DEPARTMENT OF THE ARMY

CORPS OF ENGINEERS

BEACH EROSION BOARD
OFFICE OF THE CHIEF OF ENGINEERS

WAVE AND
LAKE LEVEL STATISTICS
FOR LAKE ERIE

TECHNICAL MEMORANDUM NO. 37

WAVE AND LAKE LEVEL STATISTICS FOR LAKE ERIE

TECHNICAL MEMORANDUM NO. 37
BEACH EROSION BOARD
CORPS OF ENGINEERS

MARCH 1953

FOREWORD

This is the second of a series of reports to be issued by the Beach Erosion Board under its General Investigations program to provide wave statistics for selected regions. The need for such data is evident, and it is planned ultimately to supply it by actual wave measurement for sufficiently long periods to establish the wave climate at many locations. Suitable instruments for that purpose have not yet been developed and even after they become available much time must pass before the records can attain statistical value. The production of wave statistics by "hindcast" technique, admittedly of presently indeterminate quantitative accuracy, will nevertheless provide the engineer with better wave data than have heretofore been available.

Thorndike Saville, Jr., author of the report, is a Hydraulic Engineer in the Research Division of the Beach Erosion Board under the supervision of Joseph M. Caldwell, Chief of the Division. At the time this report was prepared, the technical staff of the Board was under general supervision of Colonel E. E. Gesler, President of the Board and R. O. Eaton, Chief Technical Assistant.

The author was aided in the study by Robert F. Dearduff, Hydraulic Engineer; by Morrison G. Essick, John C. Fairchild, Francis W. Kellum and Herman P. VanEckhardt in computations and compilations; in map reduction by Carleton L. Bell, George P. Cummings, Lowell E. Finch, Richard E. Nearman and John J. Sharer; and in drafting by Wendell E. Reece. The report was edited for publication by Albert C. Rayner. Views and conclusions stated in the report are not necessarily those of the Beach Erosion Board.

TABLE OF CONTENTS

	Page
Introduction	1
Wave Statistics	1
Lake Levels	8

APPENDICES

- A - Wave Statistics for Monroe, Michigan
- B - Wave Statistics for Cleveland, Ohio
- C - Wave Statistics for Erie, Pennsylvania
- D - Wave Statistics for Buffalo, New York

FIG.1 LOCATION OF WAVE HINDCASTING STATIONS FOR LAKE ERIE

WAVE AND LAKE LEVEL STATISTICS FOR LAKE ERIE

by

Thorndike Saville, Jr.
Hydraulic Engineer, Research Division,
Beach Erosion Board, Corps of Engineers

INTRODUCTION

The General Investigations program of the Beach Erosion Board comprises investigations, regional rather than local in scope, designed to improve, simplify, and expedite the solution of local problems, by giving a compilation of all existing data pertinent to shore processes in the particular region. As a first step in the compilation of these data a study of wave and lake level conditions on the Great Lakes is being made. The results of such a study for Lake Erie are presented herein.

WAVE STATISTICS

Four stations on Lake Erie were selected for a comprehensive wave analysis, the locations (see Figure 1) being as follows:

<u>Station</u>	<u>Latitude</u>	<u>Longitude</u>	<u>Vicinity</u>
A	41°50' N	83°10' W	Monroe, Michigan
B	41°35' N	81°45' W	Cleveland, Ohio
C	42°12' N	80°05' W	Erie, Pennsylvania
D	42°49' N	78°57' W	Buffalo, New York

These particular stations were selected since it was thought that they would give adequate coverage to the entire lake shore in the United States, and permit interpolation of values between stations, thus giving an accurate representation of wave action at any point along the United States shore line.

Wave characteristics were determined from synoptic weather charts for each station for the three-year period 1948-1950. The weather maps used were the United States Surface Synoptic Charts compiled at six-hour intervals by the U. S. Weather Bureau. Fetch areas, and the wind speeds and durations in these areas, were determined directly from the weather maps; these values were used with curves derived by Sverdrup and Munk (1)* and revised by Arthur (2) to obtain the hindcast wave

*Numbers in parenthesis refer to References on Page 14 .

characteristics. The revisions in the curves recently suggested by Bretschneider (3) were not employed, hence the wave periods determined may be expected to be slightly low. The only major variation from the usual methods of wave forecasting or hindcasting (4) was that the surface wind was determined directly from reported observations rather than from a gradient wind determined from the isobar spacing. It was thought that with the lake area so small in comparison to the area of the pressure cell, the isobaric pattern on the surface would be influenced to a large extent by the surface topography, and gradient winds determined from the isobar spacing would not necessarily give true values of wind velocity over the lake surface. Hence reported values of the surface wind could be expected to give a more realistic figure of the wind velocity. Observations have shown (5) that the greater surface friction serves to reduce the wind over land from what it may be over water. Since the reported values were almost always obtained at land stations, the wind speeds used in the analysis may have been lower than those actually occurring over the lake in the generating area. Some compensation was made for this by selecting the top speed of the Beaufort range reported rather than the middle value.

The wave characteristics thus determined are for the significant wave -- that is, the period is that of the predominating waves, and the height is the average of the higher one-third of these predominant waves. These values are summarized for each station in Tables A-1 through D-1 (Appendices A through D). It should also be noted that the wave conditions given in these tables are deep water conditions. They must be used in conjunction with refraction diagrams to obtain inshore values. The tables show, for each station, the number of hours duration that deep water waves of any given height, period, and direction occurred during any month of the three-year period; and also for each month (as summations) the number of hours' occurrence of waves of any particular height and period exclusive of direction; the number of hours' occurrence of waves of any particular height and direction exclusive of period; and the total number of hours' occurrence of waves of any particular height.

As an example of the data presented, from Table B-1 (Table 1 for Station B) for the month of July, waves of 1 to 2-foot height and 2 to 3-second period from the north occurred for 6 hours during 1948, 18 hours during 1949, and 12 hours during 1950. Thus, waves of this category occurred for a duration of 36 hours during the three-year period and hence can be expected to occur for about 12 hours (on the average) during July of any year in the future. Waves of 1 to 2-foot height and 2 to 3-second period (from all directions) occurred for 120 hours over the three-year period, or an average of 40 hours per year. Waves of 1 to 2 foot height from the north (all periods) occurred for 66 hours over the three-year period, or an average of 22 hours per year. Waves 1 to 2-foot height (all periods and all directions) occurred for 198 hours over the three-year period, or an average of 66 hours per year.

Tables A-2 through D-2 show the summations of the values in Tables A-1 through D-1 for the entire year, and are read similarly to those tables.

During much of the winter season portions of the lake are covered with ice, and fetch areas are limited considerably. In addition, for a somewhat greater portion of the winter season, the coast area of the lake is covered with ice, and, even though waves are generated in offshore areas, they never reach the shore, being interrupted by the ice around the rim of the lake. No account of this effect of the ice was taken in the actual hindcasting of the waves, and the durations given for the various winter months are computed as though there were no ice on the lake, a fact that should be remembered in using these data.

From yearly records of lake and air temperatures, and the dates of opening and closing of the lake for navigation, an average ice-free period was determined. For Lake Erie this appeared, to run, on the average, from April through November, and the average ice-free period was determined as 1 April - 1 December for all four stations. A summation of the wave data for this ice-free period is shown in Tables A-3 through D-3. These tables are similar to Tables 1 and 2, and represent a summation of the values in Tables 1 for all months from April through November. The durations of waves of particular height and direction have also been tabulated as percentages of time for the three-year period and are shown graphically in the wave roses for the full year and also for the ice-free period in Figures A-1 through D-1. In these roses, as in all other curves contained herein, the durations are percentages of 365 days, for the ice-free period as well as the full year data.

Figures A-2 through D-2 show the total percentages of time that the wave height may be expected to be greater than any particular height throughout the year. They thus show the (average) total duration time of specific waves over the year. Two curves are shown, one based on the data gathered for the entire year's period, and the other on just the average ice-free period (April through November). For example, at station B, the total duration of waves in excess of 10 feet in height during the ice-free period is expected to be 0.09 percent of the time; and 0.13 percent of the time during the full year. Hence waves 10 feet or higher can be expected to occur for a total duration of 11.5 hours ($0.0013 \times 365 \times 24$) over the course of each year, and, of this, 8 hours ($0.0009 \times 365 \times 24$) will be during the ice-free portion of the year when the waves will be certain to reach the shore.

Figures A-3 through D-3 show the frequency with which storms resulting in waves higher than a given height can be expected to occur. For example, at station B, on 0.56 percent of the days each year the waves may be expected to be ten feet or greater in height, and on 0.29 percent of the days they may be expected to reach this height during the ice-free portion of the year. Thus waves ten feet or higher may be expected to occur (on the average) twice each year (0.0056×365); of these occurrences, only one (0.0029×365) will be expected to occur during the ice-free portion of each year.

Combining the data obtained from graphs on Figures B-2 and B-3, waves ten feet and higher may be expected to occur at Station B about twice each year, and the average duration of each storm will be about 6 hours. During the ice-free portion of the year, waves of ten feet and higher may be expected to occur only once, and the duration of this storm is expected to be about 6 hours.

There are, in general, two methods of plotting points to obtain frequency curves such as those shown in Figures A-3 through D-3. One, based on the so-called theory of sampling, involves the assumption that the known period of record (three years) is a fair average sample of all similar three-year periods over an infinite number of years, and that therefore the largest storm of this three-year period is the median of all storms of the same class in all other three-year periods. This results in a frequency given by the following equation.

$$F = \frac{2N + 1}{2T} \times 100$$

where F = frequency (in percent) of the occurrence of storms equalling or exceeding the given storm

T = number of days of record

N = number of occurrences of a storm equal to or greater than the given storm

The second method essentially considers only the period of record, in which case the frequency becomes

$$F = \frac{N}{T} \times 100$$

Values of F are the abscissas of points on the frequency curve. Using the second equation above, the largest storm which occurred in the known three-year period would have an abscissa of .0914 percent and would represent the storm which would most probably occur once in three years, i.e., would be the "three-year storm", etc. But this would be contrary to the theory of sampling, where (above) the assumption is made that the largest storm in the known three-year period was the median of the largest storms in a long succession of three-year periods. Therefore, over a long period such as 300 years, it will be exceeded not 100 times, but 50 times; i.e. it is by definition not a "3-year storm", but a "6-year storm".

Either of the above equations could be, and have been used to prepare frequency curves. Although the former is the one most generally used for hydrologic data, the latter method has been used in this case. The use of this formula ($F = 100 N/T$) will result in somewhat more conservative interpretation of the data, and was thought justified in view of the extremely short period of record (3 years).

The points plotted may be represented fairly closely by a continuous curve which frequently approximates a straight line, as may be seen from the figures. The curves shown have, in general, been drawn as lines of visual best fit; occasionally, however, more weight has been placed on the higher values. This tends to give a somewhat more conservative interpretation, which is thought warranted in some cases. The user is free to make his own interpretation of the plotted points.

In view of the shortness of the period of record, some doubt may arise as to the validity of extrapolation from these curves, and as to whether the three years chosen were representative (i.e., that they represent average conditions, and not three years of abnormally high or low waves). In a similar report, on Lake Michigan, (6) hindcasts were made for one station for a period of 12 years (1939-1950) for all storms which were expected to give waves greater than 8 feet. The points determined were compared to those determined from the three-year data. These points fitted a straight line curve very closely and, though the points mostly lay slightly above those determined from the three-year data, the curve was not greatly different from that which had been drawn from the three-year data. Observations of the "average maximum" wave were obtained at this same station by the Milwaukee lightship over the period 10 April 1931 to 28 September 1932 (7) and these points were also compared to those hindcast. Although the exact correspondence between the significant waves hindcast and the "average maximum" waves observed is not known, values should be closely comparable -- and although the observed points lay somewhat higher for the lower waves, agreement was good for the higher waves. The comparison of these various points is shown in Figure 2.

Although these comparisons were made for a station on Lake Michigan, rather than one on Lake Erie, it is thought that the same degree of accuracy should be observed on Lake Erie, and therefore reasonable confidence can be put in the curves shown, at least for values of the waves occurring with frequencies less than about once in 10 years (with the possible exception of Station A).

Although for structural design purposes the important factor is the size of the maximum probable wave (within a certain time period), for computations involving sand movement and littoral drift, a more desirable parameter would be some averaged factor including within it the effect of both height and period, the variation of these parameters, and the duration that waves of each particular category exist. Present day knowledge indicates that sand movement by wave action is best correlated with the amount of energy transmitted forward (and eventually on to the beach) by the waves. The total energy per unit width in each wave is, in deep water

$$E_0 = \frac{wLH^2}{8} \left[1 - 4.93 \left(\frac{H}{L} \right)^2 \right] = \frac{wE}{16\pi} H^2 T^2 \left[1 - 4.93 \left(\frac{H}{L} \right)^2 \right]$$

where w = unit weight of water = 62.4 lbs./cu.ft.

g = acceleration due to gravity = 32.2 ft./sec/sec.

H = wave height (ft.)

T = wave period (sec.)

L = wave length (ft.)

One-half of this energy is transmitted forward from deep water toward the shore, and it is this amount of energy that eventually reaches the shore line. The total energy transmitted forward in any given period of time (E_T) is then $E_0/2$ times the number of waves occurring in that period of time, and

$$E_T = \frac{E_0}{2} \times \frac{(3600t)}{T} = 7.195 \times 10^4 H^2 T t \left[1 - 4.93 \left(\frac{H}{L} \right)^2 \right]$$

where t is the duration of the waves in hours. If some particular time interval (say, one month) is considered during which waves of varying height and period pass a given point toward shore, then the heights and associated periods may be tabulated (as in Tables A-1 through D-1), and there will be n groups. If the height of the i th group is represented by its class mark H_i , and the wave period in that group denoted by T_i , and the duration of the group by t_i , then the total amount of energy transmitted forward during the entire time interval is

$$E_T = E_{T1} + E_{T2} + E_{T3} + \dots + E_{Ti} + \dots + E_{Tn}$$

and

$$E_T = 7.195 \times 10^4 \sum_{i=1}^n \frac{H_i}{T_i} H_i^2 T_i t_i \left[1 - 4.93 \left(\frac{H_i}{L_i} \right)^2 \right]$$

Tables A-4 through D-4 show a tabulation of the average energy transmitted forward from deep water toward the shore during the average ice-free period in each category of height, period, and direction. Thus, for Station B, waves of 1 to 2-foot height and 2 to 3-second period from the north may be expected to transmit forward toward the shore 4724×10^4 foot-pounds per foot of wave crest each ice-free period. Waves of 1 to 2-foot height and 2 to 3-second period (all directions) would be expected to send forward $21,619 \times 10^4$ foot-pounds per foot of wave crest each ice-free period; waves of 1 to 2-foot height from the north (all periods) would be expected to send forward 6165×10^4 foot-pounds of energy per foot of wave crest; and waves of 1 to 2-foot height (all periods and directions) would be expected to transmit toward the shore $29,921 \times 10^4$ foot-pounds of energy per foot of wave crest each ice-free period. Tables A-5 through D-5 show a similar tabulation for the average full year. Since the values in Tables A-1 through D-1 represent significant wave height and period, these energy values are those obtained if the

wave system is uniform and consists only of waves of significant height and period. Wave trains in nature are, however, exceedingly irregular, and have less energy than that determined by the significant wave concept. The relationship between the actual energy contained in any given wave train and that computed from the significant wave has been examined somewhat by personnel at Scripps Institution of Oceanography (8) and more recently by Barber (9) and Darbyshire (10), and has been found to be very nearly a constant ratio (on the order of 0.58). The energies given, therefore, may be considered to be the true value of the energy multiplied by some nearly constant value, and hence can be used to determine quite accurately ratios of energies from different directions. These latter represent very closely the ratios of the drift-producing forces. Summations of these energies for each direction and period grouping are shown in Figures A-4 through D-4.

All the wave data given in the tables refer to deep water conditions -- that is, depths greater than one-half the wave length. As such, interpolation between stations to obtain values for other points along the shore is quite valid, and it is felt that adequate deep water hindcast values may be thus obtained for all points on the shores of Lake Erie in the United States.

Although the deep water data are useful for many types of design work, particularly for preliminary considerations, it is usually the in-shore, shallow water data which are of most interest. These data may be readily obtained from the deep water data through the use of refraction diagrams. A partial example for Ludington Harbor on Lake Michigan has been worked out and presented in the publication dealing with wave statistics on that lake (6), to which the reader may refer if unacquainted with the techniques involved.

LAKE LEVELS*

The levels of the Great Lakes fluctuate from year to year and from month to month during each year, depending upon the volume of water in the lakes. Continuous records of lake levels have been kept by the Corps of Engineers since 1860. A summary of these records for Lake Erie is shown in Figure 3, which is a hydrograph of the monthly average levels from 1860 to date. The monthly average was chosen to eliminate the effects of short period barometric or wind induced changes in stage. For Lake Erie, the average level during the period of record (1860-1952) was 572.31 feet (above mean tide at New York, 1935 Datum), the highest one-month average of 574.60 occurring in April 1952 and the lowest of 569.43 occurring in February 1936. The difference between the highest and lowest monthly average levels is thus 5.17 feet, although the seasonal variation usually ranges

*Much of the following data on lake levels is taken almost verbatim from an unpublished report by the Great Lakes Division, Corps of Engineers, entitled "Preliminary Examination Report on Property Damage on the Great Lakes" issued in June 1952(11).

MONTHLY MEAN WATER LEVELS OF LAKE ERIE
 DATA COMPILED BY U.S. LAKE SURVEY, CORPS OF ENGINEERS
 FIG. 3

between one and two feet (having an average range of 1.6 feet). The greatest range in level in a single season between the high and low month was 2.8 feet, and the lowest was 0.5 feet. The usual pattern of seasonal variation shows high levels in the summer and low levels in late winter (Figure 4). The highest monthly average level is usually reached in June and the lowest in February, though occasionally seasonal fluctuations have departed greatly from this pattern.

Figure 5 shows the percentage of time that the seasonal high average monthly level reached various elevations on Lake Erie for single, two, three, four, and five consecutive years. For example, it shows that the high monthly average each year reached elevation 571 feet or higher 98 percent of the time, reached elevation 572 feet or higher 89 percent of the time, reached elevation 574 feet or higher 14 percent of the time, and so on. It also shows that while the high monthly average level reached 572 feet or higher 89 percent of the time in single years, it reached this elevation only 82 percent of the time in two consecutive years, only 75 percent of the time in three consecutive years, only 70 percent of the time in four consecutive years, and only 63 percent of the time in five consecutive years.

Superimposed on the long range and seasonal fluctuations resulting from the actual quantities of water present in the lake, are daily and even hourly fluctuations resulting from an unbalance or tilting of the lake surface. These are induced primarily by winds, though some have attempted to ascribe them to differential barometric pressures. Figure 6 is derived from data given in a report by the Great Lakes Division Engineer (11) and shows the frequency of occurrence of short period fluctuations at various gage sites on Lake Erie during the period of record. Short-period rises at intermediate points between gage sites depend upon local conditions, but reference to the figures for points in the vicinity will provide an indication of the rises to be expected.

It has been found (12,13) that, at least for shallow water areas, the rise in level due to wind stress may be predicted quite accurately by the formula

$$S = 1.165 \times 10^{-3} \frac{V^2 F}{D} N \cos \alpha$$

where S is the total set-up (difference in water surface elevations at the windward and leeward sides of the lake) in feet, F is the fetch length in statute miles, V is the average wind velocity over the fetch in miles per hour, D is the average depth in feet of that portion of the lake that is more or less contiguous to the fetch, α is the angle between the wind and the fetch, and N is a shape coefficient dependent on the planform and nearshore hydrography of the particular area. Though methods of computing N are available, unless the area is a very marked convergent bay, it is usually sufficient to assume values of $N = 1$. The actual rise in water surface elevation above still water level will be slightly greater than $S/2$ depending on the nearshore hydrography; an average value of 0.57 has been in general use, and is quite adequate. Although this formula has been checked quite adequately for shallow areas (experimental tanks, the Zuider-Zee, and Lake Okeechobee) extension to deeper waters, as Lake Erie, may be unwarranted, and it should be used with some caution.

AVERAGE SEASONAL FLUCTUATION
LAKE ERIE

1860-1951

FROM REPORT BY GREAT LAKES
DIVISION ENGINEER JUNE 1952

FIG. 4

FIG. 5

FIG. 6

REFERENCES

1. Sverdrup, H. U. and W. H. Munk, Wind Sea and Swell: Theory of Relations for Forecasting, H. O. Pub. 601, 1947.
2. Arthur, R. S., Revised Wave Forecasting Graphs and Procedures, Scripps Inst. of Oceanog. Wave Report 73, 1947 (unpub.).
3. Bretschneider, C. L., Revised Wave Forecasting Relationships, Proceedings of the 2nd Conf. on Coastal Engineering, 1951.
4. Hydrographic Office, Techniques for Forecasting Wind Waves and Swell, H. O. Pub. 604, 1951.
5. Hydrometeorological Section, U. S. Weather Bureau, Analysis of Winds over Lake Okeechobee During Tropical Storm of August 26-27, 1949, Hydromet. Report 26, 1951.
6. Saville, T., Jr., Wave and Lake Level Statistics for Lake Michigan, Beach Erosion Board Tech. Memo. 36, 1953.
7. Milwaukee District, Corps of Engineers, Lake Michigan Wave Measurements at Milwaukee, Wisconsin, Misc. Report 20/203-1, 1933 (unpub.).
8. Scripps Institution of Oceanography, A Statistical Study of Wave Conditions at Five Open Sea Localities Along the California Coast, Wave Report 68, 1947 (unpub.).
9. Barber, N. F., Ocean Waves and Swell, London Institution of Civil Engineers, Maritime and Waterways Division, 1950.
10. Darbyshire, J., The Generation of Waves by Wind, Proceedings of the Royal Society, Series A, Vol. 215, No. 1122, 1952.
11. Great Lakes Division, Corps of Engineers, Preliminary Examination Report on Property Damage on the Great Lakes Resulting from Changes in Lake Level, June 1952 (unpub.).
12. Keulegan, G. H., Wind Tides in Small Closed Channels, Jour. Res., Nat'l. Bur. Stds., RP 2207, v. 46, n.5, 1951.
13. Saville, T., Jr., Wind Set-up and Waves in Shallow Water, Beach Erosion Board Tech. Memo. 27, 1952.

WAVE AND LAKE LEVEL STATISTICS
FOR
LAKE ERIE

APPENDIX A
WAVE STATISTICS
FOR
STATION A
MONROE, MICHIGAN

TABLE A-1
STATISTICAL HINDCAST DATA FOR LAKE ERIE STATION A, MONROE, MICHIGAN
Duration given in hours. Height and period, sometimes include lower value but not the upper.

JANUARY

Period	1-2 Seconds				2-3 Seconds				3-4 Seconds				4-5 Seconds				5-6 Seconds				7-8 Seconds			
	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total
2-10	NE	12	6	6	24																12	6	6	24
	E		24	24																		24	6	30
	ENE	12	18	30		6	6	12														12	24	36
	SE	6		6																				
	SEA	6		6																				
1-2	Total	24	30	54	54	6	6	12													24	30	36	90
	NE	18		18	18	6	6	12													6	6	6	18
	ENE					24	24	24																
	E					24	24	24					6	6	12									
	SEA					6	12	18														6	12	18
2-3	Total	18		18	18	24	24	42					6	6	12						6	12	18	36
	NE					12	6	18													12	6	18	36
	E						6	6					18	18							18	6	24	42
	ENE												6	6										
	SEA												6	6										
3-4	Total												24	24										
	NE					6		6													6	6	12	24
	E												18	6	12									
	ENE												6	6	12									
	SEA												6	6	12									
4-5	Total					6		6					24	12	36						6	12	18	36
	NE																							
	E																							
	ENE												6	6										
	SEA																							
5-6	Total																							
	NE																							
	E																							
	ENE																							
	SEA																							
TOTAL																								
CALM																								
TOTAL																								

FEBRUARY

Period	1-2 Seconds				2-3 Seconds				3-4 Seconds				4-5 Seconds				5-6 Seconds				7-8 Seconds			
	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total
2-10	NE	24	6	30																	24	6	6	36
	E		12	12																	6	12	6	24
	ENE	12		12																	6	6		12
	SE	6		6																				
	SEA	6		6																				
1-2	Total	24	18	42																	30	18	12	60
	NE	24		24																	24			24
	E																				6	12	18	36
	ENE																				6	6	12	24
	SEA																							
2-3	Total																							
	NE																							
	E																							
	ENE																							
	SEA																							
3-4	Total																							
	NE																							
	E																							
	ENE																							
	SEA																							
4-5	Total																							
	NE																							
	E																							
	ENE																							
	SEA																							
5-6	Total																							
	NE																							
	E																							
	ENE																							
	SEA																							
TOTAL																								
CALM																								
TOTAL																								

TABLE A-1
STATISTICAL HINDCAST DATA FOR LAKE ERIE STATION A, MONROE, MICHIGAN
Duration given in hours. Height and period groupings include lower values but not the upper.

Wave Height (ft)	Period	1-2 Seconds				2-3 Seconds				3-4 Seconds				4-5 Seconds				Seconds				1-5 Seconds			
		1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total
.5-1	NE	6			6																	6			6
	ENE				6	6			6	6													12		12
	ESE	12			12																	12			12
	SE	6			6																	6			6
	Total	24			36				6	6												24			42
1-2	NE	12	6		18	42	6	12	60													54	12	12	78
	ENE				6	6	6	24	48													6	6	24	48
	E									6												6			6
	ESE	6			6	6	12	12	30	12				12								24	12	12	48
	Total	18	6		24	66	24	66	156	18				18								102	30	66	198
2-3	NE	6			6	30			6	34												36			92
	ENE					18			18					6	6							18	6		24
	E					6	6		12	12	18											18	24		62
	ESE													6	6								6	6	6
	Total	6			6	54	6	6	66	18	18	18	54									78	24	24	126
3-4	NE					34			34	6												42			42
	ENE								6	6				12	12										18
	E													6	6							6			6
	ESE								12	12				6	6							6	12	12	30
	Total					34			54	6	18	24	48									42	18	42	102
4-5	NE									6				6	12							6			12
	ENE									6	6	12										6	6	12	30
	E									6				6	6							6	6	12	30
	ESE													6	6							6	6	12	30
	Total									6	12	18	36									6	12	24	42
5-6	NE									18												18			18
	ENE									6												6			6
	E									6												6			6
	ESE																								
	Total									24												24			24
TOTAL		48	6	12	66	156	70	96	382	48	78	60	186					6	6			252	114	174	540
CALM																									
TOTAL HOURS																						992	628	824	1624

APRIL

Wave Height (ft)	Period	1-2 Seconds				2-3 Seconds				3-4 Seconds				4-5 Seconds				Seconds				1-5 Seconds			
		1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total
.5-1	ENE	18			18	12			12													30			30
	E	6			6	6			6													12			12
	ESE		12		12	6			6													6	12		18
	SE			6	6																		6		6
	Total	24	12	6	42	24			24													48	12	6	66
1-2	NE					6	6																6		6
	ENE					30			12	42	6											36			48
	E						12		12					6									18		18
	ESE					6	24		30	18												24	24		48
	Total					36	36	18	90	34	6			30								60	42	18	120
2-3	NE									6				6	6										
	ENE						6	6	12					6	6							6	12	18	36
	E													18	18								18	18	36
	ESE					6			6	6				6	12							12		6	18
	Total					6	6	6	18	6				36	32							12	6	24	60
3-4	ENE									18				6	24	6						24			30
	E									12	6	18											12	6	18
	ESE													12	12								12	12	24
	Total									30	12	24	54	6								24	12	24	60
4-5	E													18	18										
	ESE																								
	Total																								
	E																								
	Total																								
TOTAL		24	12	6	42	66	42	24	132	48	18	84	150	6				6	6			144	72	120	336
CALM																									
TOTAL HOURS																						576	648	600	1824

TABLE A-1

STATISTICAL HINDCAST DATA FOR LAKE ERIE STATION A, MONROE, MICHIGAN

Duration given in hours. Height and period groupings include lower value but not the upper.

MAY

HEIGHT/FEET	Period	1-2 Seconds				2-3 Seconds				3-4 Seconds				4-5 Seconds				1-5 Seconds			
		1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total
5-1	NE	12			12													12			12
	ENE		12		12														12		12
	ESE	12		6	18													12		6	18
	SE	12			12													12			12
	TOTAL	36	12	6	54													36	12	6	54
1-2	ENE	24			24	24			24									48			48
	E					24	6	6	36									24	6	6	36
	ESE						18		18			6	6						18	6	24
	SE					6	6	30	42									6	6	30	42
	TOTAL	36			36	54	24	36	108			12	12					54	12	36	102
2-3	ENE					12	6	12	30			6	6					12	6	18	36
	E							12	12			12	12			6	6			30	30
	ESE							18	18	6	12		18					6	12	18	36
	SE																				
	TOTAL					12	6	42	60	6	12	18	36			6	6	12	18	48	102
3-4	NE									12			12					12			12
	ENE							6	6											6	6
	E							6	6											6	6
	ENE																				
	TOTAL							12	12	12			12					12		12	24
4-5	E											6	6			12	12			18	18
	ESE										6		6					6			6
	SE											6	12							18	24
	ESE																				
	TOTAL										6	12	18			12	12	6		18	36
TOTAL		66	12	6	84	84	36	70	210	24	12	30	66			18	18	126	60	156	378
CALM																		570	684	600	1854
TOTAL HOURS																		798	798	798	2394

JUNE

HEIGHT/FEET	Period	1-2 Seconds				2-3 Seconds				3-4 Seconds				1-5 Seconds			
		1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total
5-1	ENE	6	12	6	24									6	18	6	30
	E			6	6			12	12							18	18
	ESE		6	6	12	6			6					6	6	6	18
	SE			6	6			12	12							18	18
	TOTAL	6	18	12	36	6		24	42					12	24	24	60
1-2	NE	12			12	36	42		78	12		12	36	36			90
	ENE	6			6	36	18		54				42	18			60
	E					6	12	12	30			12	12	6	12	24	42
	ESE		12		12	12		24	36				12	12	18	42	60
	TOTAL	18	12		30	84	72	36	192	12	12	24	102	102	36	42	216
2-3	NE					6			6					6			6
	ENE									6			6	6			18
	E									18	6		24	18	6		42
	ESE							6	6	6	12		18	6	18		42
	TOTAL					6	6	12	30	24	18		48	36	24		108
3-4	NE																
	E																
	ESE																
	SE																
	TOTAL																
TOTAL		24	36	30	90	96	60	54	210	36	30	12	78	156	156	138	450
CALM														549	549	549	1647
TOTAL HOURS														720	720	720	2160

TABLE A-1

STATISTICAL HINDCAST DATA FOR LAKE ERIE STATION A, MONROE, MICHIGAN
Duration given in hours. Height and period groupings include lower value but not the upper.

JULY

HEIGHT (FEET)	Period	1-2 Seconds				2-3 Seconds				3-4 Seconds				4-5 Seconds			
		1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total
5-1	NE		6		6		6		6						12		12
	E	6	6		12									6	6		12
	ESE	6		6	12	6			6					12		6	18
	SE	12	12		24	6	6		12					18	18		36
	SSE	12			12									12			12
	TOTAL	36	24	6	66	12	12		24					48	36	6	90
1-2	NE		6		6	24			24					24	6		30
	ENE	6	12		18	6	18		24					12	30		42
	E		6		6	6	6	12	24	6			6	12	12	12	36
	ESE		6		6	24	18	12	54					24	24	12	60
	SE	6	6	12	24	24			24					30	6	12	48
	SSE	6			6	6			6					12			12
	TOTAL	18	36	12	66	90	42	24	156	6			6	114	78	36	228
2-3	NE					6			6					6			6
	ENE					6	6		12		12		12	6	18		24
	E						12		12	6			6	6	12		18
	ESE										6		6		6		6
	TOTAL					12	18		30	6	18		24	18	36		54
3-4	ENE					6			6					6			6
	E										6		6		6		6
	TOTAL					6			6		6		6	6	6		12
4-5	NE										6		6		6		6
5-6	NE											12	12			12	12
	TOTAL	54	60	18	132	120	72	24	216	12	30	12	54	186	162	54	402
	CALM													520	502	470	1492
	TOTAL HOURS													724	724	724	2232

AUGUST

HEIGHT (FEET)	Period	1-2 Seconds				2-3 Seconds				3-4 Seconds				4-5 Seconds			
		1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total
5-1	NE	36			36	6			6					42			42
	ENE	12	6		18	6			6					18	6		24
	E	18			18	6		18	24					24		18	42
	ESE		6	24	30				24	24					6	48	54
	SE			6	6				12	12						18	18
	SSE	12			12									12			12
	TOTAL	78	12	30	120	18		54	72					96	12	84	192
1-2	NE	12	18		30	24	12	6	42					36	30	6	72
	ENE					12	24	18	54					12	24	18	54
	E						12	12	24						12	12	24
	ESE					6	6	6	18					6	6	6	18
	SE					6	6	12	24					6	6	12	24
	TOTAL	12	18		30	48	60	54	162					60	78	54	192
2-3	NE					12	6		18					18	6		18
	E						12		12						12		12
	TOTAL					12	18		30					6	18		36
3-4	NE									6				6	6		6
	TOTAL	90	30	30	150	78	78	108	264	12			12	180	108	138	426
	CALM													564	526	606	1696
	TOTAL HOURS													724	724	724	2232

TABLE A-1
STATISTICAL HINDCAST DATA FOR LAKE ERIE STATION A, MONROE, MICHIGAN
Duration given in hours. Height and period groupings include lower values but not the upper.

[illegible]

OCTOBER

	1-2 Seconds				2-3 Seconds				3-4 Seconds				Seconds				1-4 Seconds			
Measurements	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total
NE		12	6	18													12	6	18	
ESE		6		6		6	6	12									12	6	18	
SSE	12		6	18	6		6	12					6	12	12	30				
SSW		12	24	36	6		18	24					18			36	42			
SW	6			6									6			6				
Total	18	30	24	72	12	6	24	42					30	24	36	90				
NE		30		30	6	12	36	54					6	48	30	84				
ESE		6		6	24	12	12	48					24	18	12	54				
SSE		6		6	6	6	18	30		6	6	12	6	18	24	48				
SW	6			6	30	12	6	48	6	6		12	42	18	6	66				
SSW					36	12	12	60					36	12	12	60				
SW					12		6	18					12			24				
Total	6	42		48	114	60	84	258	6	12	6	24	126	114	90	330				
NE					6		6	12					6			12				
ESE					6	6	6	18		6		6	6			24				
SW					6		12	18	6			6	18			36				
Total					12	24	36	78	6	6		12	30			60				
NE							12	12								24				
+ ESE										6		6				12				
TOTAL	24	72	24	120	138	66	150	354	12	24	6	42	174	162	180	516				
CALN																	570	588	267	1425
TOTAL HOURS																	222	228	728	2228

TABLE A-1

STATISTICAL HINDCAST DATA FOR LAKE ERIE STATION A, MONROE, MICHIGAN
Duration given in hours. Height and period groupings include lower values but not the upper.

NOVEMBER

HEIGHT/FEET	Period	1-2 Seconds				2-3 Seconds				3-4 Seconds				4-5 Seconds				5-6 Seconds															
		1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total												
1-5-1	NE	6			6													6			6												
	E		6		6														6		6												
	ESE	6			6	12			12									18			18												
	SE			12	12															12	12												
	Total	12	6	12	30	12			12									24	6	12	42												
1-2	ENE							6	6											6	6												
	E					12	12		24									12	12		24												
	ESE					18	6	12	42	6			6					24	6	18	48												
	SE					18			18									18			18												
	Total					48	18	24	102	6			6					34	18	36	108												
2-3	ENE									6			6					6			6												
	E							6	6									6			6												
	ESE					12			12	12			12					24			24												
	SE							12	12				12	12						24	24												
	Total					12	6	12	30	18			24	24				24	6	24	60												
3-4	E											6	6					6			6												
	ESE									12			12					12			12												
	SE					6			6	6			6					12			12												
	Total					6			6	18			24					12	18		30												
	4-5	NE											6	6					6			6											
E												6	6					6			6												
ESE												6	6							6	6												
Total												12	6	12						12	18												
5-6		ESE																6	6		6												
TOTAL	12	6	12	30	78	24	48	120	30	30	18	78					6	6	120	60	84	264											
CALM																		600				660				636				1896			
TOTAL HOURS																		720				720				720				2160			

DECEMBER

HEIGHT (FEET)	Period	1-2 Seconds				2-3 Seconds				3-4 Seconds				4-5 Seconds				5-6 Seconds				7-8 Seconds			
		1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total
2-1	E		6		6																	12			12
	ESE	6	6	12	24																	6	6	12	24
	SE		6	6	12			6	6													6	12	18	
	Total	6	12	18	42			6	6	12												6	24	30	60
	NE							6	6														6		6
1-2	ENE			6	6			12		6												12	6	6	24
	E					18	48	6	72		12		12									18	48	6	84
	ESE							48	48													48			48
	SE							6	6													6			6
	SSE							6	6													6			6
2-3	Total			6	6	24	72	6	150	6	12		18									30	132	18	174
	ENE					6		6	12													6			12
	E										12		12										12		12
	SE							6	6		6		6										12		12
	Total					6	6	6	18	18		18										6	24	6	36
3-4	ESE							6	6			12	12			6	6								24
	SE										12		12									12			12
	Total							6	6		12	12	24			6	6					12	24		36
	E																								
	ESE															6	6					12			12
6-7	Total															12	12					6	6		18
	ESE																								
	Total																								
	ESE															6	6								12
	Total															12	12					6	6		18
7-8	E																								
	ESE																								
	Total																								
	ESE															6	6								12
	Total															12	12					6	6		18
8-9	E																								
	Total	6	18	24	48	30	132	24	186	6	42	12	60									6	6		12
	E																								
	Total																								
	Total																								
TOTAL		6	18	24	48	30	132	24	186	6	42	12	60					30	30			12	12	42	192
CALM																									
	TOTAL HOURS																								
TOTAL																									

TABLE A-2
STATISTICAL WINDCAST DATA FOR LAKE ERIE STATION A, MONROE, MICHIGAN
FULL YEAR

Period	1-2 Seconds				2-3 Seconds				3-4 Seconds				4-5 Seconds				5-6 Seconds				7-8 Seconds			
	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total
5-1	NE	92	30	18	140	6	6		12												101	74	18	193
	ENE	92	48	18	158	12	12		24												60	60	48	168
	E	92	60	18	170	24	6	30	60	18			18								90	64	48	202
	ESE	38	60	90	208	66	12	36	114												120	72	126	318
	SE	34	30	60	124	18	12	48	78												72	42	108	222
	SSE	36	6	18	60			6	6													36	6	24
Total	320	228	222	770	132	48	120	300	18			18									480	322	324	1126
1-2	NE	90	60	6	156	178	96	72	346		12		12								288	168	78	534
	ENE	42	18	6	66	198	132	138	468	12			12								252	150	108	510
	E		12		12	162	186	78	426	24	30	20	84								186	228	108	522
	ESE	12	18		30	108	198	96	402	48	6	6	60								168	222	102	492
	SE	6	12	12	30	120	48	108	276												126	60	120	306
	SSE	12			12	36	6	24	66												48	6	24	78
Total	162	130	24	316	822	666	316	2004	84	48	36	168								1044	822	324	2478	
2-3	NE	6			6	78	12	24	114				6	6							84	12	30	126
	ENE					60	18	30	108	12	12	18	42								72	30	48	150
	E					6	36	30	72	60	34	36	130				6	6			66	90	72	228
	ESE					24	6	24	54	48	62	18	128								72	48	42	162
	SE					18	6	30	54	12	12	24	48								30	18	54	102
	SSE							12	12															12
Total	6			6	186	78	120	414	132	170	102	404				6	6				324	198	230	752
3-4	NE					54		12	66	24	6	6	36								78	6	18	102
	ENE					6		12	18	30	6	24	60	6		6	12				42	6	42	90
	E							6	6			42	18	60		6	12	18			48	36	84	
	ESE							18	18	12	24	30	66				6	6			72	24	24	90
	SE					6		6	18	18	6	18	42								12	18	18	48
	Total					96	48	114	258	96	96	96	384	6	6	24	36				144	102	168	414
4-5	NE									6	12	24	42								6	12	12	24
	ENE									6	6	12	24								6	6	12	24
	E										12	36	48	6		18	24				6	12	24	
	ESE									6	6	12	24								6	6	12	24
	Total									18	36	84	138	6		18	24	6			6	30	36	72
	5-6	NE										18	24	42									18	24
ENE										6	6	12									6	6	12	
E											6	6	12				24	24				6	30	36
ESE																	6	6				6	6	
Total										6	30	30	66				30	30				6	30	60
6-7		NE																						
	ENE																							
	E																							
	ESE																							
	Total																							
	7-8	NE																						
ENE																								
E																								
ESE																								
Total																								
8-9		NE																						
	ENE																							
	E																							
	ESE																							
	Total																							
	9-10	NE																						
ENE																								
E																								
ESE																								

TABLE A-3
STATISTICAL HINDCAST DATA FOR LAKE ERIE STATION A, MONROE, MICHIGAN
(ICE-FREE PERIOD (1 APRIL - 30 NOV))

Duration given in hours. Height and person groupings include lower value but not the upper

Duration given in hours. Height and person groupings include lower value but not the upper

HEIGHT (FEET)	Period	1-2 Seconds				2-3 Seconds				3-4 Seconds				4-5 Seconds				5-6 Seconds				1-6 Seconds			
		1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total
3-1	NE	54	18	6	78	6	6		12													60	24	6	90
	ENE	36	36	6	78	18	12	24	54													34	48	30	112
	E	48	24	12	84	18		30	48	18			18									84	24	42	150
	ESE	24	42	54	120	60	6	30	96													84	48	84	216
	SE	36	24	42	102	18	12	42	72													54	36	84	174
	SSE	30	6	18	54			6	6													30	6	24	60
	Total	228	150	138	516	120	36	132	288	18			18									366	186	270	822
1-2	NE	24	54	6	84	96	72	42	210		12		12									120	138	48	306
	ENE	36	18		54	180	72	72	324	6			6									222	90	72	384
	E		12		12	120	84	60	264	18	12	18	48									138	108	78	324
	ESE	6	18		24	192	114	66	392	36	6	6	48									144	138	72	354
	SE	6	6	12	24	102	42	90	234													108	48	102	258
	SSE	12			12	36		18	54													48		18	66
	Total	84	108	18	210	636	348	348	1368	60	30	24	114									780	522	390	1692
2-3	NE					30	6	18	54				6	6								30	6	24	60
	ENE					36	18	24	78	12	12	12	36									48	30	36	114
	E						30	18	48	30	6	30	66		6	6						30	24	54	108
	ESE					24	6	24	54	42	36	6	84									66	42	30	138
	SE					6		24	30	6		12	18									12		36	48
	Total					96	60	108	264	90	54	66	210			6	6						186	114	180
3-4	NE						12	12	18		6	24										18	18		36
	ENE					6		6	12	18		6	24	6				6				30		12	42
	E						6	6			24	6	30		6	6							18	42	
	ESE										6	12	30									6	18	12	30
	SE					6		6	6				6									12			12
	Total					12		24	26	48	36	30	114	6		6	12					66	36	60	162
4-5	NE									12	12	24											12	12	24
	E									6	36	42			12	12						6	6	48	54
	ESE									6	6	6	18									6	6	6	18
	Total									6	24	54	84			12	12					6	24	66	96
5-6	NE										24	24												24	24
	E										6	6			18	18							24	24	
	ESE														6	6							6	6	
6-7	Total										30	30			24	24								54	54
	E										6	6			12	12								18	18
7-8	E														6	6								12	12
8-9	E														6	6			6	6				12	12
9-10	ENE														6	6								6	6
	E														6	6								6	6
	Total														12	12								12	12
	TOTAL	312	258	156	726	864	480	612	1956	222	144	210	576	6		84	90			6	6	1404	882	1260	3546
	CALM																								
	TOTAL HOURS																								

TABLE A-4
STATISTICAL ENERGY DATA FOR LAKE ERIE STATION A, MONROE, MICHIGAN
ICE-FREE PERIOD (1 APRIL - 30 NOV)

Energy given in foot-pounds per foot of crest per year $\times 10^{-4}$.
Height and period groupings include lower value but not the upper

Height (feet)	Period					
	Dir.	1-2 Seconds	2-3 Seconds	3-4 Seconds	4-5 Seconds	5-6 Seconds
5-1	NE	155	40			195
	ENE	155	182			937
	E	166	161	85		412
	ESE	238	324			962
	SE	202	242			444
	SSE	107	20			127
	Total	1023	969	85		2077
1-2	NE	623	2802	226		3651
	ENE	400	4324	113		4837
	E	89	3523	904		4516
	ESE	178	3763	904		4845
	SE	178	3123			3301
	SSE	89	721			810
	Total	1557	18256	2147		21960
2-3	NE		1963	312		2275
	ENE		2835	1874		4709
	E		1745	3436	404	5385
	ESE		1963	4373		6336
	SE		1091	937		2028
	Total		9597	10932	404	20933
3-4	NE		829	2430		3259
	ENE		829	2430	789	4048
	E		415	3038	789	4242
	ESE			3038		3038
	SE		415	608		1023
	Total		2488	11544	1578	15610
4-5	NE			3977		3977
	E			4959	2598	9557
	ESE			2983		2983
	Total			13919	2598	16517
5-6	NE			5864		5864
	E			1466	5795	7261
	ESE				1932	1932
	Total			7330	7727	15057
6-7	E			2016	5366	7382
	Total					
7-8	E				3549	4401
	Total					
8-9	E				4524	4524
	Total					
9-10	E				5602	5602
	Total					
TOTAL					11202	11202
TOTAL		2580	31310	47973	36950	4401
						123214

TABLE A-5
STATISTICAL ENERGY DATA FOR LAKE ERIE STATION A, MONROE, MICHIGAN
FULL YEAR

Energy given in foot-pounds per foot of crest per year $\times 10^{-6}$.
Height and period groupings include lower value but not the upper

Height (feet)	Period					
	Dir.	1-2 Seconds	2-3 Seconds	3-4 Seconds	4-5 Seconds	5-6 Seconds
5-1	NE	285	40			325
	ENE	214	202			418
	E	250	202	85		537
	ESE	404	383			787
	SE	285	262			547
	SSE	119	20			139
	Total	1357	1109	85		2751
1-2	NE	1157	4884	226		6267
	ENE	489	6245	226		6960
	E	89	5685	1582		7356
	ESE	222	5865	1130		6717
	SE	222	3683			3905
	SSE	89	881			970
	Total	2268	26743	3164		32175
2-3	NE		4144	312		4456
	ENE		3926	3186		6112
	E		2417	7808	404	10829
	ESE		1963	5422		7385
	SE		1963	2499		4462
	SSE		436			436
	Total		15049	18427	404	33880
3-4	NE		4562	3645		8207
	ENE		1244	6075	1578	8897
	E		415	6075	2366	8856
	ESE		1244	6683	787	8716
	SE		415	4253		4668
	SSE					
	Total		7880	26731	4733	39344
4-5	NE			6959		8551
	ENE			3977		3977
	E			7954	5196	13150
	ESE			3977		3977
	Total			22867	5196	29655
	NE			10262		10262
	ENE			2932		2932
5-6	E			2932		10659
	ESE				7127	11932
	Total			16126	9659	25785
	E			2016		12380
	ESE				3315	2683
	Total			2016	10732	16063
	E				3549	7550
7-8	ENE				3549	3549
	SE				3549	3549
	Total				10647	15048
	E				6524	10158
	ENE				5602	5602
	E				5602	5602
	Total				11204	11204
TOTAL		3825	59781	89416	37099	14942
						216063

FIG. A-1

FIG. A-2

FIG. A-3

AVERAGE AMOUNT OF ENERGY TRANSMITTED SHOREWARD PER FOOT OF CREST LENGTH PER YEAR, IF WAVE SYSTEM IS CONSIDERED AS AN HYPOTHETICAL UNIFORM SYSTEM COMPOSED OF WAVES OF SIGNIFICANT HEIGHT AND PERIOD ONLY.

LAKE ERIE - STATION A (Monroe)

FIG. A-4

WAVE AND LAKE LEVEL STATISTICS
FOR
LAKE ERIE

APPENDIX B
WAVE STATISTICS
FOR
STATION B
CLEVELAND, OHIO

TABLE B-1
STATISTICAL HINDCAST DATA FOR LAKE ERIE STATION B, CLEVELAND, OHIO
Duration given in hours. Height and period groupings include lower value but not the upper

		JANUARY																			
Direction	Period	1-2 Seconds				2-3 Seconds				3-4 Seconds				4-5 Seconds				1-5 Seconds			
		1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total
1-1	NW					6	6	12										6	6	12	
	N		6	6	12	12			12									18	6	24	
	NNE	6			6	12	6	15										6	12	6	24
	ENE	6	6	6	18	20	12	42										6	24	18	60
	Total	24			24	42	12	54	6	6	12	24						24	42	102	
1-2	WNW					12	12	24	6	6	12	24						18	18	12	48
	W					6	6	30	42									6	6	30	42
	WNW					6	6	12										6	6	12	
	N	12			12	12	18	30										24	18	42	
	Total	6			6	12	6	18	6	12	18	36						24	12	24	60
2-3	ENE	6			6	12	12	18	6	6								18	12	30	
	Total	48			48	76	54	90	180	24	24	42	90					168	78	90	336
	W					12	12	6	30	24	24	6	54					36	36	12	84
	WNW					12	12	12	36	12	12	18	42					24	24	30	78
	Total					6	6			6	6							6	6	12	
3-4	WNW											6	6							6	6
	N										6	12	18						6	12	18
	NNE					6	6	12				6	6						6	12	18
	ENE					12			12			6	6					6	12	12	24
	Total					36	30	30	96	36	54	30	120					6	72	90	240
4-5	W					12			12	12	24		36					12	36		48
	WNW									6		12	18					6		12	18
	NW									6		6						6		6	
	N									6		6						6		6	
	Total									6	6	6	18					6	12	6	24
5-6	ENE									6		6						6		6	
	ENE									6		6		6				6		6	
	Total					12			12	42	36	18	96					42	36	18	120
	W									6	6	6	18	6	12	18	6	12	18	36	
	WNW									6		6	12	12	6	18	6	12	12	30	
6-7	NW											6	6							6	6
	WNW											6	6							6	6
	Total									12	12	18	42					18	18	36	72
	W									6		6						6		6	
	WNW									6		6		12		12	6	12		18	
7-8	ENE									6		6						6		6	
	ENE									6		6						6		6	
	Total									12		12		12		12	12	12	6	30	
	W									6		6						6		6	
	WNW									6		6		6		6	6	6	6		6
TOTAL		54	6	6	66	132	126	90	348	132	126	132	390	54	18	72	144	318	312	246	876
CALM																		426	432	478	1336
TOTAL HOURS																		744	744	744	2232

TABLE 9-4
STATISTICAL HINDCAST DATA FOR LAKE ERIE STATION 9, CLEVELAND, OHIO
Duration given in hours. Height and period groupings include lower value but not the upper.

FEBRUARY

Period	1-2 Seconds				2-3 Seconds				3-4 Seconds				4-5 Seconds				5-6 Seconds			
	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total
1-2																				
W				6				6												6
WNW	12			12				6				6					12			6
N	6			6	6			6	12								12			12
NNE	6	6	12	24	12			6	18			6	6				18	6	24	48
NE				6	6			6									6	6		12
Total	24	12	24	60	24			18	42			6	6				48	12	48	108
3-4																				
W				6	6	12	24	42			12	12					6	12	36	54
WNW	6			6	6	6	18	30	6	6		12					18	12	18	48
NW						12	24	36										12	24	36
NNW							12	12									6		12	18
N		6		6	6	18	6	30			6	6					6	24	12	42
NNE					30		12	42	12	6	6	24					42	6	18	66
NE					12		18	30	6		18	24					18		36	54
ESE					6	6		12									6	6		12
Total	6	6		12	72	36	114	222	24	18	42	78					102	72	156	330
5-6																				
W					6	6	12	24	6		12	18					12	6	24	42
WNW					6			6		6		6					6	6		12
NW						6		6			6							12		12
NNW									6		18	24					6		18	24
N										6		6						6		6
NNE					6		6	12	12			12					18		6	24
NE											12	12							12	12
Total					18	12	18	48	24	18	42	60					48	30	60	132
7-8																				
W											6	6			6	6			12	12
WNW									12	12	12	36					12	12	12	36
NW									6		6	12					6		6	12
NNW										6	6	12						6	6	12
N											12	18	6			6	12		12	24
NNE											12	12					12			12
Total									24	18	42	96	6		6	12	42	18	48	108
9-10																				
W											6	6			6	6			6	6
WNW											6	12	12			24	12	18		30
NW											6	6					6			6
NNW												6								6
Total											12	18	18	12		30	24	24		48
11-12																				
W											6	6			6	6			6	6
WNW															6	6			6	6
NW															6	6			6	6
Total															12	12			12	12
TOTAL	30	18	24	72	114	66	150	330	124	72	144	342	20	24	6	40	300	180	324	804
CALM																	176	972	1140	2288
TOTAL HOURS																	676	672	272	2020

TABLE B-1
STATISTICAL HINDCAST DATA FOR LAKE ERIE STATION 6, CLEVELAND, OHIO
Duration given in hours. Height and period groupings include swell alone but not the upper

MARCH																																																																																																																																																																																																																																																																																																			
Year	Period	1-2 Seconds				2-3 Seconds				3-4 Seconds				4-5 Seconds				5-6 Seconds				7-8 Seconds				9-10 Seconds																																																																																																																																																																																																																																																																									
		1942	1943	1944	Total	1943	1944	1945	Total	1944	1945	1946	Total	1945	1946	1947	Total	1946	1947	1948	Total	1947	1948	1949	Total	1948	1949	1950	Total																																																																																																																																																																																																																																																																						
5-9	IN	6		6																																																																																																																																																																																																																																																																																															
	END	6		6																																																																																																																																																																																																																																																																																															
	TOTAL	12		12																																																																																																																																																																																																																																																																																															
	IN					6	6			6		6																																																																																																																																																																																																																																																																																							
	END					12	12			6		6																																																																																																																																																																																																																																																																																							
1-2	IN					6	6			6		6																																																																																																																																																																																																																																																																																							
	END					12	12			6		6																																																																																																																																																																																																																																																																																							
	TOTAL					12	12			6		6																																																																																																																																																																																																																																																																																							
	IN					12	12			6		6																																																																																																																																																																																																																																																																																							
	END					12	12			6		6																																																																																																																																																																																																																																																																																							
2-3	IN					12	12			6		6																																																																																																																																																																																																																																																																																							
	END					12	12			6		6																																																																																																																																																																																																																																																																																							
	TOTAL					12	12			6		6																																																																																																																																																																																																																																																																																							
	IN					12	12			6		6																																																																																																																																																																																																																																																																																							
	END					12	12			6		6																																																																																																																																																																																																																																																																																							
3-4	IN					12	12			6		6																																																																																																																																																																																																																																																																																							
	END					12	12			6		6																																																																																																																																																																																																																																																																																							
	TOTAL					12	12			6		6																																																																																																																																																																																																																																																																																							
	IN					12	12			6		6																																																																																																																																																																																																																																																																																							
	END					12	12			6		6																																																																																																																																																																																																																																																																																							
4-5	IN					12	12			6		6																																																																																																																																																																																																																																																																																							
	END					12	12			6		6																																																																																																																																																																																																																																																																																							
	TOTAL					12	12			6		6																																																																																																																																																																																																																																																																																							
	IN					12	12			6		6																																																																																																																																																																																																																																																																																							
	END					12	12			6		6																																																																																																																																																																																																																																																																																							
5-6	IN					12	12			6		6																																																																																																																																																																																																																																																																																							
	END					12	12			6		6																																																																																																																																																																																																																																																																																							
	TOTAL					12	12			6		6																																																																																																																																																																																																																																																																																							
	IN					12	12			6		6																																																																																																																																																																																																																																																																																							
	END					12	12			6		6																																																																																																																																																																																																																																																																																							
6-7	IN					12	12			6		6																																																																																																																																																																																																																																																																																							
	END					12	12			6		6																																																																																																																																																																																																																																																																																							
	TOTAL					12	12			6		6																																																																																																																																																																																																																																																																																							
	IN					12	12			6		6																																																																																																																																																																																																																																																																																							
	END					12	12			6		6																																																																																																																																																																																																																																																																																							
7-8	IN					12	12			6		6																																																																																																																																																																																																																																																																																							
	END					12	12			6		6																																																																																																																																																																																																																																																																																							
	TOTAL					12	12			6		6																																																																																																																																																																																																																																																																																							
	IN					12	12			6		6																																																																																																																																																																																																																																																																																							
	END					12	12			6		6																																																																																																																																																																																																																																																																																							
8-9	IN					12	12			6		6																																																																																																																																																																																																																																																																																							
	END					12	12			6		6																																																																																																																																																																																																																																																																																							
	TOTAL					12	12			6		6																																																																																																																																																																																																																																																																																							
	IN					12	12			6		6																																																																																																																																																																																																																																																																																							
	END					12	12			6		6																																																																																																																																																																																																																																																																																							
9-10	IN					12	12			6		6																																																																																																																																																																																																																																																																																							
	END					12	12			6		6																																																																																																																																																																																																																																																																																							
	TOTAL					12	12			6		6																																																																																																																																																																																																																																																																																							
	IN					12	12			6		6																																																																																																																																																																																																																																																																																							
	END					12	12			6		6																																																																																																																																																																																																																																																																																							
10-11	IN					12	12			6		6																																																																																																																																																																																																																																																																																							
	END					12	12			6		6																																																																																																																																																																																																																																																																																							
	TOTAL					12	12			6		6																																																																																																																																																																																																																																																																																							
	IN					12	12			6		6																																																																																																																																																																																																																																																																																							
	END					12	12			6		6																																																																																																																																																																																																																																																																																							
TOTAL	IN	12		12	76	72	72	244		150	150	150	450		18	24	48	120		12	12																																																																																																																																																																																																																																																																														
	END																																																																																																																																																																																																																																																																																																		
	TOTAL	12		12	76	72	72	244		150	150	150	450		18	24	48	120		12	12																																																																																																																																																																																																																																																																														
	IN																																																																																																																																																																																																																																																																																																		
	END																																																																																																																																																																																																																																																																																																		
CAL N																												120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120		120	

TABLE B-1
STATISTICAL HINDCAST DATA FOR LAKE ERIE STATION B, CLEVELAND, OHIO
Duration given in hours. Height and period groupings include lower value but not the upper
APRIL

Height (feet)	Period	1-2 Seconds				2-3 Seconds				3-4 Seconds				4-5 Seconds				5-6 Seconds			
		1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total
5-1	WNW			6	6	6			6									18			18
	NE	12			12													12			12
	Total	12			18	6			6									24			24
1-2	W					6			6			6	6					6		6	12
	WNW					12	12		24	6	6		12					18	18		36
	NW						6	18	24									6	18		24
	WNW					30	30	12	72									30	30	12	72
	N						18	6	24				6	6				18	12		30
	NNE					36			36	6	12		18					42	12		54
	NE					18	6	12	36	6			6					24	6	12	42
	Total					102	72	48	222	18	18	12	48					120	90	60	270
2-3	W					18			18									18			18
	WNW					12	6		18	30	18	12	60					42	24	12	78
	NW							6	6	6	6	12	24					6	6	18	30
	WNW							6	12				18						24	6	30
	N									6	18		24					6	18		24
	NNE							6	6				6					6		6	12
	NE					6	6		12		12	12	24					6	18	12	36
	Total					36	18	18	72	48	72	36	156					84	90	54	228
3-4	W									6			6					6			6
	WNW									6		6	12			6		6	6	6	18
	NW									12	18	12	42					12	18	12	42
	WNW									6	6	30	42					6	6	30	42
	N									12			12					12			12
	NNE									12			12			6		6	18		18
	NE									6	6		12	6	6		12	12	12		24
	Total									60	30	48	138	12	12		24	72	42	48	162
4-5	W									6	6	12						6		6	12
	WNW										12	12				6	6		12	6	18
	NW										6	18	24					6	18		24
	WNW											6	6							6	6
	N											6	6							6	6
	NNE											6	6					6		6	12
	NE										6	18		6	6		12	6	12	6	24
	Total									6	24	48	78	12	6	6	24	18	30	54	102
5-6	W													6			6	6			6
	WNW													12			12				12
	NW									12	6	18						12	6		18
	NE										6	6			6	6				12	12
	Total									12	12	24		18	6	12		18	12	18	48
6-7	W													6			6	6			6
	WNW														6		6		6		6
	Total													6	6		12	6	6		12
7-8	WNW														6	6			6		6
	NE													6	6	12		6	6		12
	Total													6	6	12		6	6		12
8-9	W															6	6		6		6
TOTAL		18			18	198	70	66	330	132	156	156	444	48	36	18	102	342	282	240	864
	CALM																				
	TOTAL HOURS																	378	438	480	1296
																		720	720	720	2160

TABLE B-1
STATISTICAL HINDCAST DATA FOR LAKE ERIE STATION B, CLEVELAND, OHIO
Direction given in hours. Height and period groupings include lesser values but not the upper

		MAY																							
Direction	Period	1-2 Seconds				2-3 Seconds				3-4 Seconds				4-5 Seconds				1-5 Seconds							
		1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total				
E-1	W	6		6	12													6		6	12				
	NE							6	6													6	6	6	6
	ENE	6		6	12													6		6	12	12	12	12	12
	ENE							12	12	6		6	12					6		6	12	12	12	12	12
	ENE							6	6			6	6									12	12	12	12
1-2	W																								
	NE																								
	ENE	6				24	24	60	108									30	24	66	120				
	ENE					30	12	30	72									30	12	42	84				
	ENE					30	12	12	60	18	12	6	36					30	12	18	60				
2-3	W																								
	NE																								
	ENE	6				30	60	120	210									120	70	160	350				
	ENE					6	6	6	18									12		6	18				
	ENE					6	6	6	18									12		6	18				
4-5	W																								
	NE																								
	ENE	6				12	12	6	30									12	12	18	42				
	ENE					6	6	12	24									12	12	18	42				
	ENE					6	6	6	18									12	12	18	42				
TOTAL		18	6	24	48	96	192	360	648	216	108	180	420	36	36	6	78	360	216	420	792				
CALM TOTAL HOURS																						360			

		JUNE																							
Direction	Period	1-2 Seconds				2-3 Seconds				3-4 Seconds				1-5 Seconds											
		1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total								
E-1	W	6		6	12													6		6	12				
	NE																								
	ENE	6		6	12													6		6	12	12	12	12	12
	ENE																								
	ENE																								
1-2	W																								
	NE																								
	ENE	6				12	12	6	30									12	12	18	42				
	ENE					6	6	12	24									12	12	18	42				
	ENE					6	6	6	18									12	12	18	42				
2-3	W																								
	NE																								
	ENE	6				12	12	6	30									12	12	18	42				
	ENE					6	6	12	24									12	12	18	42				
	ENE					6	6	6	18									12	12	18	42				
4-5	W																								
	NE																								
	ENE	6				12	12	6	30									12	12	18	42				
	ENE					6	6	12	24									12	12	18	42				
	ENE					6	6	6	18									12	12	18	42				
TOTAL		18	6	24	48	96	192	360	648	216	108	180	420	36	36	6	78	360	216	420	792				
CALM TOTAL HOURS																						360			

TABLE B-1
STATISTICAL HINDCAST DATA FOR LAKE ERIE STATION 8, CLEVELAND, OHIO
Duration given in hours. Higher and period groupings include those within but not the upper

1010

[illegible]

ALGEBRA

TIME	7-2 seconds				2-3 seconds				3-4 seconds				4-5 seconds			
	1948	1949	1950	TOTAL	1948	1949	1950	TOTAL	1948	1949	1950	TOTAL	1948	1949	1950	TOTAL
1-1																
1-2																
2-1																
2-2																
3-1																
3-2																
TOTAL	36	24	30	90	114	114	114	342	34	34	32	100	134	120	134	388
CALCULATED TOTAL HOURS	<div style="display: flex; justify-content: space-between;"> 5:10 PM 5:10 PM </div>															

TABLE B-1
STATISTICAL HINDCAST DATA FOR LAKE ERIE STATION B, CLEVELAND, OHIO
Duration given in hours. Height and period groupings include lower value but not the upper.

SEPTEMBER

Period	1-2 Seconds				2-3 Seconds				3-4 Seconds				4-5 Seconds				1-5 Seconds			
	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total
IV		6	6		6		6										12		12	
NW	12	6	6	24			12	12									12	6	18	36
NNW					12		12	12									12		12	
NN					6		6	6									6		6	
NNE	24			24	6		6	12									30		6	36
NE	6		12	18													6		12	18
Total	42	12	18	72	6	12	18	36									48	12	36	96
IV					12	6		18		6		6					12	12		24
NW					6	12		18		6		6					6	18		24
NNW					12	24	6	42		6		6					12	30	6	48
NN					18	24	6	48									18	24	6	48
NNE		6	6		6	24	12	42									6	24	18	48
NE					78		12	90	12		12	24					50		24	118
Total		6	6	12	126	36	42	276	42	18	18	78					180	114	66	360
IV					6			6		12		12					6	12		18
NW										12	6	18						12	6	18
NNW									6	24	6	36					6	24	6	36
NN						6	6	12		6	6	12						6	12	18
NNE					6		6	12	12			12					18		6	24
NE					12		18	30			24	24					12		42	54
Total					24		30	54	18	54	42	114					42	54	72	168
IV					6		6	12		24		24					6	24	6	36
NW										6		6						6		6
NNW											6	6							6	6
NN										12	6	18					12	6	18	
NNE											6	6							6	6
NE															6	6			6	6
Total					6		6	12		42	24	66			6	6	6	42	36	84
IV										6	6	12						6	6	12
NW													6		6			6		6
NNW										6		6						6		6
NN											6	6							6	6
NNE											18	18							18	18
NE											6	6							6	6
Total										12	24	48		6		6	18	36	54	
IV													6		6			6		6
NW										6	6				18	18			24	42
Total										6	6			6	18	36			36	84
IV															6	6			6	6
NW															6	6			6	6
Total															12	12			12	12
TOTAL	42	12	24	78	174	126	96	396	60	126	126	312		12	36	48	276	376	282	934
CALM																	*** **			
TOTAL HOURS																	740 720 720 2160			

TABLE B-1
STATISTICAL MINGCAST DATA FOR LAKE ERIE STATION B, CLEVELAND, OHIO
Duration given in hours. Height and period groupings include lower value but not the upper.

OCTOBER																						
HEIGHT (FEET)	Period	1-2 Seconds				2-3 Seconds				3-4 Seconds				4-5 Seconds				1-5 Seconds				
		1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	
5-8	NW	6			6													6			6	
	N	12			12													12			12	
	NNE							6	6											6	6	
	NE			6	6															6	6	
	ENE			6	6															6	6	
	Total	18		12	30			6	6									18		12	36	
2-2	NW							6	6											6	6	
	WNW					6		12	18	18			18					24		12	36	
	NW	6			6	12		18	30									18		18	36	
	WNW					12	6	6	24									12	6	6	24	
	N					30	18		48									30	18		48	
	Total	6			6	60	36	66	162	24	12	18	54					90	48	24	222	
2-3	NE							6	6			6	6							12	12	
	WNW							12	12	18		6	24					18	12	6	36	
	NW					6		6	12			6	6					6		12	18	
	WNW							6	6			12	12						18	18		
	N					12	6	18	30	6	6		12					6	18	6	30	
	Total					6	36	12	54	30	22	30	102					36	78	42	156	
3-4	WNW									18	6	12	36					18	6	12	36	
	NW											6	6							6	6	
	N									6		6	12					6		6	12	
	NNE									6	6	6	18					6	6	6	18	
	NE									6		6	6					6			6	
	Total									36	18	24	78					36	18	24	78	
4-5	W											6	6							6	6	
	WNW											6	6	6				6		6	12	
	Total											12	12	6				6	6	6	12	
5-6	WNW										6	6								6	6	
6-7	WNW															6	6			6	6	
7-8	WNW																6	6			6	6
	Total																12	12			12	12
TOTAL		24		12	36	66	72	84	222	70	84	84	258	6		18	24	186	156	178	540	
CALM																		558 308 546 1672				
TOTAL HOURS																		749 744 749 2222				

TABLE B-1
STATISTICAL HINDCAST DATA FOR LAKE ERIE STATION B, CLEVELAND, OHIO
Duration given in hours. Height and period groupings include lower value but not the upper

NOVEMBER																																																				
Period	1-2 Seconds				2-3 Seconds				3-4 Seconds				4-5 Seconds				5-6 Seconds				7-6 Seconds																															
	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total																												
1-2	W	6		6																	6		6																													
	SW			6	6			6													6		6																													
	SE	6		6	12	6		6													12		6	18																												
	Total																																																			
1-2	W						6	6														6	6																													
	SW					12		12													12		12																													
	SE					6		6				6	6								6	6	12																													
	SW					12		12													12		12																													
	SE					6	6	12				6	6								6	6	12	18																												
	Total					30	18	18	66				18	18								30	18	36	84																											
2-3	W				6			6	6												12		12																													
	SW				18	12		30				12	12								18	12	12	42																												
	SE				6	6		12	6	36	6	48									12	42	6	60																												
	SW										6	6											6	6																												
	SE										6	6										6	6																													
	Total					30	18	48	96	24	42	36	102									36	60	36	132																											
3-4	W								12		12	24									12		12	24																												
	SW								6	36		42									6	36		42																												
	SE										12	18										12	6	18																												
	SW										6	6											6	6																												
	SE						6	6				6	6										12	12																												
	Total						6	6	24	48	30	102									24	48	36	108																												
4-5	W										6	6											6	6																												
	SW								12	6		18	18	6	24						12	24	6	42																												
	SE													6	6								6	6																												
	SW										12	12											12	12																												
	SE										6	6											6	6																												
	Total									12	6	30	48		18	12	20					12	24	42	78																											
5-6	W										6	6											6	6																												
	SW												6		6								6	6																												
	SE													6	6								6	6																												
	Total												6	6	12							6	12	18																												
6-7	W												12		12								12	12																												
	SW														12	12							12	12																												
	SE															12	12						12	12																												
	Total															24	24						24	24																												
8-9	W															6		6		6			6	6																												
	SW																6	6		6			6	6																												
	SE																	6	12		6		6	12																												
	Total																	6	12		6		6	12																												
9-10	W																6		6				6	6																												
	SW																	6	6				6	6																												
10-11	W																							6	6																											
	SW																							6	6																											
16-17	W																							6	6																											
	SW																							6	6																											
TOTAL	6		6	12	66	36	24	126	60	96	130	276		36	30	66	12		84	36	144	168	204	516																												
CALM																																	576				532				316				1644							
TOTAL HOURS																																					720				720				720				2160			

DECEMBER

CALM
TOTAL HOURS

TABLE B-2
STATISTICAL HINDCAST DATA FOR LAKE ERIE STATION 9, CLEVELAND, OHIO
FULL YEAR

Direction given in hours; height and period groupings include lower values not set free upper

Period	1-2 Seconds				2-3 Seconds				3-4 Seconds				4-5 Seconds				5-6 Seconds				6-7 Seconds				7-8 Seconds				8-9 Seconds			
	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total				
5-8	W	6	12	18	30	6	18	18	42																							
	SW	24	18	18	60	6	18	18	42																							
	W	18	24	24	66	6	18	12	36																							
	SW	12	18	6	36	18	6	24	48																							
	W	30	18	18	66	12	24	12	48																							
	SW	12	30	18	60	12	24	12	48																							
	W	18	6	24	48	6	18	18	42																							
	SW	6	6	12	24	6	6	12	24																							
	Total	180	168	156	504	84	78	130	392																							
1-2	W	24			24	78	36	120	234	6	30	42	78																			
	SW	24	6		30	114	78	190	382	18	48	24	90																			
	W	6		6	12	118	78	190	394	18	12	30																				
	SW	12	6	6	24	130	126	256	512	6	6	12																				
	W	18	30	12	60	150	114	264	528	18	18	36	72																			
	SW	6			6	222	60	282	342	12	12	24																				
	W	6	6		12	66	42	108	216	18	18	36	72																			
	SW	6			6	18	12	30	60	6	6	12																				
	Total	78	24	24	126	876	624	1464	2952	216	216	432																				
2-3	W					30	42	54	126	39	70	82	189																			
	SW					78	60	72	210	76	84	90	250																			
	W					30	36	60	126	72	120	60	252																			
	SW					78	82	24	184	28	88	66	172																			
	W	6			6	11	60	24	95	96	90	42	228																			
	SW					70	30	30	130	108	36	46	210																			
	W					92	18	36	146	92	42	70	174	6	6	6	18															
	SW																															
	Total	6			6	224	160	256	640	562	576	678	1810	6	6	6	18															
3-4	W					12	16	6	34	42	66	30	138																			
	SW					6			6	77	70	72	219																			
	W					6			6	90	72	39	198																			
	SW					6			6	14	16	60	160																			
	W					6	6	18	30	46	78	12	130																			
	SW					12	72	70	154	54	168	110	432	12	6		18															
	W					6			6	108	42	24	174	6	12	6	24															
	SW									6																						
	Total					24	24	24	72	232	292	256	1080	18	24	12	54															
5-6	W					24	36	24	84	24	42	30	96																			
	SW					70	60	24	154	12	48	30	90																			
	W					6	24	16	46	6	12	6	24																			
	SW					24			24	36	60	6	120																			
	W					6			12	18	18	6	42																			
	SW					12	6	16	34	6	36	6	54																			
	W					6	6	12	24	6	6	6	30																			
	SW																															
	Total					24	24	24	72	112	172	108	378	18	24	12	54															
7-8	W					12	16	6	34	42	66	30	138																			
	SW					6			6	77	70	72	219																			
	W					6			6	90	72	39	198																			
	SW					6			6	14	16	60	160																			
	W					6	6	18	30	46	78	12	130																			
	SW					12	72	70	154	54	168	110	432	12	6		18															
	W					6			6	108	42	24	174	6	12	6	24															
	SW									6																						
	Total					24	24	24	72	112	172	108	378	18	24	12	54															
9-10	W					12	16	6	34	42	66	30	138																			
	SW					6			6	77	70	72	219																			
	W					6			6	90	72	39	198																			
	SW					6			6	14	16	60	160																			
	W					6	6	18	30	46	78	12	130																			
	SW					12	72	70	154	54	168	110	432	12	6		18															
	W					6			6	108	42	24	174	6	12	6	24															
	SW									6																						
	Total					24	24	24	72	112	172	108	378	18	24	12	54															
11-12	W					12	16	6	34	42	66	30	138																			
	SW					6			6	77	70	72	219																			
	W					6			6	90	72	39	198																			
	SW					6			6	14	16	60	160																			
	W					6	6	18	30	46	78	12	130																			
	SW					12	72	70	154	54	168	110	432	12	6		18															
	W					6			6	108	42	24	174	6	12	6	24															
	SW									6																						

TABLE B-3
STATISTICAL HINDCAST DATA FOR LAKE ERIE STATION B, CLEVELAND, OHIO
ICE-FREE PERIOD (1 APRIL - 30 NOV.)
Duration shown in hours. Height and period groupings include lower values but not the upper.

Wavecrest	Period	1-2 Seconds				2-3 Seconds				3-4 Seconds				4-5 Seconds				5-6 Seconds				7-6 Seconds			
		1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total
5-7	H	6	6	6	18	6	6	6	18	6	6	6	18	6	6	6	18	6	6	6	18	6	6	6	18
	ANW	18	12	12	42	6	18	18	24	6	18	18	24	6	18	18	24	6	18	18	24	6	18	18	24
	AW	18	6	24	42	6	18	6	24	6	18	6	24	6	18	6	24	6	18	6	24	6	18	6	24
	AWW	18	6	24	42	6	18	6	24	6	18	6	24	6	18	6	24	6	18	6	24	6	18	6	24
	N	24	6	12	42	6	18	6	24	6	18	6	24	6	18	6	24	6	18	6	24	6	18	6	24
	AWT	30	24	36	90	24	42	42	64	42	42	42	64	42	42	42	64	42	42	42	64	42	42	42	64
	WT	18	6	24	42	6	18	6	24	6	18	6	24	6	18	6	24	6	18	6	24	6	18	6	24
	CAW	6	6	6	18	6	6	6	18	6	6	6	18	6	6	6	18	6	6	6	18	6	6	6	18
	SWW	114	66	126	294	60	36	102	198	60	36	102	198	60	36	102	198	60	36	102	198	60	36	102	198
	Total	114	66	126	294	60	36	102	198	60	36	102	198	60	36	102	198	60	36	102	198	60	36	102	198
1-2	H	6	6	6	18	6	6	6	18	6	6	6	18	6	6	6	18	6	6	6	18	6	6	6	18
	ANW	18	6	6	24	6	18	6	24	6	18	6	24	6	18	6	24	6	18	6	24	6	18	6	24
	AW	6	6	6	18	6	18	6	24	6	18	6	24	6	18	6	24	6	18	6	24	6	18	6	24
	AWW	12	6	6	24	114	102	156	372	6	6	6	18	6	6	6	18	6	6	6	18	6	6	6	18
	N	6	24	12	42	108	132	114	354	12	18	30	60	12	18	30	60	12	18	30	60	12	18	30	60
	AWT	6	6	6	18	6	18	6	24	6	18	6	24	6	18	6	24	6	18	6	24	6	18	6	24
	WT	6	6	6	18	6	18	6	24	6	18	6	24	6	18	6	24	6	18	6	24	6	18	6	24
	CAW	6	6	6	18	6	6	6	18	6	6	6	18	6	6	6	18	6	6	6	18	6	6	6	18
	SWW	42	48	24	114	612	432	576	1620	138	120	138	396	138	120	138	396	138	120	138	396	138	120	138	396
	Total	42	48	24	114	612	432	576	1620	138	120	138	396	138	120	138	396	138	120	138	396	138	120	138	396
2-3	H	6	6	6	18	6	6	6	18	6	6	6	18	6	6	6	18	6	6	6	18	6	6	6	18
	ANW	18	6	6	24	6	18	6	24	6	18	6	24	6	18	6	24	6	18	6	24	6	18	6	24
	AW	6	6	6	18	6	18	6	24	6	18	6	24	6	18	6	24	6	18	6	24	6	18	6	24
	AWW	12	6	6	24	114	102	156	372	6	6	6	18	6	6	6	18	6	6	6	18	6	6	6	18
	N	6	24	12	42	108	132	114	354	12	18	30	60	12	18	30	60	12	18	30	60	12	18	30	60
	AWT	6	6	6	18	6	18	6	24	6	18	6	24	6	18	6	24	6	18	6	24	6	18	6	24
	WT	6	6	6	18	6	18	6	24	6	18	6	24	6	18	6	24	6	18	6	24	6	18	6	24
	CAW	6	6	6	18	6	6	6	18	6	6	6	18	6	6	6	18	6	6	6	18	6	6	6	18
	SWW	42	48	24	114	612	432	576	1620	138	120	138	396	138	120	138	396	138	120	138	396	138	120	138	396
	Total	42	48	24	114	612	432	576	1620	138	120	138	396	138	120	138	396	138	120	138	396	138	120	138	396
3-4	H	6	6	6	18	6	6	6	18	6	6	6	18	6	6	6	18	6	6	6	18	6	6	6	18
	ANW	18	6	6	24	6	18	6	24	6	18	6	24	6	18	6	24	6	18	6	24	6	18	6	24
	AW	6	6	6	18	6	18	6	24	6	18	6	24	6	18	6	24	6	18	6	24	6	18	6	24
	AWW	12	6	6	24	114	102	156	372	6	6	6	18	6	6	6	18	6	6	6	18	6	6	6	18
	N	6	24	12	42	108	132	114	354	12	18	30	60	12	18	30	60	12	18	30	60	12	18	30	60
	AWT	6	6	6	18	6	18	6	24	6	18	6	24	6	18	6	24	6	18	6	24	6	18	6	24
	WT	6	6	6	18	6	18	6	24	6	18	6	24	6	18	6	24	6	18	6	24	6	18	6	24
	CAW	6	6	6	18	6	6	6	18	6	6	6	18	6	6	6	18	6	6	6	18	6	6	6	18
	SWW	42	48	24	114	612	432	576	1620	138	120	138	396	138	120	138	396	138	120	138	396	138	120	138	396
	Total	42	48	24	114	612	432	576	1620	138	120	138	396	138	120	138	396	138	120	138	396	138	120	138	396
4-5	H	6	6	6	18	6	6	6	18	6	6	6	18	6	6	6	18	6	6	6	18	6	6	6	18
	ANW	18	6	6	24	6	18	6	24	6	18	6	24	6	18	6	24	6	18	6	24	6	18	6	24
	AW	6	6	6	18	6	18	6	24	6	18	6	24	6	18	6	24	6	18	6	24	6	18	6	24
	AWW	12	6	6	24	114	102	156	372	6	6	6	18	6	6	6	18	6	6	6	18	6	6	6	18
	N	6	24	12	42	108	132	114	354	12	18	30	60	12	18	30	60	12	18	30	60	12	18	30	60
	AWT	6	6	6	18	6	18	6	24	6	18	6	24	6	18	6	24	6	18	6	24	6	18	6	24
	WT	6	6	6	18	6	18	6	24	6	18	6	24	6	18	6	24	6	18	6	24	6	18	6	24
	CAW	6	6	6	18	6	6	6	18	6	6	6	18	6	6	6	18	6	6	6	18	6	6	6	18
	SWW	42	48	24	114	612	432	576	1620	138	120	138	396	138	120	138	396	138	120	138	396	138	120	138	396
	Total	42	48	24	114	612	432	576	1620	138	120	138	396	138	120	138	396	138	120	138	396	138	120	138	396
6-7	H	6	6	6	18	6	6	6	18	6	6	6	18	6	6	6	18	6	6	6	18	6	6	6	18
	ANW	18	6	6	24	6	18	6	24	6	18	6	24	6	18	6	24	6	18	6	24	6	18	6	24
	AW	6	6	6	18	6	18	6	24	6	18	6	24	6	18	6	24	6	18	6	24	6	18	6	24
	AWW	12	6	6	24	114	102	156	372	6	6	6	18	6	6	6	18	6	6	6	18	6	6	6	18
	N	6	24	12	42	108	132	114	354	12	18	30	60	12	18	30	60	12	18	30	60	12	18	30	60
	AWT	6	6	6	18	6	18	6	24	6	18	6	24	6	18	6	24	6	18	6	24	6	18	6	24
	WT	6	6	6	18	6	18	6	24	6	18	6	24	6	18	6	24	6	18	6	24	6	18	6	24
	CAW	6	6	6	18	6	6	6	18	6	6	6	18	6	6	6	18	6	6	6	18	6	6	6	18
	SWW	42	48	24	114	612	432	576	1620	138	120	138	396	138	120	138	396	138	120	138	396	138	120	138	396
	Total	42	48	24	114	612	432	576	1620	138	120	138	396	138	120	138	396	138	120	138	396	138	120	138	396
7-8	H	6	6	6	18	6	6	6	18	6	6	6	18	6	6	6	18	6	6	6	18	6	6	6	18
	ANW	18	6	6	24	6	18	6	24	6	18	6	24	6	18	6	24	6	18	6	24	6	18	6	24
	AW	6	6	6	18	6	18	6	24	6	18	6	24	6	18	6	24	6	18	6	24	6	18	6	24
	AWW	1																							

TABLE B-4
STATISTICAL ENERGY DATA FOR LAKE ERIE STATION 9, CLEVELAND, OHIO
(ICE-FREE PERIOD (1 APRIL - 30 NOV))

Energy given in foot-pounds per foot of crest per year $\times 10^{-6}$.

Height and period groupings include lower value but not the upper.

Height (feet)	Period					
	Dir.	1-2 Seconds	2-3 Seconds	3-4 Seconds	4-5 Seconds	5-6 Seconds
1-1	W	26	21			56
	WNW	22	21			164
	WSW	23	21			164
	WNW	22	21			164
	N	21	21			164
	NNE	172	222			200
	NE	23	61			142
	NNE	12				12
	Total	622	667			1272
	W		1201	452		1652
1-2	WNW	172	2422	1130		3710
	WSW	27	2423	247		3211
	WNW	172	4769	226		5368
	N	311	4724	1730		6165
	NNE		4004	2577		6602
	NE	44	1201	1522		2827
	NNE	44	160			249
	Total	244	24619	7454		29221
	W		3726	2811		6737
	WNW		3470	7188		10678
2-3	WSW		1745	3808		5553
	WNW		2702	6286		9284
	N	102	2425	9442		11936
	NNE		1762	8795		10702
	NE		2377	5622	402	8425
	Total	102	20468	47972	402	60026
	W		222	6275		6719
	WNW			12150	787	12929
	WSW			2112		9113
	WNW			13722		13823
3-4	N		415	6443		7078
	NNE		415	10322		11522
	NE			6122	2252	2838
	Total		1687	65065	4732	71977
	W			5865		5865
	WNW			7754	1022	18322
	WSW			7154	1222	8282
	WNW			5765	1277	7244
	N			1222		1222
	NNE			5765	6275	1222
4-5	NE			3777	2877	2877
	Total			29768	2822	23151
	W			3044		3044
	WNW			4392	5795	10193
	WSW			4392	1932	6330
	N			466	3044	3044
	NNE			2932	9657	12571
	Total			18178	25114	30308
	W			2623		2623
	WNW			3044		3044
5-6	WSW			2623		2623
	N			5366		5366
	Total			26230		26230
	WNW			10627		10627
	WSW			7096		7096
	Total			17795		17795
	W			9048	5634	14682
	WNW				5634	5634
	Total			9048	11268	20350
	W			5632		5632
6-7	WNW				7011	7011
	Total				7011	12619
	W				8529	8529
	WNW				10182	10182
	WSW				20292	20292
	Total					
	W					
	WNW					
	WSW					
	Total					
TOTAL		2554	42011	172977	112857	57332

TABLE B-5
STATISTICAL ENERGY DATA FOR LAKE ERIE STATION B, CLEVELAND, OHIO
FULL YEAR

Energy given in foot-pounds per foot of crest per year $\times 10^{14}$. Height and period groupings include lower value but not the upper.

Height (Feet)	Period							
	1-2 Seconds	2-3 Seconds	3-4 Seconds	4-5 Seconds	5-6 Seconds	7-8 Seconds	10-12 Seconds	
5-1	W	87	61					120
	WW	117	81					280
	WW	83	121					209
	WW	71	161					232
	W	131	161					232
	W	238	293	28				609
	W	75	81	20				289
	W	29						24
	Total	820	1009	56				1085
	W	178	3129					3667
1-2	WW	222	4299					5161
	WW	82	4884					5115
	WW	178	6085					6320
	W	445	6165					6950
	W	49	5129					6159
	W	82	2292					2326
	W	44	480					552
	Total	1282	32397					36752
	W		6761	9602				16493
	WW		6593	1055				20530
2-3	WW		4500	11556				16136
	WW		2926	2652				12388
	W	109	2835	14868				19807
	W		2272	10371				19203
	W		2272	9057	1211			13590
	Total	109	36187	76706	1211			108710
	W		2073	12393	709			14835
	WW		415	22977	709			23483
	WW		415	12618				18093
	W			17410				17010
3-4	W		829	9113				9942
	WW		829	17410	2366			20205
	W		415	16589	3155			15113
	W			408				608
	Total		4926	109859	7099			121467
	W			12319	7175			21715
	WW			10870	19406			38376
	WW			11720	1299			13222
	W			9992	1299			11291
	W			2983	1299			4282
4-5	W			8995	6995			15493
	W			3977	3077			2879
	Total			20589	46578			112159
	W			3378	9657			19857
	WW			2930	12386			24716
	WW			8776	7727			16523
	W			1966				1466
	W			1966	3064			5330
	W			9398	15455			19833
	Total			29320	54081			89411
5-6	W			6997	10782			29847
	WW			2016	18782		9557	25355
	W				16099			16099
	WW				5366			5366
	W				5366			5366
	Total			8063	44895		9557	22015
	WW				29892			29892
	W				16175			19195
	Total				32087			32087
	W				9448	3638		19682
6-7	WW				4529	5634		10158
	Total				19578	16269		24847
	W				5602			5602
	WW					7011		7011
	WW					7011		7011
	Total				5602	14022		19624
	W					8529		8529
	WW					8529		8529
	Total					17058		17058
	W					19182		19182
7-8	WW					20392		20392
	Total							
	W							
	WW							
	Total							
	W							
	WW							
	Total							
	W							
	WW							
8-9	Total							
	W							
	WW							
	Total							
	W							
	WW							
	Total							
	W							
	WW							
	Total							
9-10	W							
	WW							
	Total							
	W							
	WW							
	Total							
	W							
	WW							
	Total							
	W							
10-11	WW							
	Total							
	W							
	WW							
	Total							
	W							
	WW							
	Total							
	W							
	WW							
11-12	Total							
	W							
	WW							
	Total							
	W							
	WW							
	Total							
	W							
	WW							
	Total							
12-13	W							
	WW							
	Total							
	W							
	WW							
	Total							
	W							
	WW							
	Total							
	W							
13-14	WW							
	Total							
	W							
	WW							
	Total							
	W							
	WW							
	Total							
	W							
	WW							
14-15	Total							
	W							
	WW							
	Total							
	W							
	WW							
	Total							
	W							
	WW							
	Total							
15-16	W							
	WW							
	Total							
	W							
	WW							
	Total							
	W							
	WW							
	Total							
	W							
16-17	WW							
	Total							
	W							
	WW							
	Total							
	W							
	WW							
	Total							
	W							
	WW							
17-18	Total							
	W							
	WW							
	Total							
	W							
	WW							
	Total							
	W							
	WW							
	Total							
18-19	W							
	WW							
	Total							
	W							
	WW							
	Total							
	W							
	WW							
	Total							
	W							
19-20	WW							
	Total							
	W							
	WW							
	Total							
	W							
	WW							
	Total							
	W							
	WW							
20-21	Total							
	W							
	WW							
	Total							
	W							
	WW							
	Total							
	W							
	WW							
	Total							
21-22	W							
	WW							
	Total							
	W							
	WW							
	Total							
	W							
	WW							
	Total							
	W							
22-23	WW							
	Total							
	W							
	WW							
	Total							
	W							
	WW							
	Total							
	W							
	WW							
23-24	Total							
	W							
	WW							
	Total							
	W							
	WW							
	Total							
	W							
	WW							
	Total							
24-25	W							
	WW							
	Total							
	W							
	WW							
	Total							
	W							
	WW							
	Total							
	W							
25-26	WW							
	Total							
	W							
	WW							
	Total							
	W							
	WW							
	Total							
	W							
	WW							
26-27	Total							
	W							
	WW							
	Total							
	W							
	WW							
	Total							
	W							
	WW							
	Total							
27-28	W							
	WW							
	Total							
	W							
	WW							
	Total							
	W							
	WW							
	Total							
	W							
28-29	WW							
	Total							
	W							
	WW							
	Total							
	W							
	WW							
	Total

LEGEND

LAKE ERIE STATION B (Cleveland)

WAVE ROSE SHOWING PERCENT OF TIME WAVES OF
DIFFERENT HEIGHT OCCUR FROM EACH DIRECTION

FIG. B-1

AVERAGE AMOUNT OF ENERGY TRANSMITTED SHOREWARD PER FOOT OF CREST LENGTH PER YEAR, IF WAVE SYSTEM IS CONSIDERED AS AN HYPOTHETICAL UNIFORM SYSTEM COMPOSED OF WAVES OF SIGNIFICANT HEIGHT AND PERIOD ONLY.

LAKE ERIE - STATION B (Cleveland)

FIG. B-4

WAVE AND LAKE LEVEL STATISTICS
FOR
LAKE ERIE

APPENDIX C
WAVE STATISTICS
FOR
STATION C
ERIE, PENNSYLVANIA

TABLE C-1

STATISTICAL HINDCAST DATA FOR LAKE ERIE STATION C, ERIE, PA.
Duration given in hours. Height and period groupings include lower values but not the upper.
JANUARY

WIND SPEED	Period	1-2 Seconds				2-3 Seconds				3-4 Seconds				4-5 Seconds				5-6 Seconds				7-8 Seconds						
		1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total			
5-9	WSW		6		6																	6		6				
	W		6		6																	6		6				
	WSW						6		6													6		6				
	W							6	6														12	12				
	Total		12	6	12		6	6	12													12	12	30				
1-2	WSW						6		6													6		6				
	W						18	24	12	54	6	18	12	36								24	42	30	96			
	WSW	6			6		12			12			6	18								18	12	6	36			
	W							12	12				6	6									18	18				
	WSW						6	12	6	24												6	18	6	24			
	W						18	24		54												18	36		54			
	WSW	12			12		12	12	6	30			6	6	12							24	18	12	54			
	W							12	6	18													12	6	18			
	Total	12			6	24	46	36	48	210	6	42	30	78								90	126	84	300			
	WSW						6		6													6		6				
W						6	24	12	36	18	12	30	60								24	48	42	114				
WSW						12			12			30	12	42								42		12	54			
W						6			6			18		6	24							24		6	30			
WSW						6			6													6		6				
W							6		6			12	6	18								18	6	6	24			
WSW								6	6			6	12	6	24							6	12	12	30			
W																							12	12				
Total						36	48	18	102	72	36	60	180		6	6					108	90	78	276				
3-4	WSW							6	6			12	6	18			6	12	18			18	24	42				
	W							6	6		6	30	18	54			30		30			12	60	18	90			
	WSW									12		12	24									12		12	24			
	W											18	18										18	18				
	WSW												6									6		6				
	W													6								6		6				
	WSW														6							6		6				
	W															6							6	6				
	WSW																						6		6			
	W																							6	6			
Total						6		6	12	24	24	36	132		36	12	48				30	90	72	192				
4-5	WSW										6		6									6		6				
	WSW									18			18		6	18	6	30				24	18	6	48			
	W										6		6									6		6				
	WSW											6	12									6		6	12			
	W												6	6									6	6				
	Total										12		12									12		12				
5-6	WSW																											
	WSW																											
	W										6	6	12			12	12	24					18	18	36			
	WSW														6							6		6				
	Total										6	6	12	24		6	18	12	36			12	24	24	60			
6-7	WSW														6		6					6		6				
	W									6		6	12			6		6			6	6	6	18				
	Total									6		6	12			18		18			6	18	6	30				
7-8	WSW																6	6						6	6			
	W																							6	6			
8-9	WSW																6		6			6		6				
	W																6		6			6		6				
	Total																12		12			12		12				
10-11	WSW																					6		6				
	W																							6	6			
TOTAL		18	12	12	42	108	150	78	336	150	150	174	474	12	108	36	156				6	6	288	420	306	1014		
CALC																									456	324	438	1218
TOTAL HOURS																									744	744	744	2232

TABLE C-1
STATISTICAL HINDCAST DATA FOR LAKE ERIE STATION C, ERIE, PA.
(Duration given in hours. HIGHT and period groupings include lower value but not the upper)
FEBRUARY

		Frequency																																		
Period		1-2 seconds				2-3 seconds				3-4 seconds				4-5 seconds				5-6 seconds				7-6 seconds														
Component		1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total											
5-1	W			6	6																6	6		6												
	WSW	12			12													12			12															
	W	6			6													6			6															
	WSW			6	6	6			6									6			6	12														
	W		12		12			6	6										12		6	18														
	WSW			12	12			6	6												18	18														
1-2	W					6			6									6			6															
	WSW					6	6	6	18									6	6	6	18															
	W					12	18	18	48	6		12	18					18	18	30	66															
	WSW					6			6		6	6	12					6	6	12	24															
	W					12		18	30			6	6					12		24	36															
	WSW					6	12	18	36									6	12	18	36															
2-3	W		6		6	12	24	6	42									12	30	6	48															
	WSW					30		12	42	6			6					24		12	48															
	W		6		6	24		30	54			12	12					24	6	60	72															
	WSW	6	12		18	102	60	114	276	12	6	36	54					120	78	150	348															
	W					6		6	12			6	6					6		12	18															
	WSW					6	6	12	18	6	12	6	24	6				18	18	6	42															
3-4	W					12	6	18	30									18	24	6	48															
	WSW					6	6	12	24			6	6	12				12	12	18	24															
	W					6		6	12		6	6	12					6	6	12	24															
	WSW					6		6	12			12	24					18	18	30	66															
	W					6		6	12			18	30					24	18	42	84															
	WSW					24	30	24	78	34	30	48	112	6				84	60	72	216															
4-5	W					6		6	12									6		12	18															
	WSW					6	6	12	24			6	12					6	12	18	36															
	W					12		12	24									12		24	36															
	WSW					6		6	12			6	12					6	6	12	24															
	W					6		6	12			6	12					6	6	12	24															
	WSW					6		6	12			6	12					6	6	12	24															
5-6	W					6		6	12									6		12	18															
	WSW					6		6	12			6	12					6	6	12	24															
	W					6		6	12			6	12					6	6	12	24															
	WSW					6		6	12			6	12					6	6	12	24															
	W					6		6	12			6	12					6	6	12	24															
	WSW					6		6	12			6	12					6	6	12	24															
7-8	W					6		6	12									6		12	18															
	WSW					6		6	12			6	12					6	6	12	24															
	W					6		6	12			6	12					6	6	12	24															
	WSW					6		6	12			6	12					6	6	12	24															
	W					6		6	12			6	12					6	6	12	24															
	WSW					6		6	12			6	12					6	6	12	24															
TOTAL		24	24	24	72	144	90	156	390	138	78	150	366	30	30	36	96	12				12	248	222	366	936										
CALM																							348				450				306				1004	
TOTAL HOURS																							876				670				412				2040	

TABLE C-1

STATISTICAL HINDCAST DATA FOR LAKE ERIE STATION C, ERIE, PA.
Duration given in hours. Height and period groupings include lower value but not the upper.

APRIL

HEIGHT (FEET)	Period	1-2 Seconds				2-3 Seconds				3-4 Seconds				4-5 Seconds				5-6 Seconds			
		1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total
1-1	KSW			6	6															6	6
	N																	6			6
	NE																	6			6
	SE																				
	Total	12		6	18													12		6	18
2-2	KSW					6			6									6			6
	N					18	18	6	42	6	12	6	24	6			6	30	30	12	72
	NE					6	6		12	6			6				12	6	6		18
	NW						42	30	72				6					48	30	30	78
	SW					12		12	24		6		6				12	6	12	30	30
	SE						6	12	18									6	12	18	18
	SW					24	12		36	6			6				30	12		42	42
	Total					24	24	66	240	18	30	6	54	6			6	114	114	72	300
2-3	KSW																	6			6
	N					24	12		36	6	18	6	30			12	12	30	42	6	78
	NE							12	12			6	18				12	18	18	30	30
	NW									6	12	12	30				6	12	12	30	30
	SW							6	6			18	6	24				18	6	24	24
	SE							6	6									6			6
	SW					24	6	6	36	18		6	24				42	6	12	60	60
	Total					48	24	18	90	24	30	48	150	6	12		18	102	90	66	258
3-4	KSW																	6			6
	N									18	12	24	30				6	18	24	66	66
	NE									6	12	12	30				6	18	12	36	36
	NW										12	12	24					12	12	24	24
	SW									6		12	18				6		12	18	18
	SE											6	6						6	6	6
	SW									18	6	6	30				18	6	6	30	30
	Total					6	6		12	24	24	72	180			6	6	66	66	72	198
4-5	KSW									6			6				6				6
	N									6			6				6	6			12
	NE												6				6				6
	NW										12	18	30					12	18	30	30
	SW											6	6						6	6	6
	Total									18	18	30	60				12	30	24	66	72
5-6	KSW																6				6
	N																6	6			6
	NE																6	6			6
	Total																12	12			12
6-7	KSW																6				6
	N																6	6			6
	NE																6	6			6
	Total																12	12			12
TOTAL		12		6	18	198	114	24	342	144	162	156	462	36	48	18	198	336	336	164	724
CALM																		384	396	456	1236
TOTAL HOURS																		720	720	720	2160

TABLE C-1

STATISTICAL HINDCAST DATA FOR LAKE ERIE STATION C, ERIE, PA
 Duration given in hours Height and period groupings include lower value but not the upper
 MAY

Period	1-2 Seconds				2-3 Seconds				3-4 Seconds				4-5 Seconds				5-6 Seconds				7-8 Seconds				
	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	
5-1	NW	12	6		18																12	6		18	
	NNE	6			6																6			6	
	TOTAL	18	6		24																18	6		24	
	WSW					18		12		12		18										24		24	
	W					2		12	24		12	6	18								12	12	18	42	
1-2	NW	6			6																6			6	
	NNW	6			6	18	12	18	48		6		6								24	18	18	60	
	N					36		30	66		12	6	18								36	12	36	84	
	NNE					6	36	30	72			6	6								36		6	42	
	NE						6	36	72	6			6								12	36	30	78	
2-3	NE							30	30		12	24	36								12	54	66		
	TOTAL	18			18	102	60	120	282	6	54	42	102								126	114	162	402	
	WSW						12		12		6		6								18			18	
	W					6	6		12		18		18		12		12				6	36		42	
	NW					6			6	12		12	24								18	12	12	30	
3-4	NNW					12			12	6	12		18								18	12		30	
	N					12	6		18	12		6	12								24	6		30	
	NNE					12	6	6	24	18	6	6	30								30	12	12	54	
	NE					12		12	24		12	24	36								12	12	36	60	
	TOTAL					60	30	18	108	48	54	42	144		12		12				108	96	60	264	
3-4	WSW									18		18		6		6						24		24	
	W						6		6	6	18	6	30								6	24	6	36	
	WSW					6			6	12			12								18			18	
	SW									30			30								30			30	
	SW						6		6												6			6	
4-5	NNE									12	12	6	30								12	12	6	30	
	NE									12	6	18									12	6	18		
	TOTAL					6	12		18	60	60	18	138		6		6				60	78	18	162	
	WSW									6		6									6			6	
	NNW									12		6	18			6	6				12		12	24	
5-6	NNE										18		18									18		18	
	NE									6		6	12		6	6	12				6	6	18	24	
	TOTAL									24	18	12	54		6	12	18				24	24	24	72	
	W													6		6					6			6	
	NNW													6		6					6			6	
6-7	NNE									12		12		6		6					6	12		18	
	TOTAL									6	12	18	36	18		18		18			24	12		36	
	W									6		6	12								6		6	12	
	NE											6	12		6						6	6	6	18	
	TOTAL									6	6	12	30		6		6				6	6	6	18	
7-8	NNW													6		6					6			6	
	NW													6		6					6			6	
	TOTAL													12		12					12			12	
	W																								
	NNW																								
8-9	TOTAL																								
	W																								
	NNW																								
	TOTAL																								
	W																								
9-10	TOTAL	36	6		42	168	102	138	408	150	198	120	468	30	30	12	72	18			18	402	336	210	1008
	CALM																								
	TOTAL HOURS																								

TABLE C-1

STATISTICAL HINDCAST DATA FOR LAKE ERIE STATION C, ERIE, PA.

Duration given in hours. Height and period groupings include lower value but not the upper.

JUNE

Height (feet)	Period	1-2 Seconds				2-3 Seconds				3-4 Seconds				4-6 Seconds			
		1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total
5-7	WAV							12	12							12	12
	N	6			6									6			6
	WAV		6	6	12										6	6	12
	N		6	6	12			6	6						6	12	18
	WAV			6	6											6	6
	N							6	6							6	6
	TOTAL	6	12	12	30			12	12					6	12	12	30
2-3	WAV					6	12	24				12	12	6	36	42	
	N					12	6	18				6	6		12	12	24
	WAV					18	6	6	30	6	6		12	24	12	6	42
	N					12		30	42					12		30	42
	WAV	6		2	8	24	6	18	48					24	12	18	54
	N	6		6	12	6	24	6	36					6	30	6	42
	TOTAL	12		8	20	48	36	72	156					40	54	24	118
2-3	WAV					6	24	30						6	24	30	
	N					6	18	18	42			12	12	6	18	30	54
	WAV							6	12	12	6		18	12	6		30
	N					6		6	12	12	6		18	18	6		42
	WAV					18		6	24	12		6	18	30		12	42
	N					6	6		12	12	6		18	18	12		48
	TOTAL					48	30	24	102	42	18	24	36	72	36	24	132
3-4	WAV									6		6	12	6		6	12
	N											6	6			6	12
	WAV									6		6	12	6		6	12
	N									6		6	12	6		6	12
	WAV									12			12	12			36
	N									12			12	12			36
	TOTAL									24		12	24	24		12	72
TOTAL		6	12	12	30	102	72	120	300	66	36	42	144	120	102	120	360
CALC																	
TOTAL HOURS														440	540	420	1400
														720	720	720	2160

TABLE G-1

STATISTICAL HINDCAST DATA FOR LAKE ERIE STATION C, ERIE, PA.
Duration given in hours. Height and period groupings include lower value but not the upper.
JULY

Direction	Period	1-2 Seconds				2-3 Seconds				3-4 Seconds				4-5 Seconds			
		1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total
0.5-1	NW			6	6											6	6
	NNW		6		6		6		6						12		12
	Total		6	6	12		6		6						12	6	18
	WSW	6			6	6	6		12					12	6		18
1-2	W					6	6	12	24		6		6	6	12	12	30
	NNW						6		6					6		6	12
	AW		6	6	12	12		12	24					12	6	18	36
	WNW						18	18	36						18	18	36
	N		6	6	12		24	6	30						30	12	42
	NNE					12	12		24					12	12		24
	NE						6		6						6		6
	Total	6	12	12	30	42	72	54	168		6		6	48	90	66	204
2-3	WSW					6			6				6	12			12
	W					24	6	6	36	12		6	18	36	6	12	54
	NNW						6	6	12	6			6	6	6	6	18
	NW					6		12	18	6	12	6	24	12	12	18	42
	NNW						12		12	6	6		12	6	18		24
	NNE									18			18	18			18
	NE						6	6	12	6			18	12	12		24
	Total					36	30	24	90	66	24	12	102	102	54	36	192
3-4	W									6	6	6	18	6	6	6	18
	WNW					6			6				6	12			12
	NW											6	12	6		6	12
	NNW												6	6			6
	Total					6			6	30	6	12	48	36	6	12	54
4-5	W										6		6		6		6
	WNW									6			6	6			6
	NW											6	6			6	6
	Total									12	6	6	24	12	6	6	24
TOTAL		6	18	18	42	84	108	78	270	108	42	30	180	198	168	126	492
CALM														540	576	618	1740
TOTAL HOURS														744	744	744	2232

TABLE C-1

STATISTICAL HINOCASST DATA FOR LAKE ERIE STATION C, ERIE, PA.
Duration given in hours. Height and period groupings include lower value but not the upper.
AUGUST

HEIGHT FEET	Period	1-2 Seconds				2-3 Seconds				3-4 Seconds				4-5 Seconds			
		1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total
5-1	WSW			6	6							6	6			6	6
	W			6	6							6	6			6	6
	WNW	12			12									12		12	12
	W	6			6									6		6	6
	WNW		6	12	18	6		6	12					6	6	18	30
	N	6	6		12		6		6					6	12		18
	NNE			12	12	12		12	24					12		24	36
	NE					6			6					6			6
	TOTAL	24	12	36	72	24	6	18	48			6	6	48	18	60	126
2-2	WSW					12		42	54			6	6	12		48	60
	W					24		18	42					24		18	42
	WNW	6	6		12	36		6	42			6	6	42	6	12	60
	W		6		6	42	24	18	84					42	30	18	90
	WNW	6	6		12	30	24	30	84					36	30	30	96
	N	6	6		12	6	36	42	84					12	42	54	108
	NNE					12		54	66					12		54	66
	NE					18		30	48					18		30	48
	TOTAL	18	24		42	180	84	240	504			12	12	174	180	252	558
2-3	W					12	6	12	30			6	6	12	6	18	36
	WNW					6			6					6			6
	W					6			6	6	6	6	18	6	12	6	24
	WNW					6			6					6	6	6	12
	N					6			6			6		6	12		12
	NNE								12			12	12	12			12
	TOTAL					12	20	12	54	24	12	12	48	36	52	24	108
3-4	W											6	6			6	6
	W									6		6	6			6	6
	WNW									24			24	24			24
	NE									6			6	6			6
	TOTAL									36		6	42	36		6	52
	TOTAL	42	36	36	114	216	120	270	606	60	12	24	108	144	168	392	828
	CALM													426	576	402	1404
	TOTAL HOURS													774	792	794	2260

TABLE C-1

STATISTICAL HINDCAST DATA FOR LAKE ERIE STATION C, ERIE, PA.
Duration given in hours. Height and period groupings include lower value but not the upper
SEPTEMBER

Period	1-2 Seconds				2-3 Seconds				3-4 Seconds				4-5 Seconds				5-6 Seconds			
	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total
0.5-1	WSW		12	12														12	12	
	W	6	6	12		6		6									6	12		18
	NW			6		6		6										6	6	12
	NNW			6															6	6
	N	6		6													6			6
	NNE	18		12	30	6		6									24		12	36
	NE	18		6	24	6		6									24		6	30
1-2	Total	48	6	42	96	12	12	24									60	18	42	120
	WSW					24	6	30		18	6	24						42	12	54
	W					6	12	6	24								6	12	6	24
	NW					18	12	6	36								18	12	6	36
	NNW					18	12	30									18	12		30
	N					60	24	84										60	24	84
	NNE					12	24	36									12	24		36
2-3	NE					66	6	6	78	6		6					72	6	6	84
	ENE					30	6	6	42	6		12	18				36	6	18	60
	Total					150	156	54	360	12	18	18	48				162	174	12	408
	WSW					12	6	18										12	6	18
	W					12		6	18	12	18	30					12	12	24	48
	NW										6	6							6	6
	NNW					6		6		18	12	30						24	12	36
3-4	N					6		6		6	12	18						12	12	24
	NNE						24	24		6							6		24	30
	ENE					6		6	12								6		6	12
	NE					12		6	18	6		6					18		6	24
	Total					30	24	48	102	12	36	48	96				42	60	96	198
	WSW						6	6		6	18	24		6		6	6	24		30
	W									6	6	12		6		6	6	6	12	
4-5	NNW									6		6						6		6
	N										12	12							12	12
	Total					6		6	6	30	18	54		6		6	6	42	18	66
	W									18	18			6		6		24		24
	WNW									6		6					6		6	
	WSW										18	18						18	18	
	Total									24	24	48		6		6	30	24	54	
5-6	WSW										6	6						6	6	
	W																			
	NNW										18	18							18	18
	WSW										6	6						6	6	
	Total									24	24	48		6		6	30	24	54	
	WSW										6	6						6	6	
	W													12		12			12	12
6-7	NNW										6	6							6	6
	Total									6	6						12		12	12
	W													12		12			12	12
	WSW										6	6							6	6
	Total										6	6					12		12	12
	W													12		12			12	12
	WSW										6	6							6	6
TOTAL	48	6	42	96	192	198	102	492	30	108	120	258	24	6	30	270	306	270	876	
CALM																	450	384	450	1284
TOTAL HOURS																	720	720	720	2160

TABLE C-1
STATISTICAL HINDCAST DATA FOR LAKE ERIE STATION C, ERIE, PA.
Duration given in hours. Height and period groupings include lower value but not the upper.

OCTOBER

WIND DIRECTION	1-2 Seconds				2-3 Seconds				3-4 Seconds				4-5 Seconds				5-6 Seconds					
	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total		
5-8	W			12	12															12	12	
	NW			6	6				6	6										12	12	
	NNW			6	6															6	6	
	N	12			12				6	6									12		6	18
	NNE			12	12															12	12	
1-2	NE		6		6														6		6	
	TOTAL	12	6	24	42				12	12									12	6	42	60
	N					6		24	30										6	24	30	
	NW						6	12	18		6									12	30	
	NNW					18	18	6	42											18	6	42
2-3	N					18	6	6	30										18	6	24	
	NNE		6		6			12	12										6	18	24	
	NE					6		18	24										6	18	24	
	TOTAL		6		6	30	42	30	102		6		6						30	54	72	156
	W						12		12		6		6							18	18	
3-4	NNW						6		6				6						6	6	12	
	NW					6	6		12	18									6	12	18	
	NNW					6	12	6	24										6	12	24	
	N					6			6										6	6	12	
	NNE						6		6				6						6	6	12	
4-5	NE									6	6	6	18						6	6	18	
	TOTAL					18	42	6	66	54	18	30	96						30	54	96	180
	N							6	6		6	6							6	6	12	
	NW									6		6	12						6	6	12	
	NNW					6	12	6	24										6	12	24	
5-6	W									6									6	6	12	
	NNE												6						6	6	12	
	NE									6	6	6	18						6	6	18	
	TOTAL									18	18	30	66						30	36	66	
	N																		6	6	12	
6-7	NW									6		6	12						6	6	12	
	NNW					6	12	6	24										6	12	24	
	N					6			6										6	6	12	
	NNE									6		6							6	6	12	
	TOTAL									18	18	30	66						30	36	66	
8-9	N																		6	6	12	
	NNW												6						6	6	12	
	TOTAL												6	6	12	24	24		6	6	12	
	W									6									6	6	12	
	NNE												6						6	6	12	
TOTAL	12	13	36	60	108	84	102	294	708	24	48	150	6	6	12	24	24	126	178	528		
	CALM																			540	618	346
TOTAL HOURS																			798	798	798	2232

TOTAL HOURS

TABLE C-1
STATISTICAL HINDCAST DATA FOR LAKE ERIE STATION C, ERIE, PA.
Cursties given in hours. Height and period groupings include lower values but not the upper
NOVEMBER

Period	1-2 Seconds				2-3 Seconds				3-4 Seconds				4-5 Seconds				5-6 Seconds				6-7 Seconds				7-8 Seconds			
	1945	1946	1950	Total	1945	1946	1950	Total	1945	1946	1950	Total	1945	1946	1950	Total	1945	1946	1950	Total	1945	1946	1950	Total	1945	1946	1950	Total
25-1	6			6	6			6													12			12				
25-2		6		6																		6			6			
25-3	6	6		12	12			12													18	6		24				
25-4					6			6					6								6			6				
25-5					6	18		24				12									6	30		36				
25-6					12	6		18													12	6		18				
25-7					12			12													12	12		24				
25-8					6			6					6								12			12				
25-9					30	36		66				6	12								36	42		78				
25-10					6	6		12					6								6	12		18				
25-11					6	6		12					6	12							18	30		48				
25-12					12			12					18								12	12		24				
25-13					12			12					18								12	12		24				
25-14					18			18					24								12	12		24				
25-15													6	6							6	6		12				
25-16					6	48		54				24	72				6	12			36	180		216				
25-17					12	6		18				12	6				6				12	6		18				
25-18					6	24		30				6	12				6				12	24		36				
25-19					12	6		18				12	6				6				18	6		24				
25-20					18			18					24								12	12		24				
25-21													6	6							6	6		12				
25-22													6	6							6	6		12				
25-23													6	6							6	6		12				
25-24													6	6							6	6		12				
25-25													6	6							6	6		12				
25-26													6	6							6	6		12				
25-27													6	6							6	6		12				
25-28													6	6							6	6		12				
25-29													6	6							6	6		12				
25-30													6	6							6	6		12				
25-31													6	6							6	6		12				
25-32													6	6							6	6		12				
25-33													6	6							6	6		12				
25-34													6	6							6	6		12				
25-35													6	6							6	6		12				
25-36													6	6							6	6		12				
25-37													6	6							6	6		12				
25-38													6	6							6	6		12				
25-39													6	6							6	6		12				
25-40													6	6							6	6		12				
25-41													6	6							6	6		12				
25-42													6	6							6	6		12				
25-43													6	6							6	6		12				
25-44													6	6							6	6		12				
25-45													6	6							6	6		12				
25-46													6	6							6	6		12				
25-47													6	6							6	6		12				
25-48													6	6							6	6		12				
25-49													6	6							6	6		12				
25-50													6	6							6	6		12				
25-51													6	6							6	6		12				
25-52													6	6							6	6		12				
25-53													6	6							6	6		12				
25-54													6	6							6	6		12				
25-55													6	6							6	6		12				
25-56													6	6							6	6		12				
25-57													6	6							6	6		12				
25-58													6	6							6	6		12				
25-59													6	6							6	6		12				
25-60													6	6							6	6		12				
25-61													6	6							6	6		12				
25-62													6	6							6	6		12				
25-63													6	6							6	6		12				
25-64													6	6							6	6		12				
25-65													6	6							6	6		12				
25-66													6	6							6	6		12				
25-67													6	6							6	6		12				
25-68													6	6							6	6		12				
25-69													6	6							6	6		12				
25-70													6	6							6	6		12				
25-71													6	6							6	6		12				
25-72													6	6							6	6		12				
25-73													6	6							6	6		12				
25-74													6	6							6	6		12				
25-75													6	6							6	6		12				
25-76													6	6							6	6		12				
25-77													6	6							6	6		12				
25-78													6	6							6	6		12				
25-79													6	6							6	6		12				
25-80													6	6							6	6		12				
25-81													6	6							6	6		12				
25-82													6	6							6	6		12				
25-83													6	6							6	6		12				
25-84													6	6							6	6		12				
25-85													6	6							6	6		12				
25-86													6	6							6	6		12				
25-87													6	6							6	6		12				
25-8																												

TABLE C-2
STATISTICAL HINDCAST DATA FOR LAKE ERIE STATION C, FWHY 76
FULL YEAR

[illegible]

TABLE C-5
STATISTICAL ENERGY DATA FOR LAKE ERIE STATION C, ERIE, PA
FULL YEAR

Energy given in foot-pounds per foot of wave per year at 10% height and period groupings include wave area but not the mean

Height (Feet)	Period (Seconds)	1-2 Seconds	2-3 Seconds	3-4 Seconds	4-5 Seconds	5-6 Seconds	6-7 Seconds	7-8 Seconds
1-2	1-2	87	87	20				19.2
1-3	1-3	92	80	20				16.9
1-4	1-4	92	20					11.5
1-5	1-5	112	40					13.7
1-6	1-6	127	81					10.2
1-7	1-7	107	100					20.0
1-8	1-8	150	101					28.1
1-9	1-9	71	41					13.2
1-10	1-10	267	181	26				12.0
1-11	1-11	44	208.2	2.147				2.074
1-12	1-12	44	412.5	2.277	1.46			2.092
1-13	1-13	267	274.2	2.289				2.072
1-14	1-14	232	274	2.25				2.112
1-15	1-15	110	268.4	2.2				2.274
1-16	1-16	311	232.5	1.7				2.949
1-17	1-17	133	220	2.04				2.282
1-18	1-18	133	232.9	1.882				2.438
1-19	1-19	133	220.2	1.88				2.28
1-20	1-20	230	230	1.88				2.28
1-21	1-21	230	230	1.88				2.28
1-22	1-22	230	230	1.88				2.28
1-23	1-23	230	230	1.88				2.28
1-24	1-24	230	230	1.88				2.28
1-25	1-25	230	230	1.88				2.28
1-26	1-26	230	230	1.88				2.28
1-27	1-27	230	230	1.88				2.28
1-28	1-28	230	230	1.88				2.28
1-29	1-29	230	230	1.88				2.28
1-30	1-30	230	230	1.88				2.28
1-31	1-31	230	230	1.88				2.28
1-32	1-32	230	230	1.88				2.28
1-33	1-33	230	230	1.88				2.28
1-34	1-34	230	230	1.88				2.28
1-35	1-35	230	230	1.88				2.28
1-36	1-36	230	230	1.88				2.28
1-37	1-37	230	230	1.88				2.28
1-38	1-38	230	230	1.88				2.28
1-39	1-39	230	230	1.88				2.28
1-40	1-40	230	230	1.88				2.28
1-41	1-41	230	230	1.88				2.28
1-42	1-42	230	230	1.88				2.28
1-43	1-43	230	230	1.88				2.28
1-44	1-44	230	230	1.88				2.28
1-45	1-45	230	230	1.88				2.28
1-46	1-46	230	230	1.88				2.28
1-47	1-47	230	230	1.88				2.28
1-48	1-48	230	230	1.88				2.28
1-49	1-49	230	230	1.88				2.28
1-50	1-50	230	230	1.88				2.28
1-51	1-51	230	230	1.88				2.28
1-52	1-52	230	230	1.88				2.28
1-53	1-53	230	230	1.88				2.28
1-54	1-54	230	230	1.88				2.28
1-55	1-55	230	230	1.88				2.28
1-56	1-56	230	230	1.88				2.28
1-57	1-57	230	230	1.88				2.28
1-58	1-58	230	230	1.88				2.28
1-59	1-59	230	230	1.88				2.28
1-60	1-60	230	230	1.88				2.28
1-61	1-61	230	230	1.88				2.28
1-62	1-62	230	230	1.88				2.28
1-63	1-63	230	230	1.88				2.28
1-64	1-64	230	230	1.88				2.28
1-65	1-65	230	230	1.88				2.28
1-66	1-66	230	230	1.88				2.28
1-67	1-67	230	230	1.88				2.28
1-68	1-68	230	230	1.88				2.28
1-69	1-69	230	230	1.88				2.28
1-70	1-70	230	230	1.88				2.28
1-71	1-71	230	230	1.88				2.28
1-72	1-72	230	230	1.88				2.28
1-73	1-73	230	230	1.88				2.28
1-74	1-74	230	230	1.88				2.28
1-75	1-75	230	230	1.88				2.28
1-76	1-76	230	230	1.88				2.28
1-77	1-77	230	230	1.88				2.28
1-78	1-78	230	230	1.88				2.28
1-79	1-79	230	230	1.88				2.28
1-80	1-80	230	230	1.88				2.28
1-81	1-81	230	230	1.88				2.28
1-82	1-82	230	230	1.88				2.28
1-83	1-83	230	230	1.88				2.28
1-84	1-84	230	230	1.88				2.28
1-85	1-85	230	230	1.88				2.28
1-86	1-86	230	230	1.88				2.28
1-87	1-87	230	230	1.88				2.28
1-88	1-88	230	230	1.88				2.28
1-89	1-89	230	230	1.88				2.28
1-90	1-90	230	230	1.88				2.28
1-91	1-91	230	230	1.88				2.28
1-92	1-92	230	230	1.88				2.28
1-93	1-93	230	230	1.88				2.28
1-94	1-94	230	230	1.88				2.28
1-95	1-95	230	230	1.88				2.28
1-96	1-96	230	230	1.88				2.28
1-97	1-97	230	230	1.88				2.28
1-98	1-98	230	230	1.88				2.28
1-99	1-99	230	230	1.88				2.28
1-100	1-100	230	230	1.88				2.28
1-101	1-101	230	230	1.88				2.28
1-102	1-102	230	230	1.88				2.28
1-103	1-103	230	230	1.88				2.28
1-104	1-104	230	230	1.88				2.28
1-105	1-105	230	230	1.88				2.28
1-106	1-106	230	230	1.88				2.28
1-107	1-107	230	230	1.88				2.28
1-108	1-108	230	230	1.88				2.28
1-109	1-109	230	230	1.88				2.28
1-110	1-110	230	230	1.88				2.28
1-111	1-111	230	230	1.88				2.28
1-112	1-112	230	230	1.88				2.28
1-113	1-113	230	230	1.88				2.28
1-114	1-114	230	230	1.88				2.28
1-115	1-115	230	230	1.88				2.28
1-116	1-116	230	230	1.88				2.28
1-117	1-117	230	230	1.88				2.28
1-118	1-118	230	230	1.88				2.28
1-119	1-119	230	230	1.88				2.28
1-120	1-120	230	230	1.88				2.28
1-121	1-121	230	230	1.88				2.28
1-122	1-122	230	230	1.88				2.28
1-123	1-123	230	230	1.88				2.28
1-124	1-124	230	230	1.88				2.28
1-125	1-125	230	230	1.88				2.28
1-126	1-126	230	230	1.88				2.28
1-127	1-127	230	230	1.88				2.28
1-128	1-128	230	230	1.88				2.28
1-129	1-129	230	230	1.88				2.28
1-130	1-130	230	230	1.88				2.28
1-131	1-131	230	230	1.88				2.28
1-132	1-132	230	230	1.88				2.28
1-133	1-133	230	230	1.88				2.28
1-134	1-134	230	230	1.88				2.28
1-135	1-135	230	230	1.88				2.28
1-136	1-136	230	230	1.88				2.28
1-137	1-137	230	230	1.88				2.28
1-138	1-138	230	230	1.88				2.28
1-139	1-139	230	230	1.88				2.28
1-140	1-140	230	230	1.88				2.28
1-141	1-141	230	230	1.88				2.28
1-142	1-142	230	230	1.88				2.28
1-143	1-143	230	230	1.88				2.28
1-144	1-144	230	230	1.88				2.28
1-145	1-145	230	230	1.88				2.28
1-146	1-146	230	230	1.88				2.28
1-147	1-147	230	230	1.88				2.28
1-148	1-148	230	230	1.88				2.28
1-149	1-149	230	230	1.88				2.28
1-150	1-150	230	230	1.88				2.28
1-151	1-151	230	230	1.88				2.28
1-152	1-152	230	230	1.88				2.28
1-153	1-153	230	230	1.88				2.28
1-154	1-154	230	230	1.88				2.28
1-155	1-155	230	230	1.88				2.28
1-156	1-156	230	230	1.88				2.28
1-157	1-157	230	230	1.88				2.28
1-158	1-158	230	230	1.88				2.28
1-159	1-159	230	230	1.88				2.28
1-160	1-160	230	230	1.88				2.28
1-161	1-161	230	230	1.88				2.28
1-162	1-162	230	230	1.88				2.28
1-163	1-163	230	230	1.88				2.28
1-164	1-164	230	230	1.88				2.28
1-165	1-165	230	230	1.88				2.28
1-166	1-166	230	230	1.88				2.28
1-167	1-167	230	230	1.88				2.28
1-168	1-168	230	230	1.88				2.28
1-169	1-169	230	230	1.88				2.28
1-170	1-170	230	230	1.88				2.28
1-171	1-171	230	230	1.88				2.28
1-172	1-172	230	230	1.88				2.28
1-173	1-173	230	230	1.88

FIG. C-1

AVERAGE AMOUNT OF ENERGY TRANSMITTED SHOREWARD PER FOOT OF CREST LENGTH PER YEAR, IF WAVE SYSTEM IS CONSIDERED AS AN HYPOTHETICAL UNIFORM SYSTEM COMPOSED OF WAVES OF SIGNIFICANT HEIGHT AND PERIOD ONLY.

LAKE ERIE - STATION C (Erie)

FIG. C-4

WAVE AND LAKE LEVEL STATISTICS
FOR
LAKE ERIE

APPENDIX D
WAVE STATISTICS
FOR
STATION D
BUFFALO, NEW YORK

TABLE 0-1
STATISTICAL HINDCAST DATA FOR LAKE ERIE STATION D, BUFFALO, N.Y.
Direction given in South. Height and period groupings include lower values, but not the upper

[illegible]

非二元性别认同

Work	1-2 seconds			2-3 seconds			3-6 seconds			6-8 seconds			8-12 seconds			12-18 seconds			18-24 seconds			24-30 seconds			30-36 seconds			36-42 seconds			42-48 seconds			48-54 seconds			54-60 seconds			60-66 seconds			66-72 seconds			72-78 seconds			78-84 seconds			84-90 seconds			90-96 seconds			96-102 seconds			102-108 seconds			108-114 seconds			114-120 seconds			120-126 seconds			126-132 seconds			132-138 seconds			138-144 seconds			144-150 seconds			150-156 seconds			156-162 seconds			162-168 seconds			168-174 seconds			174-180 seconds			180-186 seconds			186-192 seconds			192-198 seconds			198-204 seconds			204-210 seconds			210-216 seconds			216-222 seconds			222-228 seconds			228-234 seconds			234-240 seconds			240-246 seconds			246-252 seconds			252-258 seconds			258-264 seconds			264-270 seconds			270-276 seconds			276-282 seconds			282-288 seconds			288-294 seconds			294-300 seconds			300-306 seconds			306-312 seconds			312-318 seconds			318-324 seconds			324-330 seconds			330-336 seconds			336-342 seconds			342-348 seconds			348-354 seconds			354-360 seconds			360-366 seconds			366-372 seconds			372-378 seconds			378-384 seconds			384-390 seconds			390-396 seconds			396-402 seconds			402-408 seconds			408-414 seconds			414-420 seconds			420-426 seconds			426-432 seconds			432-438 seconds			438-444 seconds			444-450 seconds			450-456 seconds			456-462 seconds			462-468 seconds			468-474 seconds			474-480 seconds			480-486 seconds			486-492 seconds			492-498 seconds			498-504 seconds			504-510 seconds			510-516 seconds			516-522 seconds			522-528 seconds			528-534 seconds			534-540 seconds			540-546 seconds			546-552 seconds			552-558 seconds			558-564 seconds			564-570 seconds			570-576 seconds			576-582 seconds			582-588 seconds			588-594 seconds			594-600 seconds			600-606 seconds			606-612 seconds			612-618 seconds			618-624 seconds			624-630 seconds			630-636 seconds			636-642 seconds			642-648 seconds			648-654 seconds			654-660 seconds			660-666 seconds			666-672 seconds			672-678 seconds			678-684 seconds			684-690 seconds			690-696 seconds			696-702 seconds			702-708 seconds			708-714 seconds			714-720 seconds			720-726 seconds			726-732 seconds			732-738 seconds			738-744 seconds			744-750 seconds			750-756 seconds			756-762 seconds			762-768 seconds			768-774 seconds			774-780 seconds			780-786 seconds			786-792 seconds			792-798 seconds			798-804 seconds			804-810 seconds			810-816 seconds			816-822 seconds			822-828 seconds			828-834 seconds			834-840 seconds			840-846 seconds			846-852 seconds			852-858 seconds			858-864 seconds			864-870 seconds			870-876 seconds			876-882 seconds			882-888 seconds			888-894 seconds			894-900 seconds			900-906 seconds			906-912 seconds			912-918 seconds			918-924 seconds			924-930 seconds			930-936 seconds			936-942 seconds			942-948 seconds			948-954 seconds			954-960 seconds			960-966 seconds			966-972 seconds			972-978 seconds			978-984 seconds			984-990 seconds			990-996 seconds			996-1002 seconds			1002-1008 seconds			1008-1014 seconds			1014-1020 seconds			1020-1026 seconds			1026-1032 seconds			1032-1038 seconds			1038-1044 seconds			1044-1050 seconds			1050-1056 seconds			1056-1062 seconds			1062-1068 seconds			1068-1074 seconds			1074-1080 seconds			1080-1086 seconds			1086-1092 seconds			1092-1098 seconds			1098-1104 seconds			1104-1110 seconds			1110-1116 seconds			1116-1122 seconds			1122-1128 seconds			1128-1134 seconds			1134-1140 seconds			1140-1146 seconds			1146-1152 seconds			1152-1158 seconds			1158-1164 seconds			1164-1170 seconds			1170-1176 seconds			1176-1182 seconds			1182-1188 seconds			1188-1194 seconds			1194-1200 seconds			1200-1206 seconds			1206-1212 seconds			1212-1218 seconds			1218-1224 seconds			1224-1230 seconds			1230-1236 seconds			1236-1242 seconds			1242-1248 seconds			1248-1254 seconds			1254-1260 seconds			1260-1266 seconds			1266-1272 seconds			1272-1278 seconds			1278-1284 seconds			1284-1290 seconds			1290-1296 seconds			1296-1302 seconds			1302-1308 seconds			1308-1314 seconds			1314-1320 seconds			1320-1326 seconds			1326-1332 seconds			1332-1338 seconds			1338-1344 seconds			1344-1350 seconds			1350-1356 seconds			1356-1362 seconds			1362-1368 seconds			1368-1374 seconds			1374-1380 seconds			1380-1386 seconds			1386-1392 seconds			1392-1398 seconds			1398-1404 seconds			1404-1410 seconds			1410-1416 seconds			1416-1422 seconds			1422-1428 seconds			1428-1434 seconds			1434-1440 seconds			1440-1446 seconds			1446-1452 seconds			1452-1458 seconds			1458-1464 seconds			1464-1470 seconds			1470-1476 seconds			1476-1482 seconds			1482-1488 seconds			1488-1494 seconds			1494-1500 seconds			1500-1506 seconds			1506-1512 seconds			1512-1518 seconds			1518-1524 seconds			1524-1530 seconds			1530-1536 seconds			1536-1542 seconds			1542-1548 seconds			1548-1554 seconds			1554-1560 seconds			1560-1566 seconds			1566-1572 seconds			1572-1578 seconds			1578-1584 seconds			1584-1590 seconds			1590-1596 seconds			1596-1602 seconds			1602-1608 seconds			1608-1614 seconds			1614-1620 seconds			1620-1626 seconds			1626-1632 seconds			1632-1638 seconds			1638-1644 seconds			1644-1650 seconds			1650-1656 seconds			1656-1662 seconds			1662-1668 seconds			1668-1674 seconds			1674-1680 seconds			1680-1686 seconds			1686-1692 seconds			1692-1698 seconds			1698-1704 seconds			1704-1710 seconds			1710-1716 seconds			1716-1722 seconds			1722-1728 seconds			1728-1734 seconds			1734-1740 seconds			1740-1746 seconds			1746-1752 seconds			1752-1758 seconds			1758-1764 seconds			1764-1770 seconds			1770-1776 seconds			1776-1782 seconds			1782-1788 seconds			1788-1794 seconds			1794-1800 seconds			1800-1806 seconds			1806-1812 seconds			1812-1818 seconds			1818-1824 seconds			1824-1830 seconds			1830-1836 seconds			1836-1842 seconds			1842-1848 seconds			1848-1854 seconds			1854-1860 seconds			1860-1866 seconds			1866-1872 seconds			1872-1878 seconds			1878-1884 seconds			1884-1890 seconds			1890-1896 seconds			1896-1902 seconds			1902-1908 seconds			1908-1914 seconds			1914-1920 seconds			1920-1926 seconds			1926-1932 seconds			1932-1938 seconds			1938-1944 seconds			1944-1950 seconds			1950-1956 seconds			1956-1962 seconds			1962-1968 seconds			1968-1974 seconds			1974-1980 seconds			1980-1986 seconds			1986-1992 seconds			1992-1998 seconds			1998-2004 seconds			2004-2010 seconds			2010-2016 seconds			2016-2022 seconds			2022-2028 seconds			2028-2034 seconds			2034-2040 seconds			2040-2046 seconds			2046-2052 seconds			2052-2058 seconds			2058-2064 seconds			2064-2070 seconds			2070-2076 seconds			2076-2082 seconds			2082-2088 seconds			2088-2094 seconds			2094-2100 seconds			2100-2106 seconds			2106-2112 seconds			2112-2118 seconds			2118-2124 seconds			2124-2130 seconds			2130-2136 seconds			2136-2142 seconds			2142-2148 seconds			2148-2154 seconds			2154-2160 seconds			2160-2166 seconds			2166-2172 seconds			2172-2178 seconds			2178-2184 seconds			2184-2190 seconds			2190-2196 seconds			2196-2202 seconds			2202-2208 seconds			2208-2214 seconds			2214-2220 seconds			2220-2226 seconds			2226-2232 seconds			2232-2238 seconds			2238-2244 seconds			2244-2250 seconds			2250-2256 seconds			2256-2262 seconds			2262-2268 seconds			2268-2274 seconds			2274-2280 seconds			2280-2286 seconds			2286-2292 seconds			2292-2298 seconds			2298-2304 seconds			2304-2310 seconds			2310-2316 seconds			2316-2322 seconds			2322-2328 seconds			2328-2334 seconds			2334-2340 seconds			2340-2346 seconds			2346-2352 seconds			2352-2358 seconds			2358-2364 seconds			2364-2370 seconds			2370-2376 seconds			2376-2382 seconds			2382-2388 seconds			2388-2394 seconds			2394-2400 seconds			2400-2406 seconds			2406-2412 seconds			2412-2418 seconds			2418-2424 seconds			2424-2430 seconds			2430-2436 seconds			2436-2442 seconds			2442-2448 seconds			2448-2454 seconds			2454-2460 seconds			2460-2466 seconds			2466-2472 seconds			2472-2478 seconds			2478-2484 seconds			2484-2490 seconds			2490-2496 seconds			2496-2502 seconds			2502-2508 seconds			2508-2514 seconds			2514-2520 seconds			2520-2526 seconds			2526-2532 seconds			2532-2538 seconds			2538-2544 seconds			2544-2550 seconds			2550-2556 seconds			2556-2562 seconds			2562-2568 seconds			2568-2574 seconds			2574-2580 seconds			2580-2586 seconds			2586-2592 seconds			2592-2598 seconds			2598-2604 seconds			2604-2610 seconds			2610-2616 seconds			2616-2622 seconds			2622-2628 seconds			2628-2634 seconds			2634-2640 seconds			2640-2646 seconds			2646-2652 seconds			2652-2658 seconds			2658-2664 seconds			2664-2670 seconds			2670-2676 seconds			2676-2682 seconds			2682-2688 seconds			2688-2694 seconds			2694-2700 seconds			2700-2706 seconds			2706-2712 seconds			2712-2718 seconds			2718-2724 seconds			2724-2730 seconds			2730-2736 seconds			2736-2742 seconds			2742-2748 seconds			2748-2754 seconds			2754-2760 seconds			2760-2766 seconds			2766-2772 seconds			2772-2778 seconds			2778-2784 seconds			2784-2790 seconds			2790-2796 seconds			2796-2802 seconds			2802-2808 seconds			2808-2814 seconds			2814-2820 seconds			2820-2826 seconds			2826-2832 seconds			2832-2838 seconds			2838-2844 seconds			2844-2850 seconds			2850-2856 seconds			2856-2862 seconds			2862-2868 seconds			2868-2874 seconds			2874-2880 seconds			2880-2886 seconds			2886-2892 seconds			2892-2898 seconds			2898-2904 seconds			2904-2910 seconds			2910-2916 seconds			2916-2922 seconds			2922-2928 seconds			2928-2934 seconds			2934-2940 seconds			2940-2946 seconds			2946-2952 seconds			2952-2958 seconds			2958-2964 seconds			2964-2970 seconds			2970-2976 seconds			2976-2982 seconds			2982-2988 seconds			2988-2994 seconds			2994-3000 seconds		
	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										

TABLE D-1
STATISTICAL HINDCAST DATA FOR LAKE ERIE STATION D, BUFFALO, N. Y.
Duration given in hours; height and period groupings include mean values but not the value.

MARCH

Height (ft)	Period (sec)	1-2 Seconds				2-3 Seconds				3-4 Seconds				4-5 Seconds				5-6 Seconds				7-8 Seconds			
		1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total
1-1	SW																								
	N																								
	SW																								
1-2	SW																								
	N																								
	SW																								
2-3	SW																								
	N																								
	SW																								
3-4	SW																								
	N																								
	SW																								
4-5	SW																								
	N																								
	SW																								
5-6	SW																								
	N																								
	SW																								
7-8	SW																								
	N																								
	SW																								
9-10	SW																								
	N																								
	SW																								
11-12	SW																								
	N																								
	SW																								
13-14	SW																								
	N																								
	SW																								
TOTAL		6	18	6	30	37	76	75	188	148	148	142	438	37	20	78	135	6	25	18	49	18	18	218	250
CALM TOTAL HOURS																							518		
																							518		

APRIL

Height (ft)	Period (sec)	1-2 Seconds				2-3 Seconds				3-4 Seconds				4-5 Seconds				5-6 Seconds				7-8 Seconds			
		1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total
1-2	SW																								
	N																								
	SW																								
2-3	SW																								
	N																								
	SW																								
3-4	SW																								
	N																								
	SW																								
4-5	SW																								
	N																								
	SW																								
5-6	SW																								
	N																								
	SW																								
7-8	SW																								
	N																								
	SW																								
9-10	SW																								
	N																								
	SW																								
TOTAL		6	12	18	36	42	54	54	160	44	50	46	140	18	36	42	96	12	6	48	66	18	18	218	250
CALM TOTAL HOURS																							270		
																							270		

TABLE D-1
STATISTICAL HINDCAST DATA FOR LAKE ERIE STATION O, BUFFALO, N. Y.
Duration given in hours. Heights and period groupings include lower value but not the upper.
SEPTEMBER

Period	1-2 Seconds				2-3 Seconds				3-4 Seconds				4-5 Seconds				5-6 Seconds			
	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total
1-2																				
3-4																				
5-6																				
7-8																				
9-10																				
11-12																				
13-14																				
15-16																				
17-18																				
19-20																				
21-22																				
23-24																				
25-26																				
27-28																				
29-30																				
31-32																				
33-34																				
35-36																				
37-38																				
39-40																				
41-42																				
43-44																				
45-46																				
47-48																				
49-50																				
51-52																				
53-54																				
55-56																				
57-58																				
59-60																				
61-62																				
63-64																				
65-66																				
67-68																				
69-70																				
71-72																				
73-74																				
75-76																				
77-78																				
79-80																				
81-82																				
83-84																				
85-86																				
87-88																				
89-90																				
91-92																				
93-94																				
95-96																				
97-98																				
99-100																				
TOTAL	18	6	24	48	70	70	40	180	24	76	36	136	12	12	24	48	112	310	110	532
CALM																	606	504	606	1716
TOTAL HOURS																	770	320	720	2810

OCTOBER

Period	1-2 Seconds				2-3 Seconds				3-4 Seconds				4-5 Seconds				5-6 Seconds			
	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total
1-2																				
3-4																				
5-6																				
7-8																				
9-10																				
11-12																				
13-14																				
15-16																				
17-18																				
19-20																				
21-22																				
23-24																				
25-26																				
27-28																				
29-30																				
31-32																				
33-34																				
35-36																				
37-38																				
39-40																				
41-42																				
43-44																				
45-46																				
47-48																				
49-50																				
51-52																				
53-54																				
55-56																				
57-58																				
59-60																				
61-62																				
63-64																				
65-66																				
67-68																				
69-70																				
71-72																				
73-74																				
75-76																				
77-78																				
79-80																				
81-82																				
83-84																				
85-86																				
87-88																				
89-90																				
91-92																				
93-94																				
95-96																				
97-98																				
99-100																				
TOTAL					48	122	174	326	24	90	70	164	12	14	18	44	84	142	270	520
CALM																	660	500	440	1600
TOTAL HOURS																	770	340	740	2850

TABLE D-4
STATISTICAL HINDCAST DATA FOR LAKE ERIE STATION D, BUFFALO, N. Y.
Duration given in hours. Height and period groupings include lower value but not the upper
NOVEMBER

[illegible]

DECEMBER

[illegible]

TABLE C-2

STATISTICAL HINDCAST DATA FOR LAKE ERIE STATION D, BUFFALO, N. Y.
FULL YEAR

Duration given in hours. Height and percent groupings include lower values but not the upper.

Period	1-2 Seconds				2-3 Seconds				3-4 Seconds				4-5 Seconds				5-6 Seconds				6-7 Seconds				7-8 Seconds				Total
	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total	1948	1949	1950	Total					
9-5-1	SW	12	6	6	24	6			6	12														18	6	12	36		
	NW	12	18	30	60	6			6	6														18	18	36	72		
	W	36	24	36	96	30			30	30														66	36	36	138		
	Total	60	48	72	180	36			36	48														102	60	84	246		
1-2	SW	18	18	6	42	24	24	48	216	6														24	108	54	270		
	NW	12	18	24	54	18	18	222	258	48	48	48	144	6	12		18							72	252	234	558		
	W	60	30	18	108	180	168	288	736	36	72	48	162											378	276	336	990		
	Total	90	66	48	204	224	210	510	944	90	120	96	312	6	12		18							696	636	702	2034		
2-3	SW					64	60	42	166	60	48	12	120											126	108	36	270		
	NW					96	182	70	348	66	84	96	240	24	72	30	126							108	318	378	744		
	W					198	70	120	488	159	164	150	473											306	234	324	864		
	Total					358	312	212	882	276	276	252	804	24	72	30	138							444	660	702	1806		
3-4	SW					12		12	62	20	20	102	12				18							66	30	30	126		
	NW					36	84	12	132	158	66	360	30	30	18	102	18	6		18				216	246	96	558		
	W					12	6	18	36	132	150	156	438	12			18	36						186	114	192	492		
	Total					60	100	30	210	292	336	558	54	66	36	144	12	6		18				468	474	318	1260		
4-5	SW								48		12	60												48		12	60		
	NW								84	126	60	270	18	36	12	66	6	60	6	72				108	324	78	510		
	W								72	144	96	312	24	62	18	104								96	196	114	396		
	Total								204	270	168	642	42	78	30	150	6	60	6	72				312	520	202	1034		
5-6	SW					6	6	12	6	6	12	24												12		12	24		
	NW					18	12	24	54	48	36	12	96	12	24	12	60			6	12	18		78	18	60	216		
	W					62	36	48	84	30	24	54	144	6	6		12							78	114	72	366		
	Total					86	78	84	162	84	60	72	270	18	30	12	60	6	12	18				168	126	144	504		
6-7	SW					12	12	24	6	6	12	30					6							18	18	6	42		
	NW					30	30	30	90	24	36	18	78				12	12					12	66	78	198			
	W					6	18	24	48	60	30	72	162	6			6							72	48	76	216		
	Total					48	60	54	162	90	66	76	252	6	18		24	12						12	136	144	450		
7-8	SW								6	6	12													6		12	24		
	NW								12	18	12	42					18		18	6		6	12	18	36	18	72		
	W								24	18		42					6							24	24		48		
	Total								42	42	12	96					24		24	6		6	12	42	66	18	132		
8-9	SW								18		18	36	6	6		12								12	12	24	60		
	W								6	12	12	30	6	6	6	18								12	18	18	48		
	Total								24	12	30	66	12	12	6	36								24	30	42	108		
	NW										6	12	18												6	12	18		
9-10	SW																												
	W								24	6	30						6	24	36					24	18	36	60		
	Total								24	18	12	48					6	24	30					24	18	36	78		
	NW										6	12													6	12	18		
10-11	SW																												
	W								12	6	6	24													12	6	12	30	
	Total								18	6	12	36													18	12	30	60	
	NW																												
11-12	SW																												
	W																												
	Total																												
	NW																												
12-13	SW																												
	W																												
	Total																												
	NW																												
TOTAL 150 114 120 384 718 768 904 2572 774 1018 870 2972 418 474 330 1212 72 148 84 324 24 12 48 84 2388 2694 2358 7440																													
CALC																													
TOTAL HOURS																													
4376 4179 4702 13284																													
43948 740 876 62636																													

TABLE D-3
STATISTICAL HYDROCAST DATA FOR LAKE ERIE STATION D, BUFFALO, N. Y.
ICE-FREE PERIOD (1 APRIL - 30 NOV.)
Duration given in hours. Height and period groupings include lower value but not the upper

[illegible]

TABLE D-4
STATISTICAL ENERGY DATA FOR LAKE ERIE STATION D, BUFFALO, N.Y.
ICE-FREE PERIOD (1 APRIL - 30 NOV.)

Energy given in foot-pounds per foot of crest per year $\times 10^6$ Height and period groupings include lower values but not the upper

Height (feet)	Period	1-2 Seconds	2-3 Seconds	3-4 Seconds	4-5 Seconds	5-6 Seconds	6-7 Seconds	7-8 Seconds
.5-1	SW	48						48
	NSW	83		28				111
	W	95	141					194
	Total	226	141	28				395
1-2	SW	247	2082					2347
	NSW	312	5285	1382	145			7325
	W	534	6245	1808				8587
	Total	1113	13612	3390	145			18240
2-3	SW		4144	3436				7580
	NSW		8942	8423	4,436			23831
	W		10905	11848				22753
	Total		23991	23707	4436			54184
3-4	SW		879	6483	789			8301
	NSW		3318	26307	8677	2901		39196
	W		1,244	23,096	789			25119
	Total		5391	50069	10255	2901		73616
4-5	SW			1388				1388
	NSW			22871	5196	12780		45813
	W			15917	3795			25702
	Total			45722	12991	12780		71523
5-6	SW			1466	1922			3388
	NSW			3868	15458	11896		33214
	W			3330	5795			12125
	Total			18664	23181	11896		49745
6-7	SW			4032	3483	3815		10330
	NSW			14,124	16,079	3815		36540
	W			8063	32,197			40260
	Total			26219	51359	4630		85808
7-8	SW				3078			3078
	NSW				19,195	13202	10,461	32858
	W				7,098			7098
	Total				29371	13202	10,461	52056
8-9	NSW					6,707		6,707
	W					16,901		16,901
	Total					23608		23608
9-10	W				11203	21030		32233
	NSW				6,779	36,114		40893
	W				13,559			13,559
	Total				20338	54114		74452
10-11	NSW						12,198	12,198
	W							
	Total						12,198	12,198
	TOTAL	1339	43032	149,837	143,939	117,436	29364	527,032

TABLE D-5
STATISTICAL ENERGY DATA FOR LAKE ERIE STATION D, BUFFALO, N. Y.
FULL YEAR

Energy given in foot-pounds per foot of crest per year $\times 10^{-4}$. Height and period groupings include lower value but not the upper

Height (feet)	Period									
	Dir.	1-2 Seconds	2-3 Seconds	3-4 Seconds	4-5 Seconds	5-6 Seconds	6-7 Seconds	7-8 Seconds	Seconds	
5-1	SW	48	40						88	
	WSW	119	20	28					167	
	W	180	101						291	
	Total	357	161	28					546	
1-2	SW	312	3093	113					3468	
	WSW	401	6366	2712	437				10516	
	W	801	9849	5051					13701	
	Total	1514	19858	5876	437				27685	
2-3	SW		6107	6247					12354	
	WSW		12650	12493	8974				33617	
	W		15267	23112					38377	
	Total		34024	41857	8474				84355	
3-4	SW		829	16328	1578				12735	
	WSW		4776	94452	13910	2901			57737	
	W		2988	44340	3744				50782	
	Total		8293	91130	18932	2901			121256	
4-5	SW			9942					9942	
	WSW			49739	14290	19171			78200	
	W			51698	18189				69885	
	Total			106379	32479	19171			158027	
5-6	SW			2932	38164				6796	
	WSW			13194	30709	19094	8961		71598	
	W			20523	54021	45759			77373	
	Total			36649	88864	23787	8961		157767	
6-7	SW			8068	4366	5315			16744	
	WSW			30237	34880	6630	2869		79616	
	W			16126	72443	3315			91884	
	Total			54426	112689	13260	2869		180244	
7-8	SW				7098				7098	
	WSW				28842	13282	10461		40505	
	W				24842	4401			29243	
	Total				56782	17603	10461		82846	
8-9	SW				27143	11267	12413		51823	
	WSW				22619	16701			39520	
	W				49762	24168	23012		97342	
	Total				16905	35058			16805	
9-10	SW				28842	35054			63862	
	WSW				44813	25054			70867	
	W				13559	42443	12193		68410	
	Total				27118	8529	12193		35647	
10-11	SW				40677	51772	12178		104027	
	WSW					10182	24396		34578	
	W					19182			10492	
	Total					20364	24396		45760	
11-12	SW					11769	24396		11969	
	WSW					12885			14085	
	W					12877			13877	
	Total						47517		49517	
TOTAL		1571	62336	336340	458707	255417	126315		10296186

FIG. D-1

AVERAGE AMOUNT OF ENERGY TRANSMITTED SHOREWARD PER FOOT OF CREST LENGTH PER YEAR, IF WAVE SYSTEM IS CONSIDERED AS AN HYPOTHETICAL UNIFORM SYSTEM COMPOSED OF WAVES OF SIGNIFICANT HEIGHT AND PERIOD ONLY.

LAKE ERIE - STATION D (Buffalo)

FIG. D-4