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TIDES AND CURRENTS IN HUDSON RIVER

By

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PREFACE

The growth of commerce, engineering, and scientific work during recent years has created an urgent and constantly growing demand from navigators, engineers, scientists, and the public generally for complete tide and current information for the important waterways of the United States. To meet this demand and to augment and co-ordinate the tide and current data on file in the archives of the Coast and Geodetic Survey, this Bureau started in 1902 a series of comprehensive tide and current surveys of the important waterways of the country. This work has been completed for a number of the more important harbors of the country, and is now being carried on as rapidly as the available funds permit.

This volume is the ninth of the series on tides and currents in the important waterways of the United States. The material presented here is based upon observations made at various times, and includes in addition to the observations taken by this Bureau, data obtained from other sources. Special acknowledgment is made to the United States Army Engineers of the first district, New York, who have cooperated in tidal current surveys of New York Harbor and have also furnished this office with much valuable tidal information from various tide gages along the Hudson River.

The special aim in this publication is to give in some detail the actual results obtained from individual series of observations of both tides and currents. Tables of adjusted values based upon the observational data at hand at the time of the adjustment are included, but these will be subject to revision as new information may become available from time to time. Special attention is called to the tide and current tables which are published in advance annually by this Bureau, and which contain mean values based upon the latest information. They include the predicted tides and currents for every day in the year at a number of principal ports and give differences and ratios for obtaining similar predictions for several thousand other places throughout the world.

The manuscript of this publication was prepared in 1931, using the data up to and including the year 1930. A delay in the printing of the publication, due to the curtailment of appropriations, made it possible to include later data in some of the tables. In general, however, the tables and illustrations pertain to the years prior to 1931.

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TIDES AND CURRENTS IN HUDSON RIVER

DESCRIPTION OF HUDSON RIVER

Hudson River, sometimes called North River in the vicinity of New York, has its source in Tear of the Clouds, a small lake in the Adirondack Mountains in the northeastern part of the State of New York. It flows southerly and empties in New York Upper Bay, the total length of the river being about 300 miles. The Federal dam at Troy, which is about 132 nautical miles above the Battery at the mouth of the river, is the head of tidewater, and it is that portion of the river lying below this dam that is considered in this publication. The dam contains a lock which permits boats to pass above Troy to the town of Waterford which is about $2\frac{1}{2}$ miles above the dam.

The river at its mouth is about three fourths of a nautical mile wide. An expansion of the river which is known as Tappan Sea has a maximum width of about $2\frac{1}{2}$ miles and extends from Irvington to Croton Point, a distance of about 8 miles. The section of the river adjoining Tappan Sea on the north and extending from Croton Point to Verplanck, a distance of 5 miles, is known as Haverstraw Bay and has a maximum width of about 3 miles. Above Haverstraw Bay is a constricted portion of the river with an average width of about one fourth mile and extending a distance of about 10 miles to Storm King where the river expands to a width of more than a mile. This is followed by a series of contractions and expansions until at Albany the width is approximately 200 yards.

From the Battery to Albany, the river now has a deep and unobstructed channel with a least depth of 27 feet. The generally prevailing depth in the channel from the Battery to Kingston Point is 50 feet or more. The deepest portion of the river is in the narrow section between Iona Island and Cold Spring where the depth in many places exceeds 100 feet, and at one place above West Point a sounding of 216 feet has been recorded. The river channel above the town of Hudson was originally obstructed by sand bars and was somewhat unstable but as a result of various projects there is now a channel 27 feet deep with a width of not less than 200 feet extending up to Albany. Above Albany there is a channel 12 feet deep to the Federal dam at Troy.

Improvements of the Hudson River were commenced by the State of New York in 1797 and were carried on exclusively by the State until 1834 when the United States Government also took up the work. Between 1834 and 1892 the work was carried on by both authorities. The question of jurisdiction over the Hudson River having been settled by the courts in 1891, the Federal Government assumed legal control in that year.

The work at first consisted of dredging and the construction of jetties. The State dam at Troy was built about the year 1832 and

was later replaced by the Federal dam about 1,400 feet further north in 1915. In 1834 a board of engineers of the United States Army recommended a system of longitudinal dikes and two such dikes were constructed on the west side of the river between Troy and Van Wies Point during the period 1835-1838. The State of New York during the years 1863 and 1867 built a series of dikes extending from Albany to Hotaling Island opposite New Baltimore. In 1866 a project was adopted by the Federal Government for a navigable channel 11 feet deep between New Baltimore and Albany and 9 feet deep between Albany and Troy, the work being continued through a number of years. Between 1876 and 1880 there was more or less dredging done by the State of New York.

A plan adopted by Congress in 1892 provided for a channel 400 feet wide and 12 feet deep at mean low water from Coxsackie to Troy. During the years 1893-1896, there was considerable dredging done under this project. After 1896, the dredging was done principally between Albany and Troy, the dredging below Albany being that necessary to maintain the channel already made.

A project adopted by Congress June 25, 1910, provided for the construction of a Federal dam at Troy to replace the then existing State dam, and the excavation of a channel 12 feet deep at all stages from deep water in the lower river to Waterford, which is located above the dam at Troy, the general width below the dam to be 400 feet with wider sections forming harbors in front of Albany and Troy. This project was modified by act of Congress of March 3, 1925, which provided for a channel 27 feet deep at mean low water, 400 feet wide through rock cuts and 300 feet wide elsewhere from Hudson to Albany. An act of Congress of July 3, 1930, provided for the extension of the 27-foot channel below the town of Hudson.

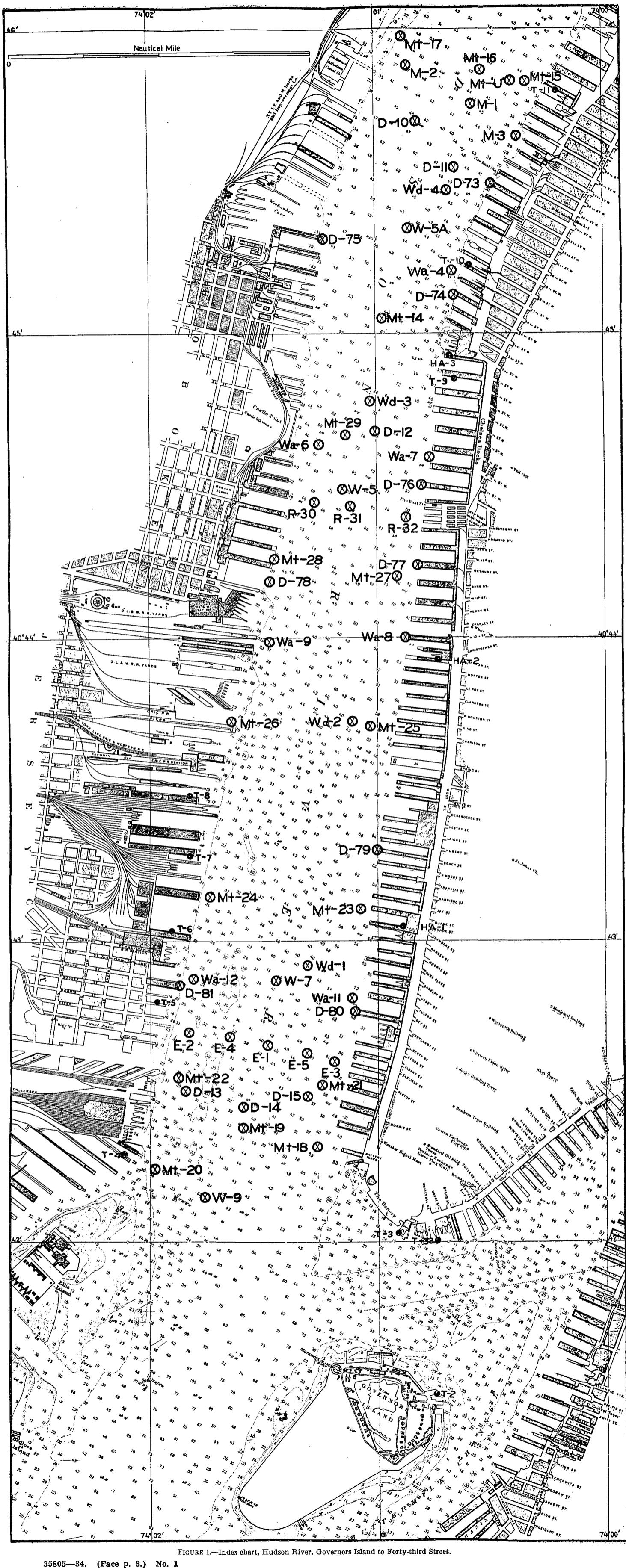
The carrying out of the various projects for the improvement of the Hudson River has had a marked effect upon the tides, especially in the upper portion of the river. The general tendency has been to advance the times of both high and low water, to increase the range of tide, and to lower the plane of mean low water. In the vicinity of Albany the range of tide has been increased by more than a foot since the improvements were commenced.

The river level is subject to considerable fluctuation resulting from the discharge of fresh water. Freshets frequently occur during the spring months, especially in March and April. Navigation in the upper portion of the river is usually closed by ice from the middle of December to the middle of March but the period varies in different years.

TIDE OBSERVATIONS

The earliest tide observations in the Hudson River by the Coast and Geodetic Survey were made in 1837 at Fort Lee, N.J. Since then there have been numerous other series of tide observations taken in connection with various hydrographic surveys. Many valuable series of observations at a number of points along the river have been secured by the United States Army Engineers, and through their courtesy the results are included in this publication.

The location of the various tide stations are shown on the index charts, figures 1 to 8, by small solid circles, the stations being numbered to correspond with the designations as listed in table 96. The



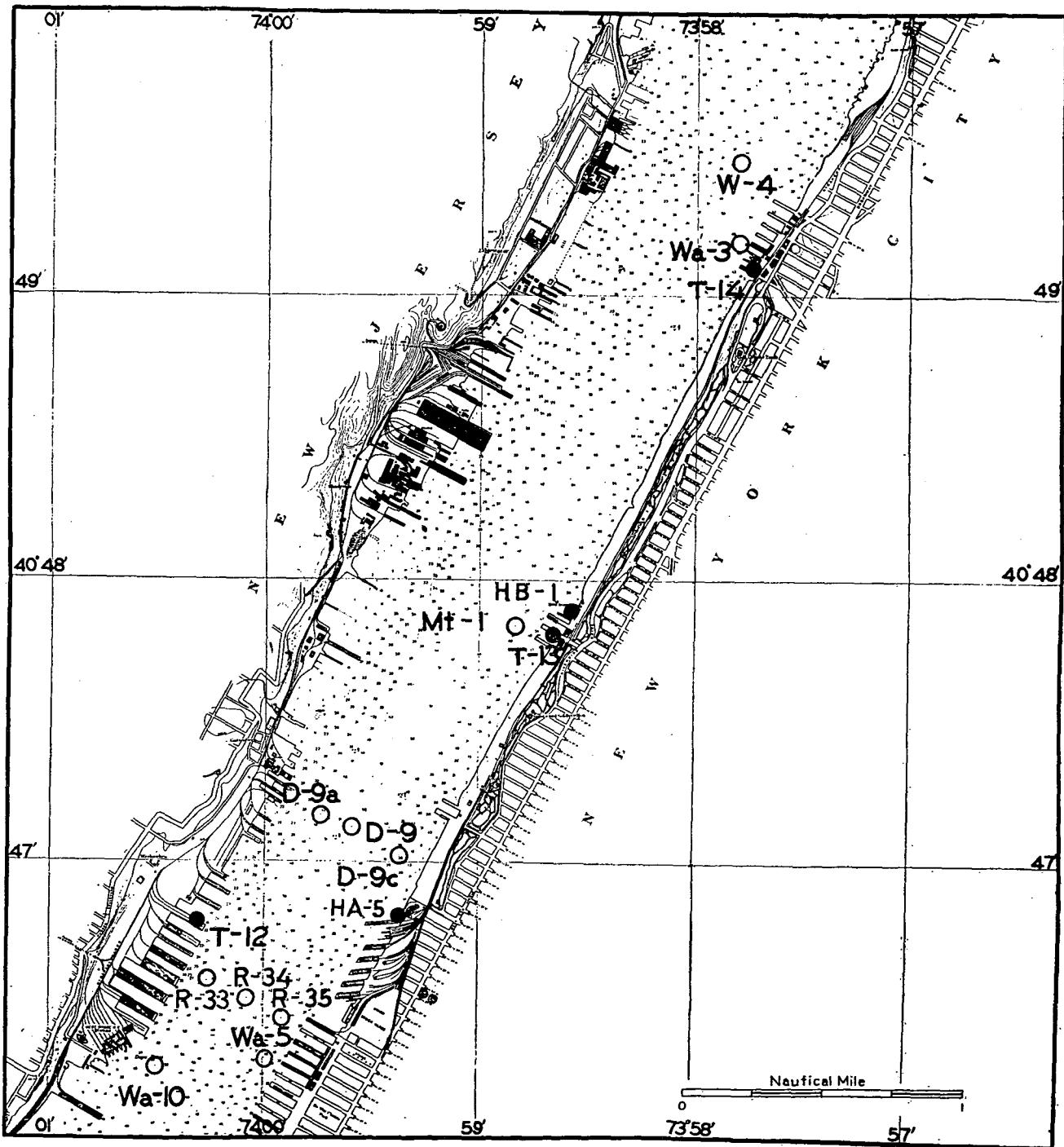
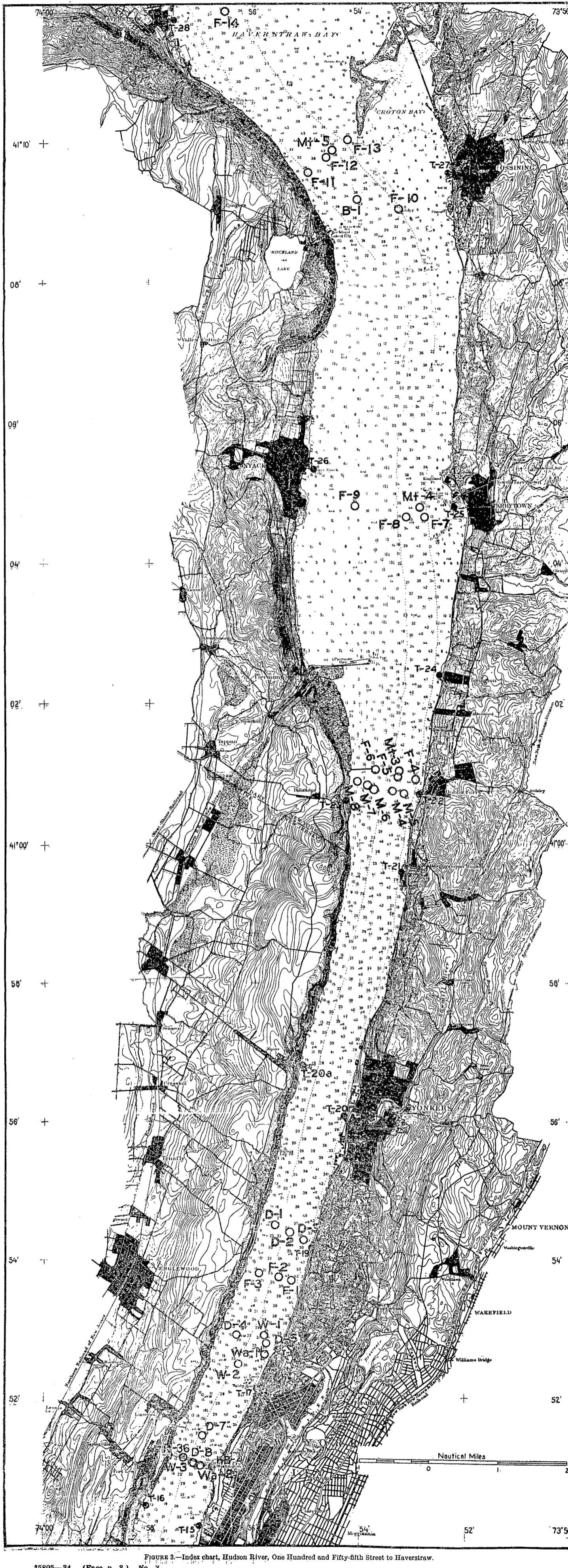


FIGURE 2.—Index chart, Hudson River, Days Point to One Hundred and Fifty-third Street.
35805—34. (Face p. 3.) No. 2



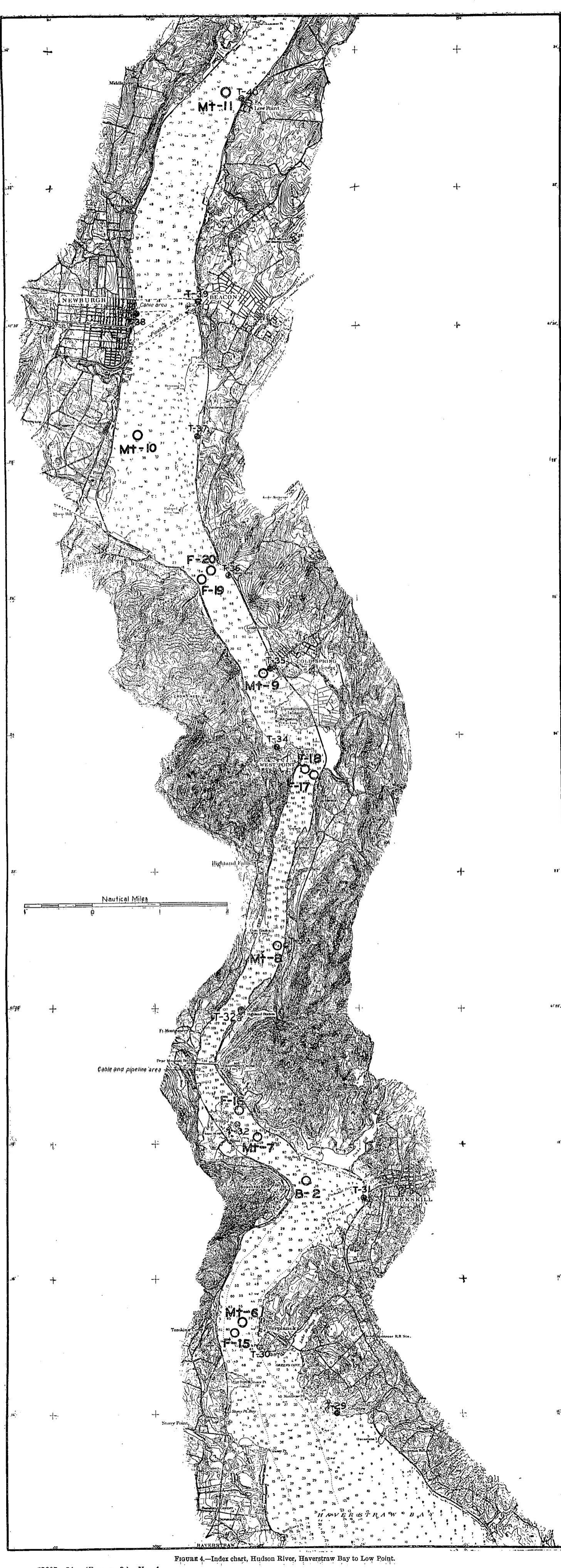


FIGURE 4.—Index chart, Hudson River, Haverstraw Bay to Low Point.

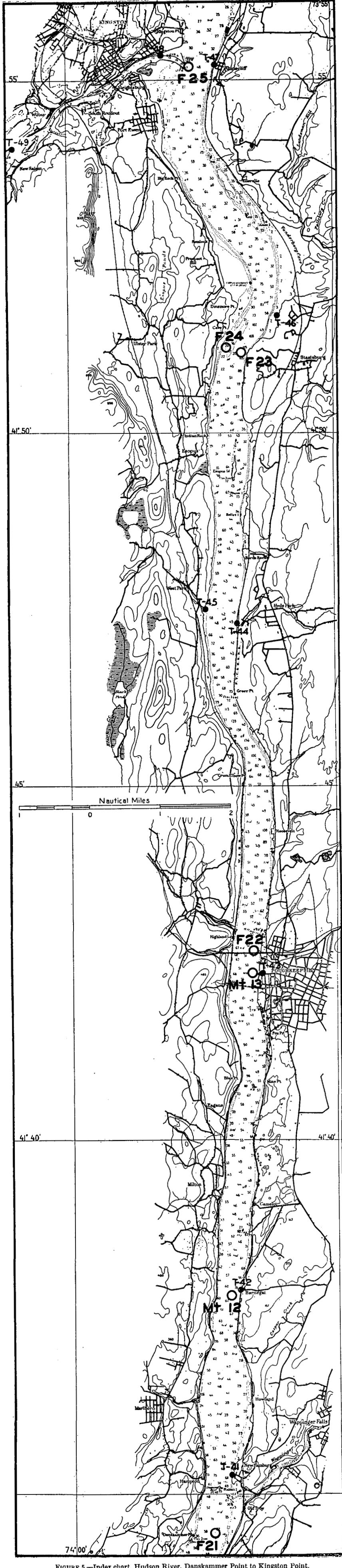


FIGURE 5.—Index chart, Hudson River, Danskammer Point to Kingston Point.
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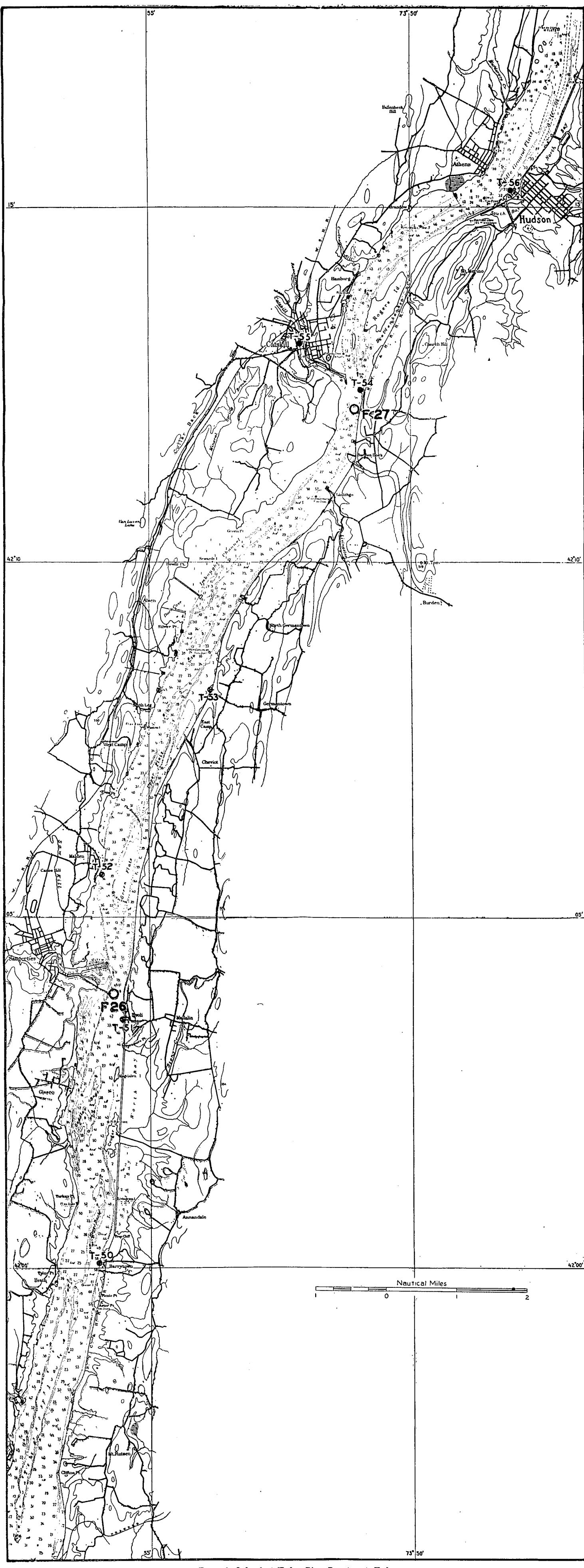


FIGURE 6.—Index chart, Hudson River, Barrytown to Hudson.

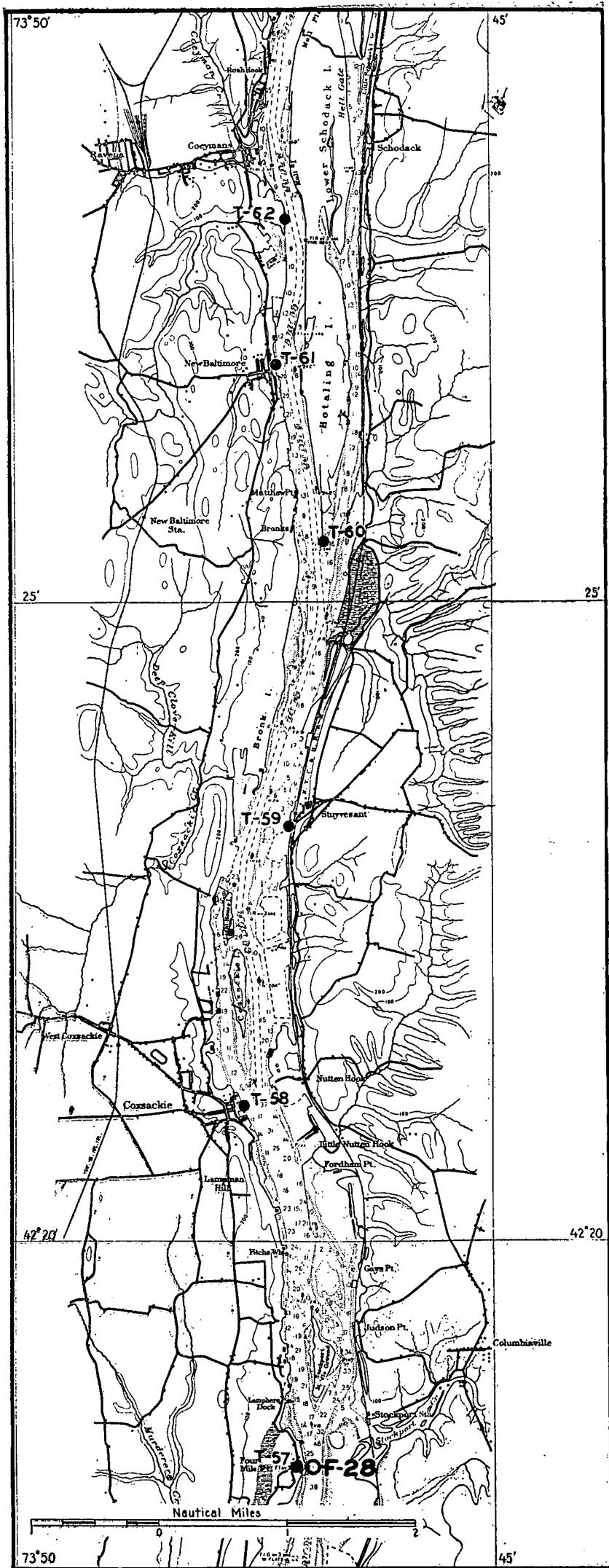


FIGURE 7.—Index chart, Hudson River, Four Mile Point to Coeymans.

35805—34. (Face p. 8.) No. 7

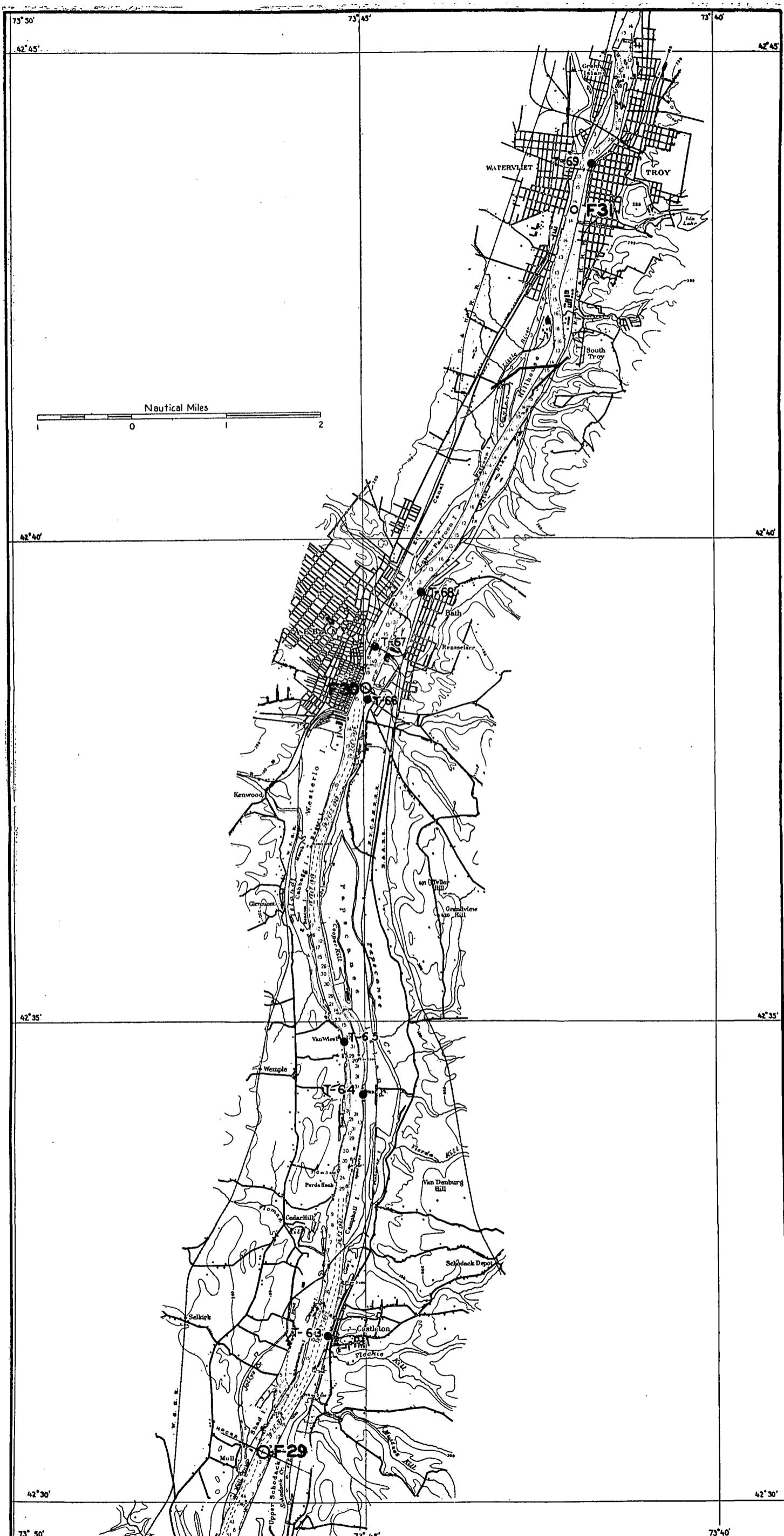


FIGURE 8.—Index chart, Hudson River, Mull to Troy.

Battery tide station is represented on the chart both as "T-3" and "T-3a", the first being its position at the Barge Office Pier where originally installed and the latter its position at the foot of Whitehall Street where it was moved in 1927.

Although Fort Hamilton is located in the Narrows 6 miles below the mouth of the river, the tidal results are included in this publication as the long period covered by the observations makes them especially valuable. This tide station was established by the Coast and Geodetic Survey on December 30, 1892, and maintained in operation practically continuously until December 5, 1920, when it was destroyed by fire. After the rebuilding of the pier on which the station had been located, the United States Army Engineers in the early part of the year 1921, installed a Gurley printing water stage register and have continued it in operation since that time. During the period November 18, 1926, to December 31, 1928, a standard gage of the Coast and Geodetic Survey was also maintained at this place in connection with some special research work being carried on in Jamaica Bay.

The principal tide station now in operation by the Coast and Geodetic Survey in this area is located at the foot of Whitehall Street and is known as the Battery tide station. The United States Army Engineers commenced tide observation at the Barge Office Pier, which is about 300 yards westerly from the present location, on May 24, 1920, a Gurley printing water stage register being used. On November 22, 1926, a Coast and Geodetic Survey standard gage was also installed at the same location. It was necessary to discontinue both gages on June 3, 1927, because of repairs to the Barge Office Pier. The gages were reestablished at the foot of Whitehall Street on August 9, 1927.

TABULATION AND REDUCTION OF TIDES

There are two forms for the tabulation of original tide records—first, as high and low waters, and second, as hourly heights. In the high- and low-water tabulation both the time and height of each high and low water are given. In the hourly height tabulation the height is given for each hour of the day.

The time generally used for the tabulation is the standard time for the locality, which, for the Hudson River, is that based upon the meridian 75° west of Greenwich. For convenience the hours of the day are numbered consecutively from 0^{h} at midnight to 23^{h} at 11 p.m., thus making unnecessary the use of the terms "a.m." and "p.m." The decimal system is now being used in the tabulation of the times of high and low water, and in the various tables of this publication time is generally expressed in hours and hundredths unless hours and minutes are indicated.

PRIMARY REDUCTIONS

The primary results sought in the reduction of any series of high and low waters are the mean high and low water lunitidal intervals, the mean high and low water heights, the mean range of tide, and the half-tide level. From the hourly heights there is obtained a plane designated as mean sea level if the tide station is on the open coast or in adjacent waters with free access to the sea. The corresponding

plane determined from hourly heights observed in a river is called mean river level and such a plane would be expected to have a slope from the mouth to the head of the river.

When a series of observations covers a considerable period of time, as at the primary tide stations, the calendar month is taken as the unit and averages obtained separately for each month, the monthly averages afterwards being combined to form yearly averages. In taking the monthly averages, it has sometimes been the practice to use only the first 29 days of each month in order to conform more closely to the synodical and anomalistic months. However, the results are practically the same as when the full calendar month is used, and any slight difference that might occur in an individual month will be absorbed in the yearly average.

For long series of observations no corrections to the lunital intervals are required except such as may be necessary to reduce them to the Greenwich or the local meridian. To reduce the range of tide to its mean value, factors depending upon the longitude of the moon's node are necessary unless the series covers a period of 19 years, which is approximately the time required for the node to pass through 360° of longitude.

The half-tide level and the mean sea level or mean river level are subject to considerable variations, more or less irregular, depending largely upon meteorological conditions, and for a satisfactory independent determination of these planes many years of observations are required. When there is available a suitable reference station with these planes already determined, corrections for other stations in the same general area may be derived through a comparison of results from simultaneous observations. The mean high- and low-water planes depend upon the range of tide and the half-tide level and after the latter have been reduced to mean values, the high- and low-water planes may be readily derived.

When a series of observations covers only a very short period of time, it is the general practice to reduce through comparison with simultaneous observations at a primary tide station not only the half-tide level but also the range of tide and the lunital intervals.

Results from the primary reductions at the principal tide stations are given in tables 1 to 96. The first 11 tables include the monthly means and extremes for Fort Hamilton covering a period of 40 years. Seasonal variations in these values are shown by means given in the bottom line of the table, these means being based upon the first 38 years of observations to include two 19-year cycles. Table 8, which gives the sea level at Fort Hamilton by months, covers the period 1893 to 1920, when the tide station was being operated by the Coast and Geodetic Survey. As the difference between sea level and half-tide level remains very nearly constant from month to month, the sea level for years subsequent to 1920 may be readily inferred from the half-tide level. From a comparison of the two planes for 28 years (1893-1920), the sea level at Fort Hamilton is found to be .04 foot higher than half-tide level.

Tidal means for 19-year periods at Fort Hamilton are included in table 9. A period of 19 years is generally considered as constituting a full tidal cycle, for during this period of time the more important of the tidal variations will have gone through complete cycles. With observations extending over this length of time, it is also reasonable

to assume that irregularities due to meteorological changes will be largely averaged out. Variations in these means may therefore be attributed to more or less permanent changes in the tidal regime of the locality. It will be noted that the variations in the lunitidal intervals are small and irregular. The mean high-water interval for the last 19-year period is 0.06 hour (4 minutes) less than for the first 19-year period. The mean low-water interval for the last period is only 0.03 hour (2 minutes) less than it was for the first period. The *mean range of tide gradually and consistently increased* from 4.67 feet during the period 1893-1911 to 4.75 feet during the period 1908-26. For subsequent 19-year periods the range has remained fixed at 4.75 feet. The half-tide level shows a gradual and consistent rising throughout the observations, except that for the periods 1911-29 and 1912-30 there was an apparent recession of 0.01 foot from the previous height. Between the first and last 19-year period there has been a total change of 0.10 foot in the half-tide level. As the interval between the middle of these two periods is 21 years, the average yearly change in half-tide level has been 0.005 foot. The same rate of change applies to the mean sea level as observed and inferred from the half-tide level. The exact causes of these changes are somewhat conjectural, as is also the answer to the question whether the changes will continue in the future at the same rate as in the past.

Tidal means and extremes for the Battery, New York City, are included in tables 12 to 23. The means and extremes for the period June 1920 to May 1927 are from observations at the Barge Office Pier, and from September 1927 to date from observations at the foot of Whitehall Street. The values for the months June, July, and August 1927, are inferred from the record at Fort Hamilton, as the gage at the Battery was not in operation at that time. The sea level in table 19 is given for such months as the data are available. The sea level for other months may be inferred from the half-tide level in table 18 by the application of the difference 0.08 foot, the average height of the sea level above half-tide level at the Battery. In tables 22 and 23 the extreme high and low waters for the years prior to 1920 are from records of the dock department of New York City, which maintains a tide gage at Pier A.

Tables 24 to 95 contain monthly means and some extremes for a number of places along the river where the observations have covered a considerable period of time. The data in these tables are from records furnished by the United States Army Engineers, who have maintained the gages at all of the stations excepting at Yonkers, where the observations were secured by the dock department of New York City. The mean high- and low-water heights for Albany were taken mostly from the annual reports of the Chief of Engineers, United States Army, other data being furnished in manuscript form. In general this group of tables include all monthly means as directly obtained, and as the observations were discontinued during the winter-time at most of the stations, only a portion of the year is usually represented.

Mean tidal constants for a stream like the Hudson River do not have the same significance as when applied to places along the coasts. In general, mean tidal quantities are averages representing all seasons of the year and all weather conditions prevailing in the locality, and averages obtained for different months do not usually differ much

from each other. In the Hudson River, however, tidal conditions vary greatly with changes in the stages of the river, and an average value representing all of the stages may differ considerably from one representing the actual tidal conditions prevailing at any particular time.

At the time of the larger freshets, the tide may be completely masked in the upper portion of the river, the water continuing to rise or fall for a period of several days without any tidal oscillation. At the time of the smaller freshets the range of tide is greatly diminished and the times of high and low waters somewhat delayed. Freshets most frequently occur during the spring months, especially in March and April. The tide may also be affected in the winter time by the formation of ice which reduces the fresh-water discharge.

Because of these conditions it does not seem feasible to include the entire calendar year in the calculation of the tidal constants for the river excepting for that portion near the mouth where the fluctuations are relatively small. Accordingly, for that portion of the river lying above George Washington Bridge the quarter of the year represented by the months of July, August, and September has been selected as the period when tidal conditions are most nearly normal, the fresh-water discharge usually being at a minimum at this time.

Tidal means as compiled for this portion of the year for the principal series of observations above George Washington Bridge are given in separate tables. Table 30 includes such means for Spuyten Duyvil for 7 years. In this table corrections were applied to the range of tide to take account of the longitude of the moon's node. The heights were also compared with simultaneous observations at the Battery and the results from this comparison are given in the bottom line of the table. Table 35 includes the means for Yonkers covering the months of July to September for a period of 20 years. Factors have been applied to take account of the longitude of the moon's node but on account of the length of the series no comparison with a primary station was deemed necessary.

The ranges and heights in table 44 for Verplanck and table 51 for Rhinecliff have been compared with simultaneous observations at the Battery and the results are given in the bottom line for each table. For the principal stations above Rhinecliff reduction by comparison with the primary tide station at the mouth of the river is of doubtful value because of the change in tidal conditions in advancing up the stream. With the observations covering a number of months, the independent determination of the tidal constants is considered preferable.

Table 93 contains the tidal means for Albany for the months of July, August, and September for a number of years. From this table there is evidence that there has been a pronounced change in the tidal conditions in this part of the river during recent years. During the period covered by these observations the times of high and low water have advanced by more than an hour and the range of tide increased by about 2 feet. The changes have not been uniform but somewhat irregular, the greatest change occurring between the summer of 1929 and the summer of 1930, when the range of tide increased by about 0.7 foot.

An examination of the records for tide stations below Albany shows that a similar increase in range of tide took place between the summer

of 1929 and the summer of 1930 as far south as Stonehouse Bar (station T-60, fig. 7). At the tide stations below Stonehouse Bar the change in the range of tide was negligible during this period. While the great drought of 1930 may have been a factor in changing tidal conditions in the upper portion of the river during that year, it is believed that the large increase in the range of tide at that time was primarily the result of the removal of some obstructing shoal in the vicinity of Stonehouse Bar, thus permitting the tide to have freer access to the river channel above. It will be noted that changes in the range of tide at Albany has affected the low-water heights to a greater extent than the high-water heights, and has resulted in the lowering of the half-tide level.

Table 96 contains a summary of tidal data from the various series of observations along the river. The station numbers in the first column correspond to the designations of the stations on the index charts, figures 1 to 8. The name of the locality is given in the second column. In some instances where several different series were made in approximately the same location, these are grouped together as a single locality such as New York, Forty-first to Forty-third Streets. The beginning and ending of each series of observations are indicated in the fifth column, but, excepting the principal tide stations, the series were in general noncontinuous. The length of the very short series of observations as expressed in days was obtained by dividing the whole number of high and low waters by four. For the longer series of observations, excepting near the mouth of the river, the results compiled are based upon observations taken during the months of July, August, and September only for reasons given on page 6.

The lunital intervals and duration of rise are expressed in hours and decimals. Both Greenwich and local intervals are given. For convenience in comparison, the Greenwich intervals are referred to the same transit of the moon for the entire river. In the local intervals the period 12.42 hours has been rejected when necessary in order to refer to the transit which next precedes the time of the tide. The duration of rise is the time from low water to high water. The duration of fall from high water to low water may be found by subtracting the duration of rise from 12.42 hours.

Following the column of mean range of tide is a column containing the half-tide level as referred to the Sandy Hook sea level datum. Values for this column were obtainable only when the tide staff used for the observations was connected with a bench mark of the first order level net.

The last column of the table contains the reference station used in reducing the observation of the several series through a comparison of simultaneous observations. Where no comparison was made the method of reduction is indicated by a reference to a footnote at the end of the table.

In using this summary of observational data several facts should be kept in mind. First, the tides in a river are subject to much irregularity due to meteorological conditions. Wind and fresh-water discharge are probably the most important disturbing factors. For this reason results obtained from a very short series of observations may vary largely from the means as derived from a very long series. Reduction by comparison of simultaneous observations can be relied upon only when there is a standard reference station so situated

that the tides may be expected to be similarly affected by both astronomical and meteorological variations as at the subordinate station. The value of the several available reference stations in New York Harbor diminishes rather rapidly in passing up the river, and while all the very short series of observations have been reduced by comparison with simultaneous observations in order to eliminate some of the astronomical inequalities, the longer series in the upper portion of the river have been reduced independently without comparison.

Consideration must also be given to the more or less permanent changes in the tide due to changes in the river bed which may result either from natural causes or from improvements carried on by man. The tabular values refer to the period covered by the observations and would therefore not necessarily be applicable to the tides of a later period following any material change in the river bed.

ADJUSTED TIDAL DATA

As results obtained directly from short series of observations at the different stations in the river depend largely upon the particular conditions which happen to prevail at the time, they are to be considered only as very rough approximations to true mean values. To correlate these results and obtain the most probable average values of the tidal constants for points along the river, the observational values were plotted as ordinates on cross-section paper with the distance of each station from the mouth of the river as represented by its latitude as the abscissa. Smooth curves were then drawn to follow the general trend of the plotted points, special weight being given to those from the longer series of observations. The adjusted values given in table 97 were taken from these curves. Above George Washington Bridge they represent average conditions for the months of July, August, and September. The lunitidal intervals and duration of rise are given in hours and hundredths and the mean range of tide in feet and tenths. The elevation of half-tide level above the Sandy Hook sea-level datum is given to the nearest five hundredths of a foot excepting in the vicinity of the Battery and at Albany where the nearest hundredth of a foot is used.

The adjusted tidal results are also represented graphically in figures 9, 10, and 11. The scale at the top of each illustration represents latitude and just below this scale are given the names of a number of points along the river. In figure 9 are given the tide and current intervals as referred to the transit of the moon over the meridian of Greenwich. The curves representing the high water and low water lunitidal intervals were derived from the adjustment described above. The lunicurrent intervals were obtained from a similar adjustment of the current data.

Figure 10 illustrates the adjusted mean range of tide along the river. In passing up the river it will be noted that the range of tide diminishes to a minimum at a point near Storm King and then increases to a maximum at a point near Catskill. This change in range may be considered as due primarily to the presence of a stationary tide wave, which, in combination with a progressive wave advancing up the river, would tend to produce a tide of this character.

Figure 11 illustrates the principal tidal datums for the Hudson River with elevations referred to mean sea level, the latter being the Sandy

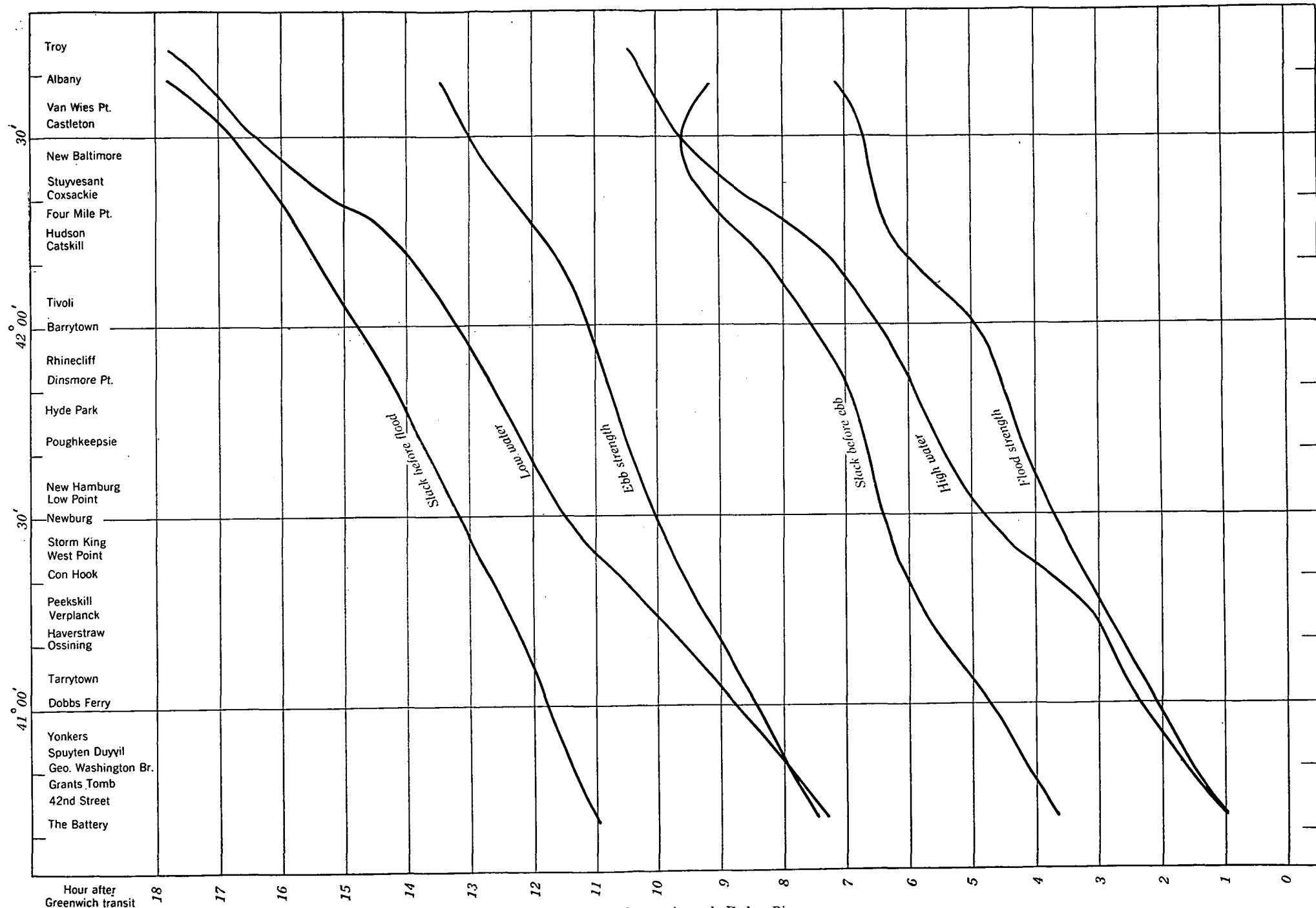


FIGURE 9.—Tide and current intervals, Hudson River.

Hook datum described on page 13. The half-tide level is the adjusted level representing in general the months of July, August, and September, and indicates the average slope in the river. The total fall from Troy to the sea is approximately 2 feet. The slope is greatest in the section of the river from Troy to Tivoli and least between Tivoli and Ossining. The mean high water is a surface elevated above the half-tide level by an amount equal to half range of tide and the mean low water a surface depressed below the half-tide level by the same amount. The Hudson River datum which is shown in this illustration is described on p. 13.

Attention is called to the fact that the adjusted values of table 97 and the graphic representations of the same are based primarily upon observations taken prior to the year 1931. Later observations at Albany indicate a permanent change in the tides in the upper part of the river which is not fully reflected in these values.

HARMONIC REDUCTION

Through the application of the harmonic analysis to the observed hourly heights of the tide, elementary tidal constituents are obtained which are represented by their amplitudes and phase lags, these being known as harmonic constants. Such constants form the basis for the prediction of tides and they may also be used in certain formulas to obtain values for some of the nonharmonic constants which are usually derived from the reduction of high and low waters.

There are included in this publication, in tables 98 to 101, the harmonic constants from 2 years of observations at Fort Hamilton, 3 years of observations at Governors Island, 2 years of observations at the Battery, and 1 year of observations at Albany. The first series analyzed for the Battery was from observations at the Barge Office Pier and the second series was from observations at the foot of Whitehall Street, the tide gage having been moved to the latter place in 1927. The two locations are about 300 yards apart so that very little difference in the tide would be expected.

The harmonic constants for Albany from observations for the year 1914 are given as a matter of record. Because of recent improvements in this section of the river considerable change in the tide has taken place and the harmonic analysis of a later series of observations is now being planned. For the predictions of tides for Albany, approximate allowances are being made for the change.

PHASE REDUCTION

The principal results to be derived from the phase reduction are the spring and neap range of tide. The moon and sun act in conjunction at times of the syzygies, causing the range to be greater than the mean, although the maximum effect does not usually become evident until a day or two after new or full moon, this lag being known as the age of the phase inequality. Similarly, the tide-producing effects of the moon and sun are opposed to each other at the times of the quadratures, causing the neap tides with a range less than the mean.

Table 102 includes results from phase reductions for several stations on the Hudson River. For the Battery the phase age and the ratios of the spring and neap ranges to the mean range were derived from the harmonic constants in table 100. For Albany the phase

age and all ratios were from a reduction of high and low waters for the period June 27 to September 23, 1930. For all other stations and including the phase inequality ratios at the Battery, the ages and ratios were derived from reductions of the high and low waters for the period June 27 to October 22, 1930, at each of the stations. The accepted spring and neap ranges at the several stations were obtained by applying the respective ratios to the accepted mean ranges which were derived from an adjustment of the tidal data for the river.

It will be noted that the ratio of the spring range to the mean range decreases from 1.2 at the Battery to 1.09 at Albany, while the ratio of the neap range to the mean range increases in nearly the same proportion. From an examination of the phase inequalities which represent the amount by which the spring high and low waters vary from the mean high and low waters, respectively, it will be seen that most of the change in the spring range ratio is due to the low-water phase inequality, the ratio of which decreases from 0.09 at the Battery to only 0.01 at Albany. Hence, while the spring high water at Albany may differ by an appreciable amount from the mean high water, the difference between

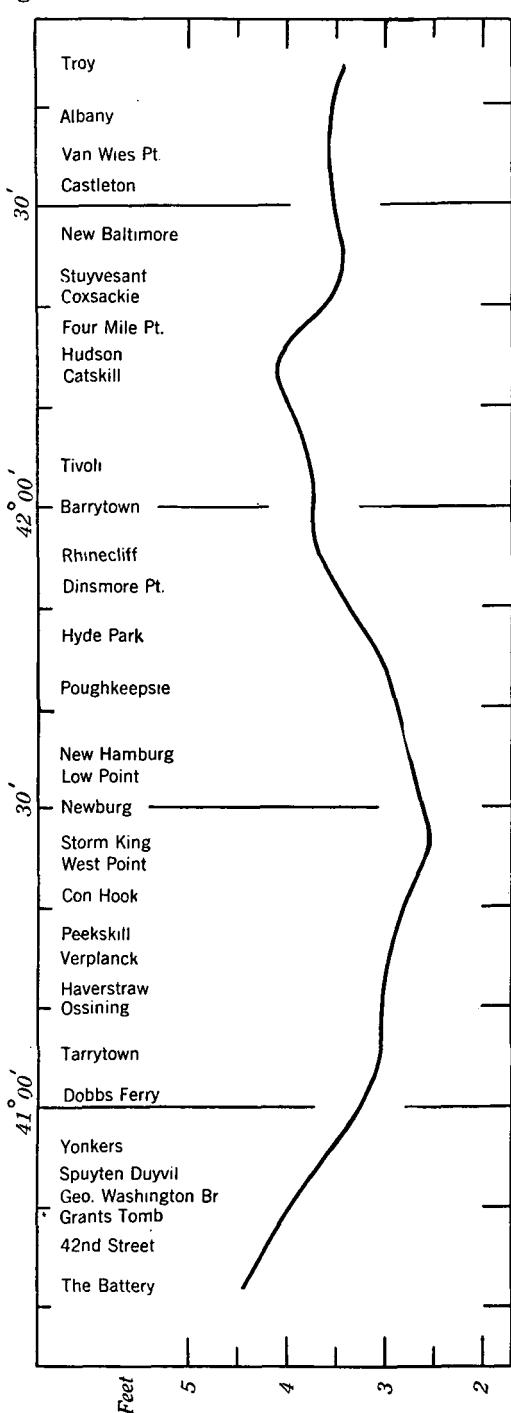


FIGURE 10.—Mean range of tide, Hudson River.

the spring low water and mean low water is almost negligible.

PARALLAX REDUCTIONS

The principal results to be derived from the parallax reduction are the perigean and apogean range of tide. As the moon approaches its perigee and its distance from the earth becomes less, the range of tide increases; and as it approaches its apogee and the distance becomes greater, the range diminishes. The maximum effect on the range of tide, however, does not usually occur until some hours after the moon has passed its perigee or apogee, this lag being known as the age of the parallax inequality.

Table 103 includes the perigean and apogean ranges for the Battery and Albany. The ratios of the perigean and apogean ranges, together with the age of the parallax inequality for the Battery, were derived from the harmonic constants in table 100. The corresponding values for Albany were derived from a reduction of high and low waters for the period June 15 to October 3, 1930. The perigean and apogean ranges for both places were obtained by applying the ratios to the accepted mean ranges.

Through a comparison with the values in table 102 it will be noted that the perigean range is slightly greater than the spring range, both at the Battery and at Albany. When the perigean and spring tides occur about the same time of month the range of tide will be unusually large, and when the apogean and neap tides occur together the range will be especially small.

DECLINATIONAL REDUCTION

This reduction has for its purpose the determination of constants depending upon changes in the declination of the moon. Table 104 includes results from declinational reductions for the Battery and Albany. The tropic intervals and tropic ranges were obtained by applying to the best determined mean intervals and ranges differences derived from the harmonic constants listed in tables 100 and 101. The tropic inequalities were based directly upon these constants. The diurnal high- and low-water inequalities for the Battery were derived directly from the high and low waters for the calendar year 1930. The corresponding inequalities for Albany were obtained from the high and low waters for the months of June, July, August, and September 1930.

EXTREME TIDES

Monthly extreme high and low waters for Fort Hamilton are given in tables 10 and 11, and for the Battery in tables 20 and 21. There are also included in tables 22 and 23 the yearly highest and lowest tides at the Battery from 1886 to 1932, the extremes for the years 1886 to 1920 being from records of the dock department of the city of New York.

Tides in New York Harbor reaching a height of 6 feet or more above the sea-level datum have been observed as follows:

- November 24, 1901, 6 feet at Fort Hamilton, 5.9 feet at the Battery.
- April 11, 1918, 6.2 feet at Fort Hamilton, 6.1 feet at the Battery.
- February 5, 1920, 5.8 feet at Fort Hamilton, 6.1 feet at the Battery.
- February 20, 1927, 6.2 feet at Fort Hamilton, 6 feet at the Battery.
- November 10, 1932, 6.4 feet at Fort Hamilton, 6 feet at the Battery.

At the times of the extreme high waters of 1901, 1918, and 1920, the phase and parallax of the moon were somewhat favorable to high

tides and the heights observed were approximately 3 feet higher than the predicted heights. The astronomical conditions accompanying the high water of February 20, 1927, were such as would be expected to cause a tide below the average. The observed heights at Fort Hamilton and at the Battery were 4.2 feet above the corresponding predicted heights at both places. This exceptionally high water resulted from a very severe storm which had been raging over the North and Middle Atlantic States for 2 days and causing extensive loss of life and property. At Spuyten Duyvil and at Yonkers the water reached a height of $3\frac{1}{2}$ feet above the local mean high water. At Albany the height reached was 2.7 feet above the local mean high water. The extreme height observed November 10, 1932, also followed a severe storm of several days duration with winds from the northeast and east reaching a velocity of more than 50 miles an hour. The observed height at Fort Hamilton was 3.8 feet above the corresponding prediction for that place and at the Battery the height was 3.6 feet above the prediction.

Tides in New York Harbor which have fallen 6 feet or more below the sea-level datum have been observed as follows:

February 27, 1886, -6.1 feet at the Battery.
February 8, 1895, -5.9 feet at Fort Hamilton, -6.2 feet at the Battery.
February 2, 1908, -6.4 feet at Fort Hamilton, -6.1 feet at the Battery.
January 6, 1912, -6.2 feet at Fort Hamilton, -5.9 feet at the Battery.
February 22, 1912, -6.2 feet at Fort Hamilton.
January 13, 1914, -6.2 feet at Fort Hamilton, -5.8 feet at the Battery.
January 26, 1928, -6.2 feet at Fort Hamilton, -5.8 feet at the Battery.

The lowest tide at Fort Hamilton, which occurred on February 2, 1908, was 3 feet below the corresponding predicted low water. The lowest tide at the Battery, recorded February 8, 1895, was 3.1 feet below the corresponding predicted height.

Extreme high waters at Albany are given in table 94, which includes heights which have been reported as being 14 feet or more above the datum of the tabulations, which is 2 feet below the Sandy Hook sea-level datum. Subsequent to 1920, the highest reading is also given for each of the years that the water did not reach the 14-foot height.

The two highest waters recorded at Albany occurred on February 9, 1857, and March 28, 1913. Each of these reached a height of approximately $23\frac{1}{2}$ feet above the datum of tabulations or $21\frac{1}{2}$ feet above the Sandy Hook sea-level datum. The high water of 1857 resulted from an ice gorge above Van Weis Point. That of 1913 was due to a freshet that followed unusually heavy rains during the latter part of March and the rapid melting of snow in the Adirondacks caused by the mildness of the weather. The height reached by the water below the dam at Troy was $29\frac{1}{2}$ feet above the sea-level datum or 8 feet higher than at Albany, making a slope of a little more than 1 foot per mile. At Castleton a height of 16.4 feet above the sea-level datum and at Stuyvesant a height of 11.2 feet above the same datum were reported, making an average slope of about 0.6 foot per mile between Albany and Stuyvesant. Between Troy and Albany a maximum surface current of 8 miles per hour was observed and at Albany about 6 miles per hour.

Extreme low waters at Albany are given in table 95, which includes the lowest recorded tide for each year from 1920 to 1932, inclusive. Improvements in the river have caused a general lowering of all tide

planes so that the low waters of recent years have fallen lower than ever previously reported. It is interesting to note that for each of the last 3 years the extreme low water at Albany occurred on the same date as the lowest tide for the same year at the Battery, and during the 2 preceding years the extreme low waters at Albany occurred when the tides were exceptionally low at the Battery although not the lowest for the year. This indicates that at low water stages, the tides at Albany reflect somewhat the tidal conditions at the mouth of the river. Similar conditions are of course not to be expected at the high water stages which result largely from excessive drainage into the river.

TIDAL DATUMS

A tidal datum may be defined as a plane or surface derived from tidal observations and used as a reference from which to reckon elevations. For general use over large areas the best and most universally accepted datum is one based on the mean level of the sea as derived from observed hourly heights. For hydrographic purposes, especially in the preparation of charts for the use of mariners, a datum approximating mean low water is generally adopted. For the Hudson River, the basic datum is mean sea level as derived from observations at Sandy Hook. The datum of soundings on the charts for the lower portion of the river is mean low water, and above Ossining the Hudson River datum. These datums, together with mean high water, half-tide level, and mean low water, are illustrated in figure 11.

MEAN SEA LEVEL

The mean sea level illustrated in figure 11 is the Sandy Hook sea-level datum and is used as a standard for the area covered by this publication. It was derived from hourly heights of the tide observed at Sandy Hook, N.J., during a period of 6 years from 1876 to 1881, inclusive. It was originally adopted in 1882 as the datum for the adjustment of a first-order level line beginning at Sandy Hook and since that time has been accepted as the basic datum for this general region. It was used by the City of New York as the datum for a comprehensive net of precise levels covering the several boroughs of Greater New York, which were run in the years 1909–12 under the direction of Frederick W. Koop, of the board of estimate and apportionment. The principal tidal series along the Hudson River have been connected with this datum through bench marks of the first-order level net.

HUDSON RIVER DATUM

Because of the large fluctuations in the level of the Hudson River due to meteorological changes and other causes, especially in the upper portion of the river, a datum derived from local tides is somewhat uncertain as it must depend to a considerable extent upon an arbitrary decision as to what constitute normal tides. To provide a standard reference plane for hydrographic work there has been adopted a plane known as the "Hudson River datum." This datum is defined as being a plane .75 foot below the Sandy Hook sea-level datum for the section of the river extending from Troy to Barren Island, and 1 foot below the Sandy Hook sea-level datum between Barren Island and Ossining. This datum, so far as applying to the section of the river

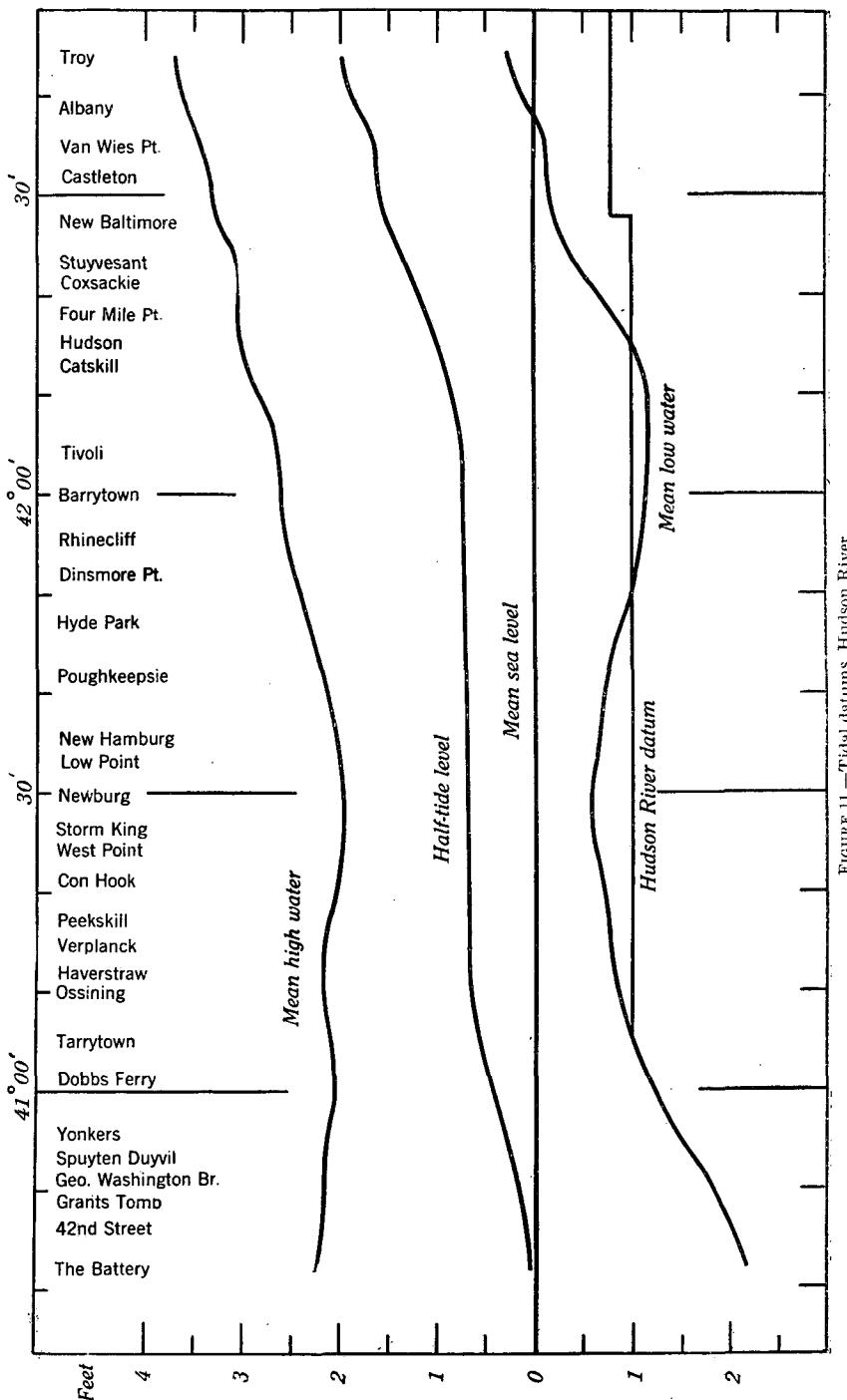


FIGURE 11.—Tidal datums, Hudson River.

between Troy and Hudson, was originally adopted by the United States Engineers Office, first district, New York City, in 1926; and at the suggestion of the Coast and Geodetic Survey in September 1931, the datum was extended to Ossining. Below Ossining where the tidal planes are more stable with less seasonal fluctuations, the hydrographic datum is taken as coinciding with the mean low water.

The Hudson River datum, which is illustrated in figure 11, may be considered as approximating the mean low water of the summer months when the river is usually at its lowest stages. The mean low water itself in the upper part of the river has been subject to considerable change as a result of recent improvements. In figure 11, the mean low water represented for Albany is based upon the average low water during the summer months for the 10-year period from 1921 to 1930, inclusive. It now appears from later observations, which were not available when the adjustment of the tidal data for the river was made, that with the completion of the improvements to the river the mean low water in the vicinity of Albany will approximate very closely to the adopted datum.

CURRENT OBSERVATIONS

Current observations in the Hudson River have been taken from time to time in connection with general surveys of New York Harbor. The stations occupied are indicated on the set of index charts (figures 1 to 8) by open circles or circles enclosing a cross, each station being designated by a numeral with certain letters prefixed. The numeral in general is the same as the original number used by the observing party to designate the station. An exception was made for the stations occupied by Henry Mitchell in years subsequent to 1871 to avoid duplication of numbers by the same party. Also a few stations occupied by H. C. Denson in 1922 which were originally designated by letters are here indicated by numbers.

The letters preceding the numerals indicate the party in charge of the work. They are as follows:

Wd = Maxwell Woodhull, 1854.	W = Isaac Winston, 1919.
Wa = Richard Wainwright, 1855.	D = H. C. Denson, 1922.
Mt = Henry Mitchell, 1858, 1871, 1872, 1873.	F = H. E. Finnegan, 1929.
M = H. L. Marindin, 1885.	E = U.S. Engineers, 1932.
B = J. B. Boutelle, 1901.	R = I. E. Rittenburg, 1932.

A number of the stations occupied in 1932 were located essentially the same as earlier stations. In these cases, the stations are designated on the index chart by their original numbers only, cross references to the other numbers being indicated in the table giving the results of the observations.

OBSERVATIONS OF 1854

The observations of 1854 were taken under the direction of Lieut. Maxwell Woodhull, commanding the schooner *Madison*, and the work extended up the Hudson River as far as Fiftieth Street, New York City. The apparatus used in these observations was not described in the records, but the bearings of the float were taken by compass and sometimes by angles. Velocities were taken on the surface and at a depth of 15 feet, the tabulated results including averages for both depths.

OBSERVATIONS OF 1855

The observations of 1855 were taken under the direction of Lieut. Richard Wainwright, commanding the schooner *Nautilus*. These observations were taken in connection with a survey of New York Harbor which had been authorized by the State of New York and in which the United States Coast Survey cooperated. The work extended up the Hudson River as far as Spuyten Duyvil. The apparatus used in these observations was not described in the records. The bearings were taken by compass and velocities are given for only one depth, presumably at the surface.

OBSERVATIONS OF 1858

In connection with a study of tides and currents in New York Harbor in 1858 by Assistant Henry Mitchell, one current station was occupied in the Hudson River near Forty-first Street, New York City. The current pole used for surface velocities was a piece of timber 12 feet long and weighted to float with 11 feet submerged. A tin tube 4 inches in diameter and 24 feet long and weighted to float with 23½ feet submerged was also used.

OBSERVATIONS OF 1871, 1872, AND 1873

Current observations were taken in the Hudson River during several successive years under the general direction of Assistant Henry Mitchell in connection with a physical survey of New York Harbor. In this work Mr. Mitchell was assisted by H. L. Marindin and F. F. Ness. The boats *Bowditch*, *Hassler*, *Argo*, and *Caswell* