quantify a data set for this period. To obtain a quantified data set for the period 1900-1949, an additional four different gage networks were established. The Thiessen polygons shown in Figures 2-6 were drawn and weighting factors computed for each gage in the various networks. These networks with their corresponding gages and weighting factors are given in Table 2.

## RESULTS

## Effect of Gage Network Size

This analysis was based on the data for the 1950-1970 period. The effect of the gage network size was investigated by comparing beginning-of-month lake levels computed by various sized networks during corresponding time periods. The statistical parameters used in the analysis were the standard deviation about zero, the mean, and the maximum of the differences in beginning-of-month levels between two different sized networks. Additional data points were added to the 1966-1970 period to make it statistically compatible with the other periods. These additional points consisted of mid-and-monthly levels





computed using the same procedure as the beginning-of-month levels. The results are presented in Table 3.

Table 3. Effect of network size on beginning-of-month levels

Period	No. of Months	Networks Compared	Mean Dev (1) (ft)	Std. Dev (1) (ft)	Max. Dev (1) (ft)
1951-1970	240	5 gage vs 6 gage	.00	.01	-.05
1960-1970	132	6 gage vs 7 gage	.00	.01	-.09
1966-1970	120	7 gage vs 8 gage	.00	.01	-.02
1967-1970	144	8 gage vs 9 gage	.01	.01	-.06

(1) Dev = Deviation between corresponding beginning-of-month levels.

The first three comparisons presented in Table 3 indicate that no additional accuracy was obtained by increasing the network size above seven gages. However, the last comparison indicated a reversal of this trend.

There are two primary reasons for this occurrence. The first is that the Rosspport gage, the 9th gage of the network, is at a strategic location, as reflected by its polygon which covers nearly 20 percent of the total lake area. Thus its weighting factor is second only to that of the Marquette gage. The second is that the data measurements from the Rosspport gage are significantly different from the majority of the gages around the lake as shown in Table 4.

Although the analysis indicates additional study is necessary concerning the Rosspport gage, the differences between the 8 and 9 gage network results are generally within the accuracy of the gage measurements. For this reason the final results presented in this paper are those obtained using the 9-gage network.

#### Effect of Weighting Factors

Comparisons were also drawn between the beginning-of-month levels computed using the Thiessen weighting factors and those computed by assigning equal weights to each gage in the network. This comparison was developed to show the difference between the proposed procedure, Thiessen polygon weighting, and the most commonly used procedure, straight averaging. The results are given in Table 5.

Table 4. Annual mean level differences

Year	ROSSPORT VERSUS:									
	Michipicoten	Thunder Bay	Point Iroquois	Grand Marais	Ontonagon	Marquette	Two Harbors	Duluth		
1967	0.0	-.05	-.05	-.06	-.07	-.08	-.12	-.14		
1968	+.06	-.08	-.06	-.08	-.10	-.11	-.14	-.17		
1969	+.03	-.12	-.10	-.09	-.14	-.13	-.16	-.19		
1970	+.06	-.19	-.10	-.11	-.18	-.14	-.18	-.21		
1971	+.03	-.07	-.09	-.11	-.07	-.15	-.18	-.21		
1972	-.03	-.10	-.18	-.19	-.16	-.22	-.25	-.29		
1967-1972 Mean	+.02	-.10	-.10	-.11	-.12	-.14	-.17	-.20		

Table 5. Differences of weighted and average beginning-of-month levels

Network Size Gages	No. of Months	Mean Dev (1) (ft)	Std. Dev (1) (ft)	Max. Dev (1) (ft)
5	252	-.01	.03	-.13
6	240	-.01	.02	-.09
7	132	-.02	.02	-.10
8	120	-.02	.03	-.10
9	144	-.02	.03	-.09

(1) Dev = Weighted Beginning-of-Month Level - Average Beginning-of-Month Level

Table 5 shows that there is a significant difference in the two procedures for Lake Superior. The large maximum differences are attributed to wind set-up and seiches. These differences indicate that the selection of weighting factors has a large effect upon the lake level computations during periods of wind stress and seiches.

#### Gage Network Selection

Due to the limited number of gages available, their distribution around the lake and the constant shifting of the gages for the 1900-1949 period, this period could not be afforded the same analysis as the 1950-1970 period. Although all of the gages were found to be shifting, some were worse than others. The Duluth gage appears to have undergone the greatest change and has demonstrated a definite trend over the years as evidenced by Figure 7. The most stable of the gages in the very early period was Marquette.

In the selection of the gage networks careful attention was paid to the distribution around the lake. For instance, only Marquette was used for the 1900-1914 period because of Duluth's great amount of subsidence and its relative location, i.e., it did not represent a balanced condition. In 1915 when Thunder Bay (Port Arthur) records became available the two-gage network was developed, since Thunder Bay (Port Arthur) appeared to be relatively stable and its location across the lake from Marquette created a somewhat balanced condition. In 1918 the Duluth and Michipicoten gages were added simultaneously, creating a balanced 4-gage network. Gage networks for the period 1931-1972 were formed by adding additional gages as they became available.

### Lake Superior Beginning-of-Month Levels

The beginning-of-month Lake Superior levels are presented in Table 16. They were computed using the gage networks given in Table 6.

Table 6. Gage networks used for Lake Superior beginning-of-month levels

Period	No. of Gages in Network
1900-1914	1
1915-1917	2
1918-1930	4
1931-1941	5(A)
1942-1944	6
1945-1950	5
1951-1959	6
1960-1965	7
1966	8
1967-1972	9

NOTE: (A) is used to distinguish between two different 5-gage networks. Refer to Figures 3 and 4.

### Rate of Storage Changes

The monthly storage changes were computed by multiplying the difference between two consecutive beginning-of-month levels by the area of Lake Superior, 31,700 square miles. The changes were then converted into monthly rates by dividing by the number of seconds in each month. These rates are given in thousands of cubic feet per second (TCFS) in Table 17. The accuracy of the rates expressed in TCFS compare with that of the beginning-of-month levels from which they were derived.

### CONCLUSIONS

This study shows that the present gage network is adequate for both scientific and planning studies and that little additional accuracy was gained by increasing the network size above seven gages. However, the additional gages may be necessary for studies relating to lake dynamics. It further indicates that additional investigation is desirable to clarify the Rossport gage discrepancy.

The method of computation, i.e., weighted or averaged, was found to have a larger effect on the beginning-of-month levels than the number of gages in the network. Therefore, the weighting factors should be carefully selected using the Thiessen polygon procedure.

Based on this study it is recommended that the beginning-of-month levels and rates of storage changes presented in Tables 16 and 17 be used for scientific studies of Lake Superior and that these data be updated on a yearly basis using the Thiessen polygon procedure.

#### ACKNOWLEDGEMENTS

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#### REFERENCES

Quinn, F. H. 1971. Quantitative Mathematical Models for Great Lakes Research. Ph. D. Dissertation, University of Michigan, Ann Arbor, Mich.

TABLE 7

## BEGINNING OF MONTH LEVELS AT POINT IRONMIBIS (FELD 1955)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1931	600.82	600.23	600.03	599.70	599.72	599.99	600.26	600.42	600.47	600.51	600.71	600.93
1932	600.26	600.68	600.42	600.19	600.28	600.55	600.76	601.03	601.27	601.06	600.70	600.36
1933	600.36	600.17	600.15	599.95	600.29	600.79	600.98	601.05	600.92	601.22	600.88	601.13
1934	600.85	600.62	600.20	600.27	600.35	600.76	601.02	601.04	600.78	601.08	601.28	601.09
1935	600.52	600.62	600.43	600.52	600.77	600.69	600.99	601.37	601.46	601.30	600.98	600.98
1936	600.46	600.60	600.21	600.43	600.45	601.13	601.16	601.04	601.07	601.01	600.62	600.27
1937	600.48	600.63	600.27	599.92	600.17	600.83	600.93	601.12	601.16	601.05	600.94	601.23
1938	600.31	600.66	600.46	600.68	601.02	601.22	601.57	601.50	601.62	601.36	600.84	600.96
1939	600.94	600.42	600.65	600.56	600.62	601.00	601.66	601.61	601.59	601.35	601.11	600.59
1940	600.71	600.12	599.86	599.88	599.93	600.41	600.99	600.98	601.00	600.89	600.52	600.77
1941	600.28	600.18	599.84	599.66	600.17	600.42	600.75	600.94	601.06	601.36	601.49	601.17
1942	601.04	600.76	600.44	600.42	600.37	600.98	601.19	601.25	601.21	601.21	601.33	601.36
1943	601.03	600.98	600.84	600.66	600.90	601.12	601.85	601.77	601.73	601.51	601.06	600.92
1944	600.46	600.51	600.05	600.07	599.89	600.56	601.23	601.52	601.50	601.65	601.26	601.02
1945	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1946	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1947	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1948	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1949	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1950	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1951	601.03	601.05	600.89	601.00	601.21	601.63	601.83	601.86	601.85	601.93	602.21	601.59
1952	601.40	601.16	600.97	600.71	601.08	601.12	601.42	601.95	601.87	601.75	601.17	600.79
1953	600.51	600.61	600.20	600.21	600.26	600.88	601.26	601.46	601.45	601.30	600.91	600.53
1954	600.55	600.12	600.21	599.87	600.21	600.88	601.24	601.14	601.03	600.92	600.54	600.61
1955	600.00	599.79	599.67	599.63	600.00	600.29	600.36	600.59	600.97	600.85	600.69	600.73
1956	600.39	600.22	599.81	599.45	599.71	600.35	600.37	600.75	600.66	600.63	600.44	600.31
1957	600.43	599.84	599.59	599.49	599.92	600.20	600.68	600.75	600.63	600.63	600.42	600.75
1958	600.37	600.14	599.80	599.57	599.77	599.91	600.06	600.42	600.80	600.99	600.68	600.69
1959	600.17	600.16	599.84	599.76	599.81	600.36	600.67	600.79	601.15	601.37	601.40	600.80
1960	600.39	600.31	600.02	599.76	600.35	600.81	601.05	600.94	600.94	600.68	600.43	600.80

NOTE: Zeros Indicate Missing Data



TABLE 7 (CONTINUED)

BEGINNING OF MONTH LEVELS AT POINT IRROQUOIS (IGLD 1955)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1961	600.03	599.83	599.68	599.86	599.96	600.15	600.31	600.45	600.40	600.64	600.68	600.26
1962	600.36	599.80	599.96	599.78	599.83	600.32	600.38	600.51	600.70	600.73	600.62	600.11
1963	599.82	600.06	599.50	599.42	599.92	599.94	600.43	600.59	600.59	600.53	600.60	600.54
1964	599.68	599.89	599.54	599.32	599.68	600.41	600.80	600.85	600.95	600.74	600.63	600.57
1965	600.13	600.10	599.62	599.65	599.91	600.34	600.47	600.55	600.50	600.62	600.79	600.64
1966	600.52	600.35	600.04	600.06	600.27	600.73	600.76	600.86	600.93	600.87	600.88	600.81
1967	600.25	600.18	599.92	599.85	600.26	600.52	600.79	600.81	600.98	600.58	600.58	600.28
1968	601.24	599.80	599.69	599.81	600.22	600.39	600.90	601.51	601.52	601.79	601.57	601.17
1969	601.38	601.07	600.77	600.56	600.72	600.86	601.11	601.08	601.11	600.79	600.64	600.67
1970	600.14	600.08	599.85	599.78	600.09	600.68	600.86	601.23	601.17	601.15	601.17	600.99
1971	600.71	600.67	600.65	600.38	600.86	601.24	601.50	601.40	601.27	601.09	601.30	601.14
1972	600.79	600.73	600.54	600.57	600.71	601.06	601.06	601.28	601.54	601.55	601.14	601.14



TABLE 8  
BEGINNING OF MONTH LEVELS AT MARQUETTE (IGLD 1955)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1900	601.01	600.72	600.47	600.23	600.35	600.49	600.44	600.83	601.20	601.76	601.70	601.43
1901	601.06	600.69	600.52	600.32	600.53	600.70	600.87	601.38	601.32	601.19	601.21	600.98
1902	600.70	600.39	600.25	600.18	600.29	600.53	600.86	601.00	600.98	601.05	600.94	600.85
1903	600.54	600.39	600.34	600.11	600.49	600.98	601.09	601.40	601.41	601.53	601.48	601.25
1904	600.89	600.55	600.44	600.35	600.30	600.76	601.00	601.01	601.08	601.33	601.36	601.08
1905	600.69	600.36	600.14	600.22	600.41	600.73	600.95	601.11	601.25	601.47	601.30	601.23
1906	600.97	600.82	600.34	600.22	600.45	600.72	601.10	601.05	601.06	601.00	600.75	600.79
1907	600.50	600.24	600.04	600.06	599.98	600.51	600.79	600.94	601.26	601.29	601.06	600.93
1908	600.43	600.09	599.81	599.76	599.92	600.55	600.86	601.05	600.90	600.89	600.55	600.27
1909	599.98	599.60	599.44	599.42	599.54	600.03	600.16	600.52	600.63	600.54	600.33	600.33
1910	600.19	599.92	599.73	599.59	599.83	600.04	600.07	600.07	600.07	600.13	599.89	599.65
1911	599.37	598.95	598.85	598.75	598.86	599.24	599.55	600.09	600.25	600.28	600.30	600.05
1912	600.03	599.72	599.66	599.49	599.74	600.12	600.42	600.61	600.66	600.79	600.79	600.42
1913	600.09	600.02	599.64	599.74	599.97	600.40	600.58	600.85	600.93	601.00	601.00	600.97
1914	600.50	600.44	600.34	599.96	600.22	600.50	600.71	600.82	600.90	600.90	600.71	600.40
1915	599.99	599.95	599.66	599.44	599.61	599.78	600.26	600.43	600.37	600.68	600.82	600.56
1916	600.69	600.65	600.37	600.24	600.86	601.30	601.70	601.75	601.79	601.75	601.74	601.38
1917	601.27	600.77	600.43	600.43	600.46	600.58	600.77	600.80	600.84	600.86	600.67	600.47
1918	600.07	599.84	599.72	599.46	599.64	600.06	600.37	600.40	600.63	600.48	600.64	600.41
1919	600.57	600.30	600.21	600.00	600.25	600.43	600.57	600.69	600.69	600.55	600.45	600.66
1920	600.37	599.97	599.96	600.12	600.42	600.68	600.85	601.10	600.97	600.84	600.70	600.29
1921	600.16	599.48	599.67	599.70	600.18	600.32	600.57	600.79	600.68	600.77	600.47	600.09
1922	599.98	599.54	599.45	599.30	599.72	600.15	600.40	600.70	600.68	600.74	600.39	600.20
1923	600.03	599.94	599.54	599.44	599.57	599.71	599.86	600.06	600.14	600.15	600.08	599.90
1924	599.83	599.54	599.21	599.04	599.27	599.29	599.42	599.58	599.93	599.94	599.90	599.71
1925	599.36	599.11	599.01	598.81	599.04	599.15	599.38	599.61	599.60	599.51	599.22	598.93
1926	598.69	598.50	598.35	598.21	598.21	598.50	598.79	599.08	599.24	599.61	599.86	599.96
1927	599.69	599.52	599.37	599.46	599.69	600.28	600.58	600.97	600.79	600.80	600.70	600.57
1928	600.59	600.07	599.88	599.70	600.03	600.39	600.78	601.03	601.28	601.36	601.54	601.15
1929	600.88	600.61	600.55	600.66	600.67	600.75	600.82	601.07	600.90	600.93	600.87	600.85

TABLE 8 (CONTINUED)  
 BEGINNING OF MONTH LEVELS AT MARQUETTE (IGLD 1955)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1930	600.51	600.25	600.20	600.02	600.11	600.45	600.96	601.16	600.90	600.85	600.74	600.77
1931	600.43	600.12	599.69	599.59	599.67	599.32	600.25	600.40	600.40	600.42	600.61	600.71
1932	600.37	600.30	600.25	600.04	600.10	600.48	600.67	600.98	601.10	600.87	600.60	600.38
1933	600.23	600.16	600.10	599.82	600.29	600.70	600.92	601.01	600.90	601.04	600.92	600.83
1934	600.63	600.45	600.21	600.22	600.36	600.87	600.93	600.99	600.84	601.06	601.09	601.14
1935	600.76	600.56	600.34	600.41	600.59	600.66	600.93	601.25	601.23	601.11	600.94	600.85
1936	600.44	600.35	600.10	600.26	600.43	601.02	601.15	600.97	600.96	600.91	600.65	600.26
1937	600.13	600.15	600.10	599.88	600.23	600.76	600.78	601.02	601.13	601.06	600.94	600.94
1938	600.64	600.50	600.34	600.45	600.62	601.27	601.56	601.47	601.53	601.26	600.92	600.89
1939	600.71	600.54	600.63	600.44	600.62	601.06	601.50	601.53	601.50	601.24	601.02	600.65
1940	600.60	600.20	599.85	599.71	599.93	600.35	600.64	600.94	600.89	600.85	600.57	600.62
1941	600.33	600.12	599.82	599.61	600.14	600.43	600.70	600.83	600.94	601.28	601.50	601.12
1942	600.92	600.77	600.39	600.39	600.55	601.01	601.08	601.14	601.25	601.17	601.26	601.26
1943	601.02	600.89	600.74	600.65	600.76	601.23	601.80	601.81	601.75	601.47	601.14	600.87
1944	600.46	600.28	599.93	599.96	600.00	600.56	601.22	601.59	601.62	601.69	601.21	601.35
1945	600.88	600.54	600.36	600.65	600.94	600.97	601.10	601.26	601.47	601.33	601.16	600.92
1946	600.25	600.55	600.36	600.38	600.53	600.82	601.09	601.16	601.25	601.24	601.28	601.19
1947	600.41	600.27	600.41	600.10	600.51	600.98	601.62	601.61	601.56	601.54	601.18	600.79
1948	600.54	600.27	599.55	599.85	600.44	600.53	600.61	600.82	600.85	600.85	600.55	600.50
1949	600.38	600.22	600.24	599.89	600.05	600.48	600.83	601.23	601.21	601.05	601.10	600.99
1950	600.61	600.56	600.42	600.28	600.48	601.39	601.82	602.01	601.96	601.84	601.84	601.60
1951	601.17	600.98	601.02	600.98	601.38	601.62	601.80	601.82	601.97	601.91	601.95	601.58
1952	601.37	601.15	600.90	600.75	601.11	601.11	601.50	601.93	601.92	601.68	601.09	600.74
1953	600.48	600.38	600.25	600.14	600.34	600.88	601.21	601.44	601.63	601.23	600.91	600.56
1954	600.37	600.14	600.08	599.78	600.23	600.65	601.19	601.19	601.03	600.88	600.64	600.52
1955	600.11	600.00	599.72	599.63	600.07	600.30	600.41	600.54	600.75	600.74	600.77	600.60
1956	600.40	600.15	599.87	599.59	599.70	600.20	600.40	600.76	600.75	600.69	600.46	600.25
1957	600.27	599.61	599.58	599.53	599.94	600.21	600.57	600.82	600.71	600.75	600.46	600.45
1958	600.01	600.07	599.83	599.58	599.82	599.44	600.20	600.51	600.73	600.60	600.60	600.54
1959	600.22	600.05	599.84	599.76	599.90	600.43	600.69	600.78	601.18	601.40	601.24	600.78

TABLE 8 (CONTINUED)

## BEGINNING OF MONTH LEVELS AT MARQUETTE (IGLD 1985)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1960	600.49	600.36	600.08	599.99	600.42	600.96	601.06	601.07	601.63	600.74	600.60	600.72
1961	600.18	599.93	599.78	599.82	600.00	600.30	600.42	600.51	600.47	600.65	600.56	600.35
1962	600.20	599.97	599.62	599.59	599.67	600.25	600.43	600.49	600.69	600.75	600.57	600.21
1963	599.93	599.61	599.54	599.54	599.95	600.09	600.52	600.62	600.70	600.61	600.62	600.41
1964	599.63	599.30	599.53	599.38	599.83	600.42	600.76	600.82	600.94	600.90	600.75	600.61
1965	600.25	600.02	599.71	599.69	599.93	600.43	600.57	600.68	600.60	600.71	600.69	600.56
1966	600.44	600.25	599.96	600.07	600.34	600.61	600.74	600.86	600.99	600.87	600.78	600.57
1967	600.34	600.14	599.95	599.90	600.38	600.53	600.84	600.89	600.96	600.67	600.63	600.42
1968	600.25	600.00	599.73	599.75	600.17	600.49	601.14	601.55	601.69	601.80	601.67	601.16
1969	601.02	601.02	600.79	600.52	600.85	601.06	601.15	601.16	601.15	600.86	600.75	600.63
1970	600.29	600.04	599.83	599.73	600.12	600.77	601.00	601.31	601.17	601.21	601.31	601.25
1971	600.97	600.80	600.81	600.63	600.91	601.32	601.56	601.54	601.48	601.33	601.28	601.23
1972	600.77	600.73	600.61	600.57	600.75	601.11	601.17	601.38	601.64	601.61	601.28	601.09

TABLE 9

## BEGINNING OF MONTH LEVELS AT ONTONAGON (IGLO 1955)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1960	600.49	600.28	599.92	599.96	600.55	601.04	601.05	601.08	601.01	600.80	600.69	600.60
1961	600.12	599.82	599.74	599.79	599.96	600.23	600.50	600.48	600.51	600.51	600.58	600.60
1962	600.09	599.79	599.62	599.71	599.82	600.25	600.43	600.52	600.72	600.71	600.47	600.27
1963	600.08	599.73	599.59	600.25	600.00	600.15	600.63	600.60	600.71	600.69	600.59	600.23
1964	599.87	599.81	599.55	599.40	599.91	600.41	600.79	600.81	600.93	601.05	600.81	600.52
1965	600.43	599.87	599.82	599.77	599.91	600.50	600.59	600.63	600.62	600.74	600.63	600.51
1966	600.41	600.17	599.96	600.00	600.15	600.51	600.73	600.79	600.95	600.71	600.64	600.60
1967	600.31	600.17	600.00	599.91	600.47	600.46	600.81	600.92	600.83	600.67	600.65	600.48
1968	600.29	600.00	599.63	599.63	600.22	600.46	601.05	601.57	601.65	601.76	601.77	601.26
1969	600.85	600.88	600.94	600.68	600.96	601.15	601.15	601.16	601.18	600.88	600.78	600.60
1970	600.23	600.11	599.85	599.79	600.10	600.56	601.03	601.33	601.20	601.27	601.35	601.28
1971	600.93	600.62	600.40	600.73	600.90	601.38	601.48	601.55	601.49	601.44	601.25	601.07
1972	600.57	600.29	600.69	600.62	600.71	601.20	601.18	601.36	601.59	601.61	601.26	600.98



TABLE 10

## BEGINNING OF 16-MONTH LEVELS AT DULUTH (IGLD 1955)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1900	600.40	600.24	600.27	599.97	600.09	600.34	600.43	600.64	601.15	601.70	601.46	601.19
1901	600.54	600.37	600.13	600.11	600.44	600.40	600.93	601.10	601.03	600.82	600.74	600.56
1902	600.33	600.04	600.16	599.69	600.23	600.44	600.69	600.85	600.71	600.76	600.77	600.59
1903	600.29	600.33	599.69	600.01	600.10	600.95	600.94	601.14	601.16	601.31	601.16	600.90
1904	600.40	600.18	600.14	600.09	600.10	600.63	600.70	600.76	601.04	600.92	601.35	600.78
1905	600.47	599.69	600.03	600.35	600.19	600.52	600.90	601.14	601.34	601.38	600.97	601.07
1906	600.62	600.33	600.47	600.04	600.54	600.53	600.88	600.98	600.92	600.89	600.68	600.21
1907	600.23	600.09	600.02	599.98	599.93	600.43	600.65	600.63	601.00	601.24	601.02	600.58
1908	599.97	599.78	599.91	599.63	599.68	600.28	600.72	600.87	600.63	600.64	600.41	599.78
1909	599.45	599.30	599.35	599.20	599.49	599.97	599.93	600.49	600.52	600.31	600.39	600.36
1910	599.82	599.83	599.56	599.35	599.62	599.70	599.77	599.99	600.04	599.80	599.63	599.66
1911	599.03	599.14	598.75	598.49	598.62	598.90	599.50	599.97	600.15	600.31	600.01	599.74
1912	599.75	599.39	599.23	599.30	599.84	600.11	600.48	600.33	600.74	600.51	600.34	600.43
1913	599.95	599.40	599.29	599.37	599.85	600.17	600.15	600.51	600.82	600.87	600.60	600.81
1914	600.53	600.12	599.70	599.77	600.10	600.40	600.48	600.65	600.77	600.85	600.42	600.17
1915	595.61	599.74	599.42	599.17	599.34	599.69	600.11	600.39	600.26	600.66	600.24	600.61
1916	600.70	600.15	600.14	600.05	600.87	601.33	601.63	601.63	601.55	601.84	601.40	600.87
1917	600.68	600.23	600.10	600.12	600.10	600.36	600.51	600.59	600.67	600.68	600.33	600.16
1918	600.01	599.54	599.53	599.30	599.30	599.72	600.07	600.45	600.36	600.24	600.27	600.41
1919	600.26	600.04	599.87	599.80	600.22	600.35	600.56	600.47	600.43	600.69	600.11	600.12
1920	595.85	600.03	599.73	600.32	600.23	600.57	600.99	600.82	600.95	600.76	600.76	600.15
1921	600.21	599.88	599.63	599.42	599.96	600.42	600.62	600.63	600.72	600.36	600.32	600.05
1922	599.54	599.70	599.09	599.19	599.67	600.05	600.61	600.48	600.88	600.53	600.69	599.75
1923	599.69	599.54	599.32	599.38	599.58	599.63	599.69	599.97	600.15	600.06	599.90	599.88
1924	599.43	599.39	599.07	598.91	599.08	599.19	599.23	599.64	599.69	599.94	599.37	599.52
1925	599.15	598.66	598.72	598.91	598.83	599.13	599.35	599.47	599.51	599.73	599.09	598.86
1926	598.55	598.53	598.09	598.03	598.08	598.13	598.72	599.02	599.34	599.66	599.16	599.71
1927	599.60	599.18	599.17	599.46	599.35	600.28	600.40	600.60	600.73	600.60	600.61	600.36
1928	599.98	599.83	599.48	599.66	599.77	600.13	600.71	601.04	601.11	601.29	601.37	601.06
1929	600.65	600.33	600.38	600.53	600.67	600.60	600.74	600.88	600.85	600.88	600.65	600.51

TABLE 10 (CONTINUED)  
 BEGINNING OF MONTH LEVELS AT DULUTH (IGLD 1955)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1930	600.42	600.16	600.14	599.77	600.22	600.34	600.67	600.95	600.95	600.68	600.60	600.28
1931	600.00	599.90	599.57	599.53	599.54	600.00	600.10	600.57	600.23	600.22	600.36	600.27
1932	600.69	600.12	600.02	599.71	599.95	600.59	600.52	600.32	600.34	600.60	600.60	600.51
1933	600.66	599.73	600.16	599.70	599.84	600.69	600.84	600.85	601.00	600.73	601.08	600.39
1934	600.59	600.26	600.27	600.20	600.44	600.78	600.87	601.32	600.91	601.00	600.82	601.14
1935	600.56	600.37	600.23	600.36	600.71	600.75	601.06	601.26	601.17	600.73	600.81	600.53
1936	600.52	600.05	600.24	600.31	600.54	601.00	601.10	600.99	600.77	600.69	600.82	600.39
1937	599.63	599.62	599.76	599.78	600.34	600.62	600.63	601.21	601.22	601.10	601.05	600.74
1938	600.91	600.24	600.10	599.71	600.89	601.16	601.60	601.47	601.34	601.25	601.22	600.80
1939	600.40	600.97	600.23	600.25	600.68	601.14	601.29	601.60	601.50	601.16	600.78	600.64
1940	599.92	600.04	599.93	599.44	599.64	600.30	600.68	601.05	600.83	600.76	600.68	600.37
1941	600.43	599.90	599.78	599.63	600.11	600.27	600.56	600.78	600.83	601.23	601.41	600.95
1942	600.63	600.45	600.20	600.22	600.68	600.99	600.67	601.21	601.23	601.21	601.11	601.16
1943	601.09	601.60	600.46	600.42	600.61	601.35	601.68	601.67	601.60	601.33	601.31	600.78
1944	600.46	599.69	599.94	599.63	600.21	600.69	601.14	601.54	601.62	601.78	601.28	600.97
1945	600.42	600.23	600.33	600.71	600.60	601.40	600.98	601.24	601.60	601.35	601.11	600.98
1946	600.46	600.26	600.37	600.61	600.68	601.75	601.04	601.26	600.52	601.20	601.24	601.02
1947	600.69	600.48	600.22	600.21	600.76	600.90	601.55	601.54	601.40	601.39	601.16	600.74
1948	600.58	600.03	599.92	599.72	600.46	600.43	600.61	600.61	600.97	600.80	600.50	600.45
1949	600.68	600.08	599.94	600.03	600.23	600.58	600.88	601.16	601.00	601.10	600.92	600.60
1950	600.66	600.39	599.90	600.33	600.56	601.40	601.75	602.07	601.97	601.93	601.77	601.43
1951	601.32	600.73	601.02	600.89	601.65	601.58	601.76	601.75	602.16	601.98	601.66	601.61
1952	601.29	601.05	600.80	600.68	601.10	601.04	601.50	601.87	601.85	601.42	600.95	600.72
1953	600.27	599.98	600.08	600.12	600.81	600.48	601.34	601.58	601.43	601.13	600.84	600.58
1954	600.60	599.76	599.87	599.63	600.34	600.91	601.14	601.10	600.96	600.81	600.63	600.35
1955	600.13	599.88	599.66	599.63	600.13	600.43	600.45	600.69	600.61	600.64	600.70	600.61
1956	600.40	600.03	599.63	599.78	599.79	600.05	600.42	600.73	600.62	600.72	600.57	600.23
1957	599.78	599.62	599.50	599.58	600.01	600.12	600.55	600.83	600.92	600.63	600.59	600.33
1958	600.11	599.70	599.61	599.76	599.67	600.91	600.31	600.49	600.65	600.49	600.60	600.46
1959	600.30	599.85	599.61	599.72	600.00	600.48	600.61	600.73	601.33	601.39	601.05	600.86

TABLE 10 (CONTINUED)  
 BEGINNING OF MONTH LEVELS AT JULUTH (IGLD 1955)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1960	600.60	600.30	599.99	600.07	600.36	601.08	601.04	601.05	601.08	600.88	600.49	600.21
1961	600.20	599.91	599.83	599.68	599.87	600.35	600.54	600.66	600.56	600.46	600.50	600.53
1962	600.02	599.81	599.67	599.77	599.84	600.23	600.51	600.47	600.74	600.85	600.48	600.37
1963	600.08	599.78	599.64	599.89	599.97	600.31	600.58	600.63	600.70	600.72	600.32	600.19
1964	599.88	599.84	599.53	599.49	600.03	600.43	600.82	601.07	601.04	601.25	601.00	600.58
1965	600.50	599.87	600.11	599.92	600.05	600.65	600.64	600.67	600.64	600.79	600.60	600.45
1966	600.41	600.12	599.97	600.16	600.31	600.70	600.93	600.94	601.14	600.67	600.58	600.14
1967	600.37	600.10	600.09	600.02	600.91	600.61	600.89	601.05	600.95	600.84	600.72	600.60
1968	600.13	600.13	599.65	599.60	600.31	600.57	601.13	601.55	601.74	601.77	601.83	601.36
1969	600.82	601.10	600.92	600.65	601.13	601.26	601.15	601.08	601.17	601.03	600.92	600.50
1970	600.44	600.03	599.96	599.77	600.12	600.84	601.11	601.32	601.22	601.28	601.59	601.54
1971	601.17	600.54	600.49	600.88	601.02	601.56	601.61	601.59	601.76	601.63	601.20	601.23
1972	600.82	600.77	600.77	600.67	601.11	601.20	601.18	601.45	601.64	601.71	601.43	601.00

TABLE 11

## BEGINNING OF MONTH LEVELS AT TWO HARBORS (IGLO 1955)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1942	600.79	600.46	600.32	600.30	600.60	601.04	600.93	601.18	601.22	601.18	601.18	601.18
1943	601.14	600.58	600.48	600.44	600.61	601.30	601.76	601.74	601.72	601.36	601.28	600.87
1944	600.50	600.02	599.96	599.78	600.17	600.61	601.19	601.54	601.68	601.68	601.24	601.00
1945	600.55	600.35	600.31	600.65	600.82	601.18	601.15	601.38	601.44	601.41	601.13	600.98
1946	600.66	600.52	600.34	600.62	600.65	600.94	600.96	601.24	600.98	601.23	601.27	601.02
1947	600.80	600.49	600.30	600.22	600.62	600.98	601.57	601.56	601.56	601.40	601.20	600.70
1948	600.58	600.08	599.93	599.90	600.44	600.48	600.57	600.58	601.05	600.76	600.55	600.47
1949	600.32	600.09	599.96	600.00	600.24	600.56	600.84	601.16	600.99	601.10	601.02	600.72
1950	600.69	600.38	599.97	600.29	600.58	601.50	601.85	602.10	602.00	601.95	601.80	601.49
1951	601.29	600.79	601.06	600.93	601.59	601.60	601.81	601.81	602.01	602.02	601.75	601.63
1952	601.34	601.08	600.88	600.73	601.12	601.08	601.49	601.95	602.00	601.53	601.04	600.76
1953	600.37	600.08	600.14	600.12	600.59	600.82	601.27	601.51	601.47	601.19	600.84	600.60
1954	600.27	599.95	599.91	599.64	600.27	600.60	601.12	601.14	600.95	600.81	600.67	600.37
1955	600.14	599.90	599.70	599.65	600.15	600.39	600.46	600.65	600.63	600.65	600.76	600.58
1956	600.41	600.07	599.84	599.73	599.74	600.10	600.43	600.73	600.83	600.74	600.55	600.28
1957	599.84	599.69	599.59	599.65	599.93	600.17	600.57	600.84	600.90	600.67	600.57	600.38
1958	600.16	599.91	599.82	599.73	599.71	599.87	600.23	600.46	600.66	600.56	600.68	600.50
1959	600.30	599.84	600.00	599.72	600.06	600.46	600.66	600.72	601.30	601.40	601.09	600.92
1960	600.61	600.33	600.05	600.05	600.37	601.08	601.04	601.06	601.08	600.89	600.54	600.28
1961	600.21	599.93	599.86	599.70	599.90	600.36	600.52	600.63	600.57	600.49	600.52	600.54
1962	600.06	599.84	599.71	599.75	599.85	600.26	600.49	600.48	600.72	600.82	600.50	600.37
1963	600.07	599.78	599.64	599.63	599.97	600.26	600.56	600.63	600.72	600.75	600.37	600.22
1964	599.93	599.86	599.56	599.49	599.98	600.45	600.81	601.06	601.02	601.21	600.98	600.63
1965	600.51	599.35	600.18	599.91	600.05	600.62	600.68	600.68	600.68	600.77	600.61	600.49
1966	600.42	600.11	599.95	600.13	600.31	600.68	600.88	600.89	601.10	600.68	600.59	600.18
1967	600.38	600.12	600.08	600.00	600.73	600.60	600.89	601.00	600.94	600.83	600.75	600.60
1968	600.17	600.10	599.65	599.65	600.28	600.56	601.13	601.54	601.73	601.75	601.80	601.34
1969	600.65	601.10	600.90	600.61	601.08	601.22	601.14	601.06	601.14	600.97	600.87	600.50
1970	600.40	600.00	599.93	599.73	600.05	600.79	601.08	601.30	601.19	601.26	601.57	601.50
1971	601.15	600.56	600.53	600.85	600.99	601.47	601.56	601.58	601.68	601.58	601.17	601.22
1972	600.84	600.74	600.72	600.64	601.03	601.18	601.15	601.39	601.63	601.67	601.39	600.97



TABLE 12  
 BEGINNING OF MONTH LEVELS AT GRAND MARAIS (IGLD 1955)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1966	600.42	600.08	599.99	600.10	600.25	600.60	600.82	600.81	601.02	600.67	600.57	600.26
1967	600.31	600.09	600.01	599.97	600.54	600.49	600.87	600.91	600.89	600.74	600.71	600.52
1968	600.13	599.97	599.62	599.64	600.20	600.50	601.08	601.52	601.64	601.71	601.82	601.27
1969	600.94	601.06	600.82	600.53	600.96	601.13	601.12	601.02	601.04	600.84	600.77	600.46
1970	600.31	600.02	599.85	599.70	600.04	600.70	600.97	601.24	601.13	601.19	601.47	601.46
1971	601.10	600.56	600.55	600.78	600.91	601.33	601.50	601.53	601.52	601.44	601.24	601.16
1972	600.51	600.69	600.59	600.61	600.88	601.15	601.09	601.28	601.59	601.59	601.27	600.96

TABLE 13

## BEGINNING OF MONTH LEVELS AT THUNDER BAY (IGLD 1955)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1915	600.20	600.03	599.95	599.57	599.71	600.10	600.61	600.71	600.77	601.01	601.03	601.03
1916	600.95	600.78	600.62	600.49	601.04	601.66	602.09	602.14	601.98	602.22	601.86	601.53
1917	601.29	600.77	600.76	600.68	600.53	600.74	601.03	601.07	601.14	600.99	600.81	600.50
1918	600.28	600.06	599.97	599.87	599.88	600.36	600.50	600.67	600.74	600.70	600.70	600.76
1919	600.57	600.34	600.10	600.14	600.40	600.74	600.93	600.88	600.84	600.90	600.53	600.56
1920	600.34	600.30	600.13	600.40	600.62	600.85	601.16	601.25	601.15	600.97	600.74	600.52
1921	600.54	600.14	599.96	599.95	600.24	600.78	600.89	600.92	600.93	600.82	600.71	600.35
1922	599.77	599.72	599.56	599.46	599.93	600.45	600.63	600.92	600.98	600.92	600.64	600.40
1923	600.09	599.86	599.72	599.63	599.72	599.93	600.18	600.39	600.35	600.34	600.37	600.21
1924	599.83	599.66	599.43	599.25	599.50	599.60	599.66	599.90	600.15	600.16	600.09	599.79
1925	599.45	599.14	599.08	599.02	599.12	599.37	599.66	599.73	599.76	599.87	599.41	599.12
1926	598.82	598.49	598.39	598.29	598.39	598.56	598.92	599.29	599.40	599.85	599.78	599.79
1927	599.63	599.52	599.42	599.54	599.84	600.43	600.78	601.02	600.97	600.87	600.82	600.43
1928	600.19	600.13	599.94	599.91	600.16	600.55	600.99	601.26	601.48	601.61	601.60	601.28
1929	600.77	600.65	600.63	600.71	600.78	600.89	601.00	601.11	601.05	601.12	601.12	600.66
1930	600.07	600.36	600.33	600.16	600.33	600.70	601.08	601.25	601.07	600.94	600.85	600.51
1931	600.29	600.13	599.87	599.70	599.86	600.14	600.45	600.54	600.52	600.68	600.63	600.62
1932	600.47	600.28	600.17	600.05	600.25	600.72	600.83	601.14	601.32	600.97	600.80	600.65
1933	600.40	600.14	600.04	600.01	600.37	600.53	601.07	601.12	601.04	601.10	601.05	600.78
1934	600.49	600.47	600.46	600.31	600.51	600.95	601.15	601.11	601.05	601.29	601.11	601.13
1935	600.82	600.76	600.53	600.57	600.67	600.67	601.16	601.35	601.28	601.10	601.08	600.67
1936	600.54	600.38	600.32	600.38	600.50	601.16	601.24	601.17	601.14	601.03	600.71	600.51
1937	600.18	600.02	600.19	600.00	600.36	600.82	600.88	601.19	601.31	601.14	601.13	600.92
1938	600.75	600.47	600.42	600.48	601.04	601.39	601.68	601.63	601.55	601.37	601.13	600.94
1939	601.66	600.68	600.42	600.47	600.66	601.16	601.58	601.61	601.61	601.40	601.01	600.80
1940	600.31	600.17	599.90	599.70	599.76	600.46	600.68	601.09	600.93	600.88	600.73	600.55
1941	600.41	600.39	599.36	599.68	600.20	600.50	600.85	600.93	600.95	601.41	601.43	601.20
1942	600.82	600.06	600.45	600.50	600.61	601.13	601.17	601.28	601.37	601.28	601.35	601.26
1943	600.96	600.77	600.65	600.57	600.71	601.29	601.89	601.86	601.84	601.52	601.33	600.97
1944	600.60	600.19	600.03	599.97	600.18	600.68	601.34	601.64	601.84	601.63	601.28	601.02

TABLE 13 (CONTINUED)

## BEGINNING OF MONTH LEVELS AT THUNDER BAY (IGLD 1985)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1945	600.61	600.44	600.48	600.66	600.96	601.00	601.20	601.33	601.45	601.44	601.11	601.05
1946	600.73	600.54	600.46	600.55	600.63	600.78	601.10	601.24	601.16	601.30	601.32	601.08
1947	600.95	600.51	600.34	600.18	600.51	601.04	601.68	601.65	601.63	601.47	601.21	600.94
1948	600.56	600.30	600.01	599.94	600.48	600.57	600.63	600.76	601.02	600.76	600.58	600.54
1949	600.31	600.14	599.94	599.87	600.12	600.52	600.86	601.26	601.15	601.07	601.11	600.79
1950	600.67	600.52	600.22	600.24	600.57	601.55	601.81	601.97	601.98	601.89	601.72	601.54
1951	601.32	600.89	600.93	600.93	601.36	601.57	601.87	601.81	601.93	601.94	601.78	601.64
1952	601.34	601.19	600.84	600.76	601.04	601.06	601.47	601.91	602.08	601.81	601.04	600.79
1953	600.52	600.15	600.09	600.07	600.32	600.88	601.40	601.45	601.56	601.23	600.81	600.55
1954	600.20	600.04	599.81	599.73	600.16	600.75	601.28	601.23	601.02	600.84	600.68	600.39
1955	600.19	599.86	599.66	599.71	600.14	600.31	600.48	600.61	600.67	600.69	600.90	600.67
1956	600.35	600.10	599.84	599.62	599.72	600.08	600.42	600.69	600.80	600.71	600.43	600.22
1957	599.83	599.60	599.55	599.53	599.89	600.20	600.54	600.81	600.71	600.64	600.50	600.36
1958	600.07	599.89	599.73	599.66	599.77	599.87	600.26	600.57	600.51	600.56	600.51	600.41
1959	600.22	599.87	599.74	599.69	599.79	600.35	600.66	600.69	601.18	601.32	601.17	600.81
1960	600.54	600.24	600.02	599.83	600.33	601.02	601.07	601.07	600.99	600.87	600.58	600.34
1961	600.09	599.80	599.83	599.73	599.89	600.31	600.48	600.53	600.55	600.52	600.46	600.44
1962	600.05	599.79	599.75	599.69	599.79	600.29	600.39	600.51	600.64	600.69	600.41	600.22
1963	599.96	599.77	599.55	599.63	599.90	600.10	600.58	600.53	600.63	600.66	600.32	600.05
1964	600.07	599.78	599.60	599.37	599.80	600.41	600.75	600.85	600.85	601.06	600.78	600.50
1965	600.29	599.82	599.79	599.64	599.85	600.31	600.52	600.45	600.62	600.69	600.54	600.55
1966	600.36	600.01	599.97	600.05	600.16	600.52	600.76	600.75	600.94	600.61	600.46	600.20
1967	600.20	600.05	599.91	599.93	600.38	600.45	600.83	600.90	600.94	600.73	600.75	600.55
1968	600.09	599.89	599.63	599.70	600.20	600.48	601.15	601.57	601.66	601.78	601.77	601.38
1969	600.97	601.08	600.83	600.55	600.93	601.15	601.15	601.13	601.10	600.89	600.77	600.45
1970	600.28	600.12	599.91	599.73	600.08	600.72	601.03	601.33	601.16	601.15	601.43	601.39
1971	601.07	600.55	600.55	600.66	600.82	601.26	601.48	601.56	601.47	601.37	601.25	601.09
1972	600.52	600.59	600.46	600.54	600.75	601.10	601.13	601.28	601.58	601.46	601.15	600.81

TABLE 14  
 BEGINNING OF MONTH LEVELS AT ROSSPONT (IGLD 1955)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1967	600.34	600.14	599.89	599.90	600.18	600.47	600.84	600.72	600.86	600.62	600.69	600.43
1968	600.03	599.82	599.56	599.73	600.16	600.34	600.97	601.64	601.54	601.72	601.65	601.30
1969	601.12	601.00	600.69	600.47	600.79	600.94	601.08	601.07	600.98	600.70	600.57	600.35
1970	600.10	600.02	599.77	599.66	599.93	600.57	600.86	601.22	600.99	601.10	601.28	601.24
1971	601.01	600.59	600.65	600.61	600.76	601.18	601.37	601.44	601.39	601.18	601.28	600.95
1972	600.81	600.53	600.28	600.44	600.57	600.96	601.01	601.17	601.49	601.42	601.09	600.83

TABLE 15

## BEGINNING OF MONTH LEVELS AT MICHIGANICUTEN HARBOR (IGLU 1955)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1918	600.23	600.16	599.96	599.67	599.94	600.39	600.75	600.80	600.97	600.87	601.02	600.87
1919	600.76	600.62	600.58	600.29	600.52	600.75	600.83	601.06	601.01	600.83	600.87	600.98
1920	600.49	600.23	600.29	600.52	600.85	600.92	601.21	601.56	601.35	600.90	600.99	600.82
1921	600.60	600.20	600.07	600.09	600.52	600.83	600.93	601.15	601.07	601.25	600.82	600.53
1922	600.30	599.75	599.87	599.88	600.08	600.54	600.73	601.06	600.94	601.04	600.61	600.75
1923	600.42	600.13	599.82	599.74	599.87	599.95	600.08	600.28	600.30	600.41	600.54	600.20
1924	600.09	599.69	599.53	599.36	599.60	599.60	599.81	599.90	600.39	600.31	600.49	599.95
1925	599.56	599.50	599.04	598.92	599.26	599.27	599.66	599.91	599.54	599.78	599.95	599.33
1926	599.09	598.53	598.32	598.53	598.32	598.81	599.05	599.38	599.43	599.82	600.01	600.05
1927	599.87	599.71	599.57	599.65	599.97	600.52	600.77	601.22	600.97	601.09	600.96	600.86
1928	600.59	600.37	600.30	600.11	600.48	600.35	601.04	601.35	601.61	601.63	601.92	601.47
1929	601.08	600.94	600.78	600.79	600.91	601.07	601.20	601.34	601.19	601.27	601.18	601.20
1930	600.79	600.58	600.46	600.36	600.31	600.75	601.28	601.43	601.25	601.23	601.08	601.02
1931	600.70	600.41	600.20	599.91	599.98	600.22	600.62	600.65	600.65	600.87	600.86	600.98
1932	600.39	600.63	600.38	600.32	600.41	600.73	600.42	601.20	601.52	601.25	600.90	600.70
1933	600.61	600.35	600.28	600.14	600.49	600.95	601.17	601.31	601.14	601.48	601.14	601.21
1934	600.70	600.77	600.43	600.44	600.57	601.01	601.26	601.19	601.11	601.38	601.40	601.26
1935	601.11	600.90	600.67	600.69	600.87	600.93	601.20	601.53	601.50	601.44	601.27	601.00
1936	600.61	600.63	600.35	600.61	600.59	601.29	601.29	601.18	601.23	601.29	600.80	600.58
1937	600.71	600.56	600.50	600.15	600.39	601.01	601.05	601.22	601.36	601.24	601.20	601.26
1938	600.54	600.75	600.61	600.85	601.18	601.45	601.72	601.68	601.76	601.50	601.07	601.06
1939	601.08	600.62	600.70	600.75	600.90	601.17	601.82	601.72	601.72	601.54	601.24	600.83
1940	600.70	600.23	599.98	599.99	599.93	600.52	601.10	601.09	601.11	600.96	600.69	600.81
1941	600.41	600.30	600.00	599.75	600.30	600.54	600.87	601.06	601.22	601.57	601.58	601.39
1942	601.04	600.77	600.56	600.61	600.62	601.15	601.34	601.37	601.47	601.38	601.55	601.50
1943	601.08	601.07	600.94	600.86	600.97	601.26	601.94	601.88	601.90	601.66	601.25	601.10
1944	600.61	600.49	600.11	600.15	600.06	600.66	601.32	601.64	601.83	601.73	601.29	600.70
1945	600.85	600.67	600.54	600.66	601.15	601.05	601.21	601.30	601.55	601.55	601.48	601.02
1946	600.77	600.62	600.48	600.51	600.66	600.83	601.20	601.18	601.41	601.37	601.58	601.35
1947	601.04	600.63	600.51	600.24	600.52	601.09	601.79	601.69	601.66	601.62	601.23	601.11



TABLE 15 (CONTINUED)

## BEGINNING OF MONTH LEVELS AT MICHIGICOTEN HARBOR (JULY 1955)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1948	600.50	600.33	599.94	600.01	600.56	600.60	600.71	601.03	600.97	600.87	600.62	600.77
1949	600.45	600.40	600.66	599.97	600.07	600.46	600.88	601.30	601.33	601.13	601.33	601.15
1950	600.68	600.79	600.60	600.33	600.60	601.49	601.88	601.94	602.03	601.62	601.77	601.79
1951	601.23	601.66	600.87	601.02	601.24	601.61	601.85	601.67	601.81	602.02	602.03	601.70
1952	601.46	601.26	600.96	600.87	601.12	601.21	601.47	602.04	602.11	601.90	601.24	600.93
1953	600.70	600.51	600.21	600.19	600.26	600.93	601.25	601.48	601.58	601.37	600.91	600.65
1954	600.46	600.18	600.10	599.97	600.28	600.45	601.30	601.24	601.02	600.90	600.83	600.50
1955	600.05	599.74	599.66	599.67	600.03	600.26	600.36	600.59	600.76	600.82	600.84	600.73
1956	600.31	600.20	599.63	599.46	599.68	600.23	600.36	600.70	600.78	600.68	600.47	600.32
1957	600.19	599.78	599.62	599.55	599.89	600.20	600.69	600.56	600.63	600.78	600.44	600.59
1958	600.18	600.00	599.62	599.53	599.78	599.81	600.09	600.45	600.67	600.92	600.96	600.55
1959	600.18	600.03	599.78	599.70	599.77	600.32	600.56	600.69	601.00	601.32	601.34	600.77
1960	600.40	600.25	600.02	599.69	600.35	600.88	600.98	600.99	600.94	600.72	600.51	600.56
1961	599.56	599.75	599.69	599.81	599.97	600.17	600.27	600.36	600.36	600.60	600.61	600.15
1962	600.13	599.72	599.84	599.55	599.76	600.23	600.29	600.45	600.64	600.63	600.48	600.09
1963	599.74	599.55	599.48	599.40	599.71	599.86	600.40	600.51	600.61	600.52	600.49	600.29
1964	600.04	599.75	599.52	599.26	599.63	600.35	600.65	600.61	600.86	601.34	600.55	600.41
1965	600.02	599.95	599.52	599.53	599.80	600.22	600.36	600.42	600.51	600.63	600.54	600.64
1966	600.37	600.18	599.94	600.05	600.14	600.56	600.62	600.72	600.90	600.69	600.77	600.68
1967	600.23	600.15	599.94	599.91	600.22	600.40	600.71	600.67	600.83	600.46	600.52	600.27
1968	600.14	599.65	599.59	599.79	600.10	600.26	600.99	601.43	601.45	601.66	601.58	601.20
1969	601.23	600.96	600.74	600.51	600.63	600.77	601.00	601.00	601.01	600.62	600.52	600.41
1970	599.58	600.07	599.73	599.63	599.90	600.47	600.66	601.13	600.96	600.97	601.16	601.10
1971	600.78	600.64	600.87	600.60	600.77	601.10	601.36	601.34	601.17	601.14	601.29	601.02
1972	600.83	600.61	600.31	600.48	600.54	600.90	600.94	601.15	601.45	601.42	601.04	600.93

TABLE 16

## LAKE SUPERIOR BEGINNING OF MONTH LEVELS (IGLU 1955)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1900	601.61	600.72	600.47	600.23	600.35	600.49	600.44	600.83	601.20	601.76	601.70	601.43
1901	601.66	600.69	600.56	600.32	600.53	600.70	600.87	601.38	601.32	601.19	601.21	600.98
1902	600.70	600.39	600.29	600.18	600.29	600.53	600.86	601.00	600.98	601.05	600.94	600.85
1903	600.58	600.39	600.30	600.11	600.43	600.38	601.09	601.40	601.41	601.63	601.48	601.25
1904	600.89	600.55	600.46	600.35	600.30	600.76	601.00	601.01	601.08	601.33	601.36	601.08
1905	600.69	600.36	600.14	600.22	600.41	600.73	600.95	601.11	601.25	601.47	601.30	601.23
1906	600.57	600.82	600.32	600.22	600.45	600.72	601.10	601.05	601.06	601.00	600.75	600.79
1907	600.50	600.24	600.08	600.06	599.98	600.51	600.79	600.94	601.26	601.29	601.06	600.93
1908	600.43	600.09	599.81	599.76	599.92	600.55	600.84	601.05	600.90	600.89	600.55	600.27
1909	599.58	599.60	599.48	599.42	599.54	600.03	600.16	600.52	600.63	600.54	600.33	600.33
1910	600.19	599.92	599.73	599.59	599.83	600.04	600.07	600.07	600.07	600.13	599.89	599.65
1911	599.37	598.95	598.82	598.75	598.86	599.24	599.55	600.09	600.25	600.28	600.30	600.05
1912	600.03	599.72	599.66	599.49	599.74	600.12	600.42	600.61	600.66	600.79	600.79	600.42
1913	600.09	600.02	599.60	599.74	599.97	600.40	600.58	600.85	600.93	601.00	601.00	600.97
1914	600.50	600.44	600.39	599.96	600.22	600.50	600.71	600.82	600.90	600.90	600.71	600.40
1915	600.10	599.99	599.82	599.51	599.66	599.94	600.44	600.57	600.58	600.85	600.93	601.00
1916	600.62	600.72	600.50	600.37	600.95	601.45	601.90	601.95	601.89	601.99	601.80	601.46
1917	601.26	600.77	600.60	600.56	600.50	600.66	600.90	600.94	600.99	600.99	600.74	600.49
1918	600.20	599.97	599.86	599.85	599.77	600.22	600.48	600.61	600.73	600.64	600.72	600.71
1919	600.59	600.37	600.29	600.11	600.37	600.62	600.77	600.83	600.60	600.77	600.65	600.65
1920	600.35	600.17	600.09	600.05	600.59	600.79	601.07	601.25	601.13	600.89	600.60	600.50
1921	600.42	600.06	599.86	599.66	600.27	600.69	600.79	600.92	600.90	600.87	600.63	600.30
1922	599.52	599.66	599.56	599.50	599.69	600.35	600.60	600.85	600.89	600.86	600.57	600.37
1923	600.12	599.92	599.66	599.56	599.71	599.84	600.02	600.23	600.26	600.28	600.29	600.09
1924	599.60	599.61	599.36	599.19	599.42	599.47	599.59	599.79	600.11	600.12	600.07	599.78
1925	599.42	599.20	599.01	598.95	599.10	599.26	599.55	599.72	599.74	599.74	599.47	599.10
1926	598.63	598.51	598.33	598.00	598.29	598.56	598.90	599.23	599.36	599.76	599.79	599.89
1927	599.78	599.53	599.42	599.34	599.74	600.40	600.68	601.01	600.90	600.88	600.81	600.57
1928	600.38	600.14	599.97	599.66	600.17	600.41	600.92	601.20	601.42	601.51	601.64	601.27
1929	600.87	600.68	600.62	600.70	600.77	600.87	600.98	601.14	601.03	601.08	601.02	600.84

TABLE 16 (CONTINUED)  
LAKE SUPERIOR BEGINNING-OF-MONTH LEVELS (IGLD 1955)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1930	600.63	600.38	600.31	600.13	600.26	600.61	601.06	601.24	601.06	600.37	600.86	600.69
1931	600.40	600.17	599.92	599.70	599.80	600.07	600.36	600.52	600.48	600.59	600.65	600.70
1932	600.44	600.37	600.23	600.07	600.21	600.64	600.67	601.08	601.26	600.37	600.74	600.56
1933	600.36	600.17	600.13	599.95	600.31	600.84	601.02	601.10	601.03	601.13	601.03	600.86
1934	600.61	600.51	600.35	600.30	600.47	600.91	601.08	601.08	600.97	601.20	601.15	601.16
1935	600.85	600.71	600.47	600.53	600.70	600.80	601.10	601.35	601.33	601.15	601.05	600.79
1936	600.52	600.40	600.25	600.36	600.50	601.13	601.21	601.09	601.07	601.01	600.72	600.43
1937	600.63	600.16	600.19	599.97	600.32	600.82	600.87	601.15	601.25	601.13	601.07	601.00
1938	600.66	600.32	600.41	600.48	600.95	601.33	601.64	601.57	601.57	601.36	601.05	600.94
1939	600.75	600.65	600.53	600.50	600.71	601.12	601.58	601.61	601.59	601.36	601.04	600.74
1940	600.45	600.17	599.90	599.75	599.84	600.42	600.90	601.04	600.97	600.88	600.66	600.62
1941	600.38	600.13	599.90	599.67	600.19	600.46	600.78	600.92	601.00	601.39	601.48	601.19
1942	600.52	600.65	600.44	600.46	600.58	601.08	601.15	601.25	601.33	601.25	601.34	601.30
1943	601.09	600.85	600.74	600.64	600.77	601.26	601.86	601.83	601.80	601.51	601.24	600.95
1944	600.54	600.27	600.03	599.98	600.09	600.63	601.28	601.60	601.73	601.67	601.26	601.03
1945	600.73	600.51	600.44	600.66	601.00	601.03	601.17	601.31	601.48	601.44	601.22	601.00
1946	600.76	600.60	600.43	600.51	600.63	600.85	601.10	601.20	601.22	601.29	601.37	601.17
1947	600.92	600.58	600.40	600.18	600.53	601.03	601.68	601.64	601.61	601.52	601.21	600.91
1948	600.54	600.27	599.97	599.93	600.49	600.55	600.64	600.82	600.97	600.81	600.58	600.58
1949	600.97	600.22	600.05	599.92	600.11	600.50	600.85	601.25	601.19	601.09	601.15	600.93
1950	600.66	600.57	600.30	600.28	600.56	601.48	601.84	601.99	601.99	601.87	601.78	601.61
1951	601.24	600.94	600.96	600.97	601.36	601.60	601.84	601.83	601.92	601.96	601.90	601.63
1952	601.56	601.17	600.83	600.77	601.09	601.11	601.48	601.95	602.02	601.68	601.10	600.80
1953	600.52	600.30	600.17	600.13	600.35	600.88	601.29	601.46	601.53	601.26	600.87	600.58
1954	600.33	600.09	599.96	599.79	600.23	600.82	601.24	601.20	601.01	600.86	600.65	600.46
1955	600.12	599.87	599.65	599.67	600.09	600.31	600.43	600.59	600.73	600.74	600.82	600.66
1956	600.57	600.14	599.84	599.58	599.71	600.16	600.40	600.72	600.78	600.70	600.46	600.26
1957	600.05	599.67	599.55	599.55	599.92	600.20	600.57	600.76	600.72	600.71	600.49	600.45
1958	600.10	599.35	599.77	599.62	599.78	599.85	600.19	600.50	600.64	600.72	600.58	600.51
1959	600.62	599.36	599.84	599.72	599.85	600.38	600.61	600.72	601.16	601.46	601.23	600.81



TABLE 16 (CONTINUED)  
LAKE SUPERIOR BEGINNING OF MONTH LEVELS (IGLD 1955)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1960	600.49	600.29	600.02	599.89	600.40	600.97	601.04	601.05	601.00	600.79	600.57	600.51
1961	600.04	599.84	599.77	599.78	599.95	600.26	600.42	600.49	600.47	600.57	600.53	600.35
1962	600.13	599.82	599.73	599.65	599.77	600.26	600.39	600.49	600.68	600.70	600.49	600.20
1963	599.53	599.71	599.53	599.66	599.90	600.06	600.52	600.57	600.67	600.62	600.49	600.26
1964	599.96	599.82	599.53	599.36	599.79	600.40	600.75	600.79	600.91	601.07	600.74	600.53
1965	600.26	599.93	599.74	599.67	599.89	600.38	600.52	600.55	600.59	600.69	600.61	600.57
1966	600.41	600.16	599.97	600.06	600.22	600.58	600.74	600.80	600.96	600.73	600.67	600.46
1967	600.31	600.13	599.93	599.91	600.36	600.48	600.82	600.83	600.90	600.65	600.65	600.43
1968	600.17	599.89	599.64	599.72	600.18	600.42	601.04	601.55	601.60	601.75	601.69	601.25
1969	601.05	601.01	600.79	600.54	600.84	601.02	601.11	601.09	601.08	600.80	600.69	600.48
1970	600.20	600.06	599.83	599.71	600.03	600.65	600.92	601.26	601.11	601.15	601.32	601.26
1971	600.96	600.64	600.66	600.64	600.85	601.27	601.47	601.49	601.42	601.30	601.27	601.10
1972	600.80	600.60	600.50	600.54	600.71	601.07	601.09	601.28	601.56	601.53	601.19	600.96

TABLE 17

LAKE SUPERIOR RATES OF STORAGE CHANGES IN TCFs

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1900	-30	-38	-79	41	46	-17	129	122	191	-20	-92	-122
1901	-122	-92	-60	72	58	58	168	-20	-44	7	-78	-92
1902	-107	-36	-36	38	79	112	46	-7	24	-36	-31	-89
1903	-69	-39	-69	130	162	38	102	3	75	-50	-78	-119
1904	-112	-25	-43	-17	152	62	4	23	85	10	-96	-129
1905	-109	-80	26	65	105	75	59	46	75	-56	-24	-86
1906	-50	-169	-59	78	89	130	-16	3	-20	-82	14	-96
1907	-66	-56	-7	-27	175	96	50	106	10	-76	-44	-165
1908	-112	-99	-16	55	206	106	63	-50	-3	-112	-96	-96
1909	-120	-44	-20	41	162	44	119	36	-31	-69	0	-46
1910	-89	-69	-46	82	69	10	0	0	20	-79	-82	-92
1911	-139	-36	-33	38	125	106	175	53	10	7	-85	-7
1912	-122	-21	-56	65	123	102	63	16	44	0	-126	-109
1913	-23	-139	-46	78	142	51	89	26	24	0	-10	-155
1914	-20	-18	-142	69	92	72	36	26	0	-69	-106	-135
1915	-32	-82	-102	51	92	170	49	9	22	26	24	-59
1916	-99	-76	-49	136	174	140	16	-20	34	-69	-116	-59
1917	-166	-62	-13	-20	53	82	13	16	-57	-69	-65	-102
1918	-76	-40	-69	41	143	49	43	40	-31	26	-3	-40
1919	-79	-51	-40	69	82	51	20	-10	-10	-73	34	-106
1920	-59	-28	60	82	60	36	59	-40	-82	-30	-102	-26
1921	-119	-56	-7	140	119	55	43	-7	-10	-79	-112	-125
1922	-79	-44	-20	133	152	87	82	13	-10	-96	-68	-82
1923	-60	-75	-25	44	43	51	69	10	7	3	-68	-79
1924	-79	-36	-56	78	16	41	66	106	3	-16	-99	-116
1925	-79	-69	-26	58	53	49	56	7	0	-89	-126	-89
1926	-112	-26	-10	43	89	116	109	44	136	10	34	-36
1927	-62	-70	40	82	205	42	109	-36	-7	-29	-82	-63
1928	-79	-50	-39	49	79	174	92	70	51	43	-126	-132
1929	-40	-22	25	24	59	36	99	-36	17	-20	-61	-69

TABLE 17 (CONTINUED)

## LAKE SUPERIOR MONTHS OF STORAGE CHANGES IN TCFS

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1930	-62	-26	-59	44	119	193	59	-59	-31	-36	-58	-92
1931	-76	-31	-73	34	69	99	53	-13	38	20	17	-86
1932	-63	-49	-53	48	142	10	135	39	-99	-76	-61	-66
1933	-53	-15	-59	123	175	61	26	-23	34	-33	-58	-82
1934	-53	-38	-16	58	145	58	0	-36	78	-16	3	-102
1935	-46	-68	20	58	34	102	62	-7	-61	-33	-89	-89
1936	-49	-33	36	46	203	27	-40	-7	-20	-96	-99	-66
1937	-63	11	-73	119	103	17	92	33	-41	-20	-24	-112
1938	-49	-40	23	160	125	106	-23	0	-72	-102	-38	-63
1939	-50	-44	-10	72	135	157	10	-7	-78	-106	-102	-96
1940	-52	-95	-50	31	191	164	46	-23	-31	-73	-14	-76
1941	-22	-84	-70	177	69	109	46	26	133	30	-99	-89
1942	-89	-77	7	41	165	24	33	26	-27	30	-14	-89
1943	-59	-48	-26	44	162	205	-10	-10	-99	-89	-99	-135
1944	-29	-82	-16	38	178	222	106	43	-20	-135	-78	-99
1945	-73	-26	73	116	10	48	46	56	-14	-73	-75	-79
1946	-59	-62	20	41	60	92	33	7	24	26	-68	-82
1947	-112	-66	-73	119	163	222	-13	-10	-31	-102	-102	-122
1948	-27	-106	-13	191	20	31	59	30	-59	-76	0	-69
1949	-50	-62	-43	65	129	119	132	-20	-94	20	-75	-89
1950	-59	-60	-25	96	304	123	50	0	-41	-30	-58	-119
1951	-59	7	3	133	73	42	3	30	14	-20	-92	-82
1952	-69	-99	-47	109	7	126	159	23	-116	-191	-102	-92
1953	-73	-48	-13	75	175	140	58	23	-92	-129	-99	-82
1954	-77	-40	-64	150	195	143	-13	-63	-51	-69	-65	-112
1955	-22	-69	-3	143	73	41	53	46	3	26	-55	-96
1956	-76	-106	-66	44	148	22	106	20	-27	-79	-68	-69
1957	-123	-33	-10	126	92	126	63	-13	-3	-73	-14	-86
1958	-69	-77	-59	55	24	116	102	46	27	-46	-24	-96
1959	-86	-51	-33	44	112	7	36	145	68	-43	-143	-102

TABLE 17 (CONTINUED)  
 LAKE SUPERIOR MONTHLY STORAGE CHANGES IN TCFG

YEAR	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1960	-60	-35	-58	148	168	24	3	-19	-76	-73	-60	-139		
1961	-60	-26	3	35	142	37	49	47	34	-13	-61	-73		
1962	-100	-33	-26	41	102	44	43	60	7	-69	-99	-89		
1963	-73	-38	36	62	54	137	16	50	-17	-49	-76	-99		
1964	-46	-35	-63	147	201	119	13	40	50	-109	-72	-89		
1965	-109	-59	-23	75	142	46	19	19	34	-26	-14	-53		
1966	-82	-69	39	55	119	35	20	33	-76	-20	-72	-53		
1967	-53	-66	-13	153	49	116	3	23	-23	0	-75	-86		
1968	-52	-38	66	157	79	211	169	16	51	-20	-150	-66		
1969	-13	-30	-82	102	57	31	47	43	-96	-36	-72	-92		
1970	-70	-54	-40	109	203	32	112	-50	14	56	-20	-99		
1971	-100	7	47	72	103	66	7	-23	41	-10	-58	-99		
1972	-60	-35	13	58	119	7	63	92	-19	-112	-78	-96		

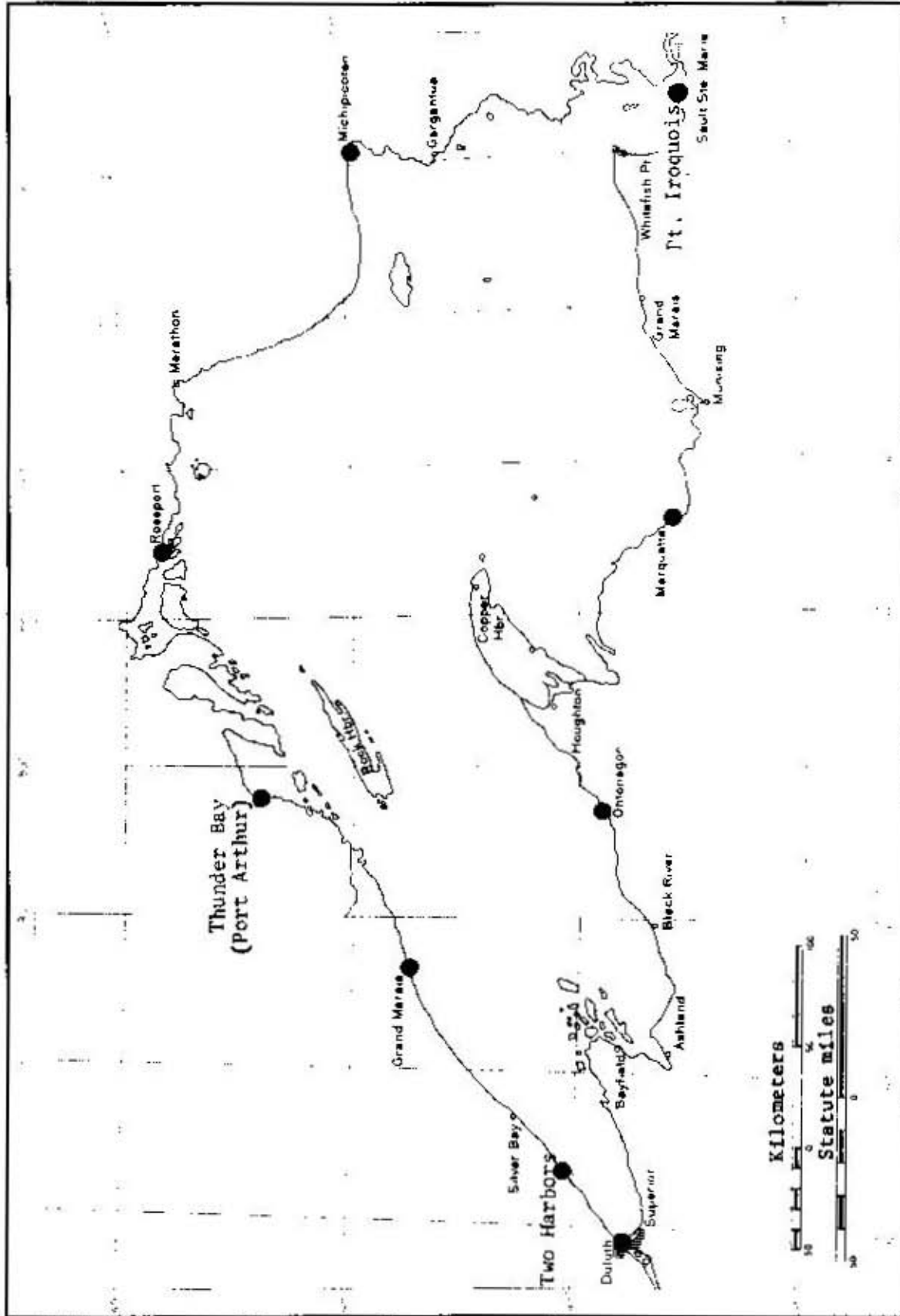


Figure 1.--Water level gauge location

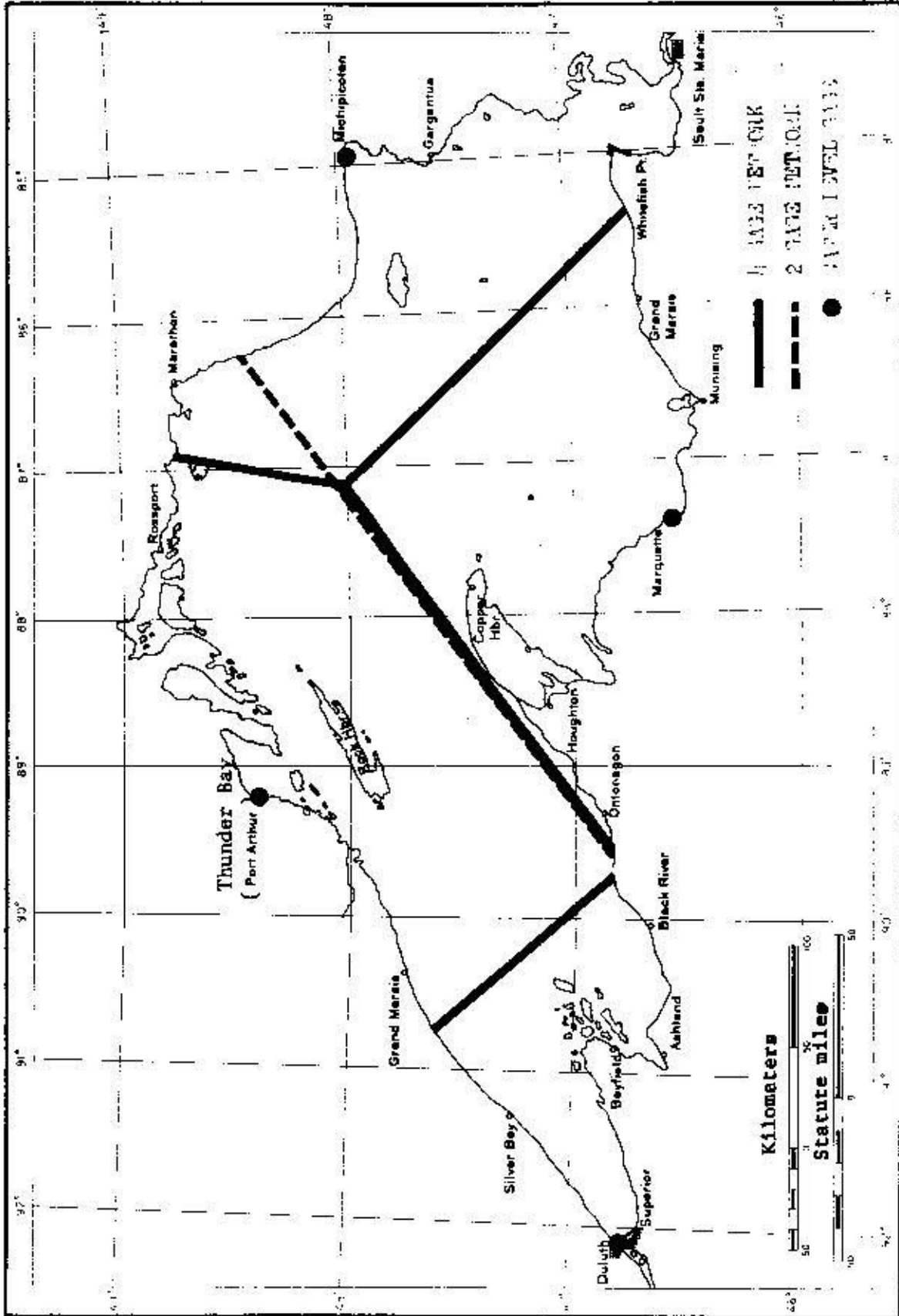


Figure 2.--Polygon network

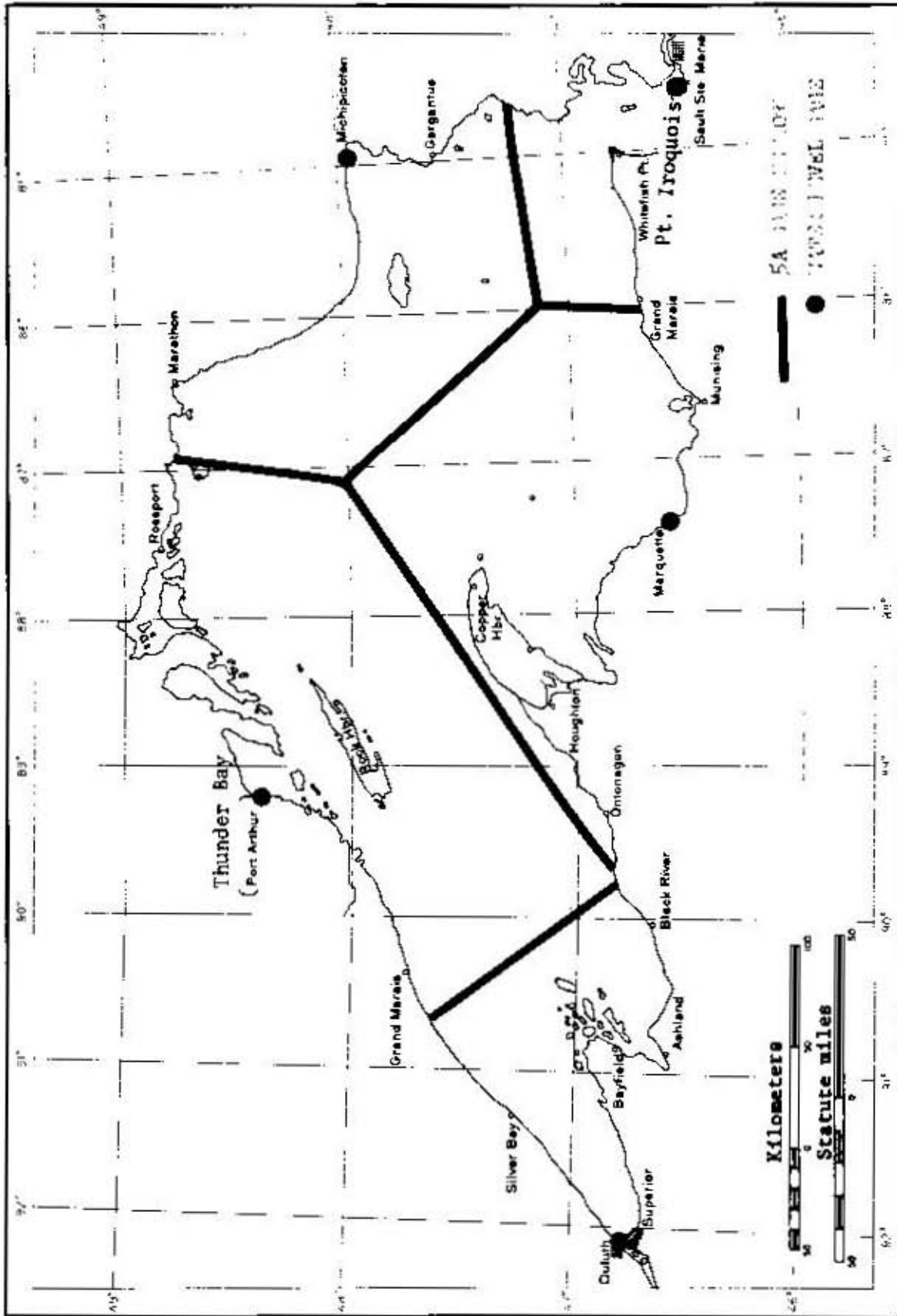


Figure 3.--Polygon network

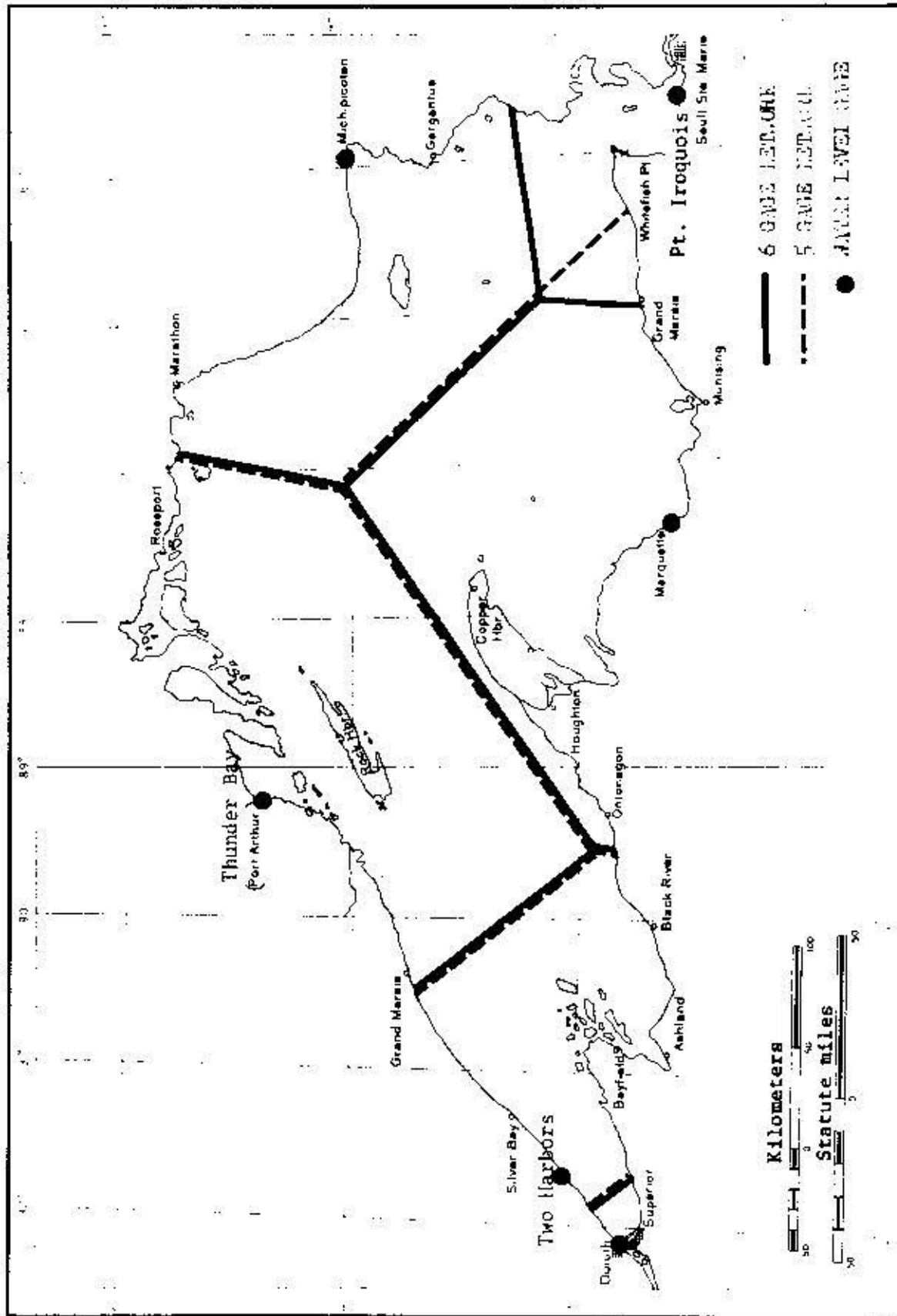


Figure 4.--Polygon network



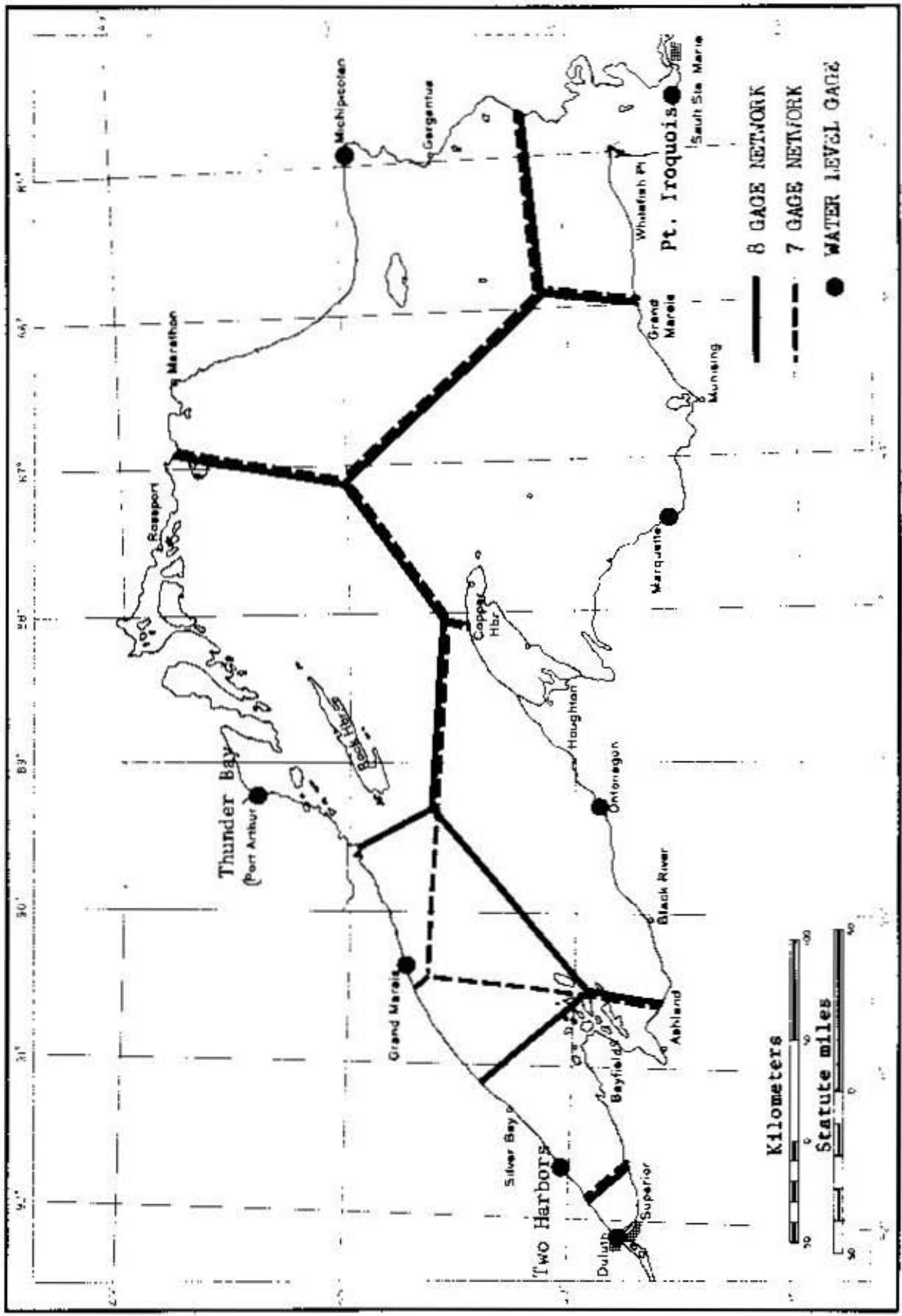


Figure 5.--Polygon network

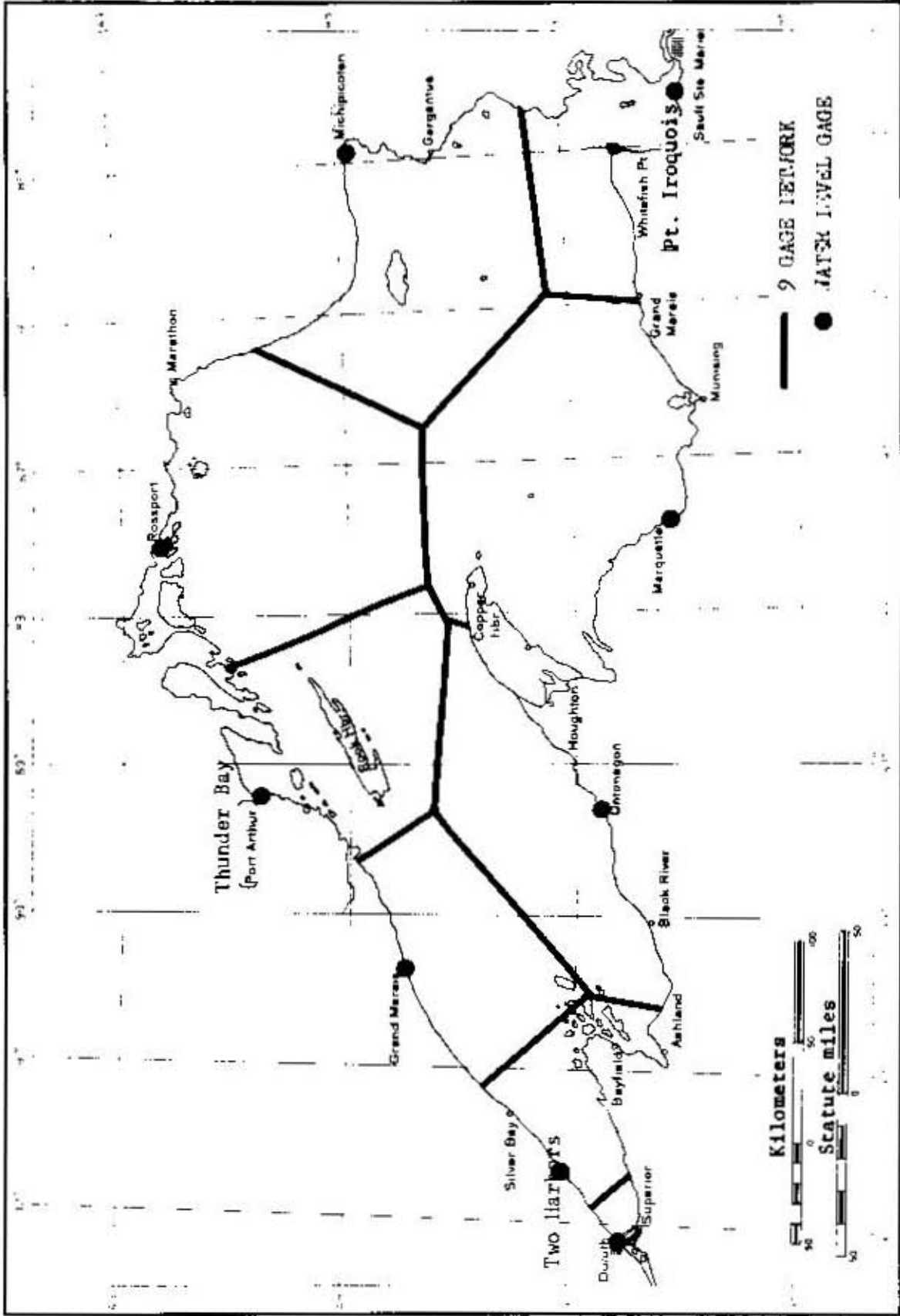


Figure 6.--Polygon network

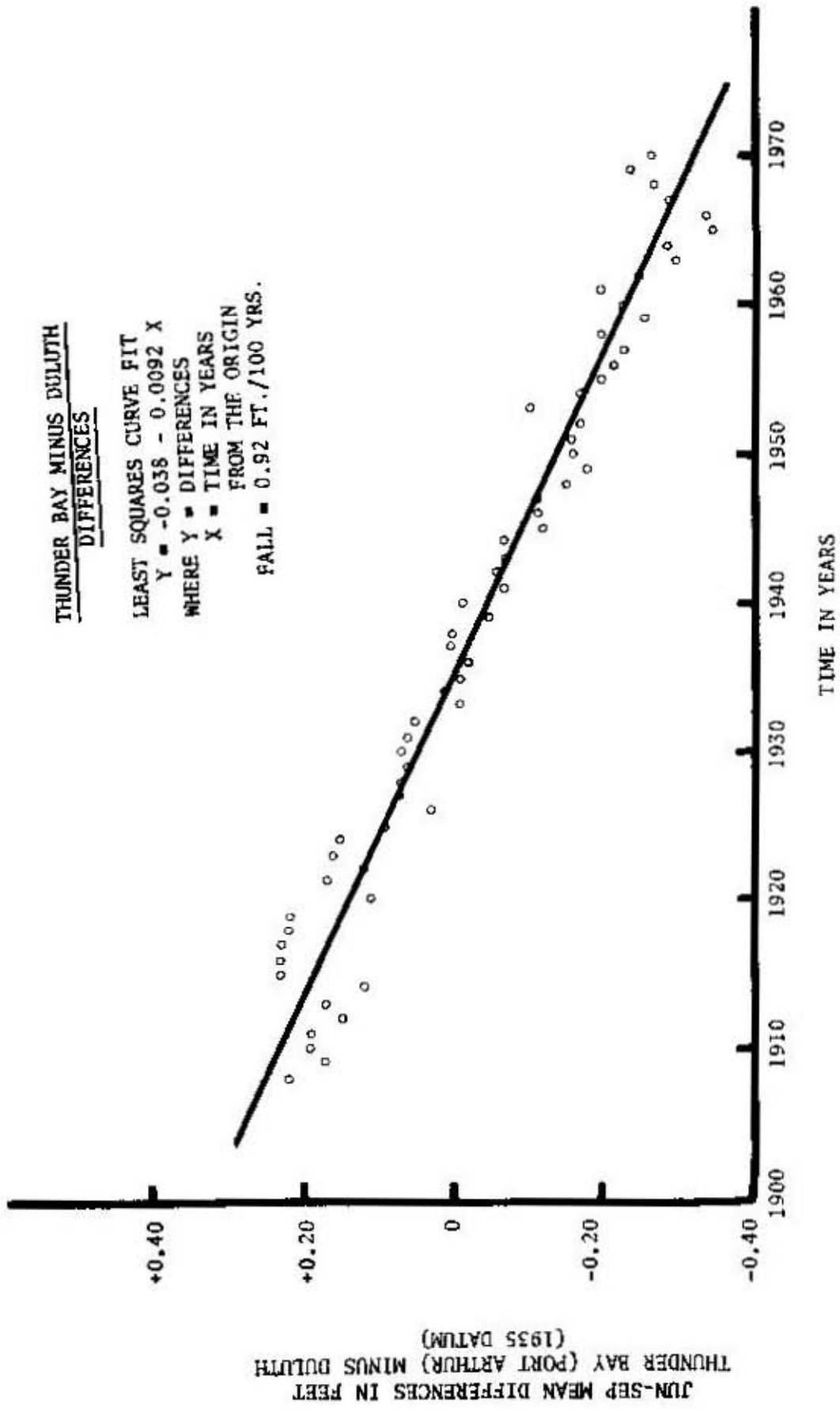


Figure 7.-- Plot demonstrating the trend of subsidence of Duluth relative to Thunder Bay (Port Arthur)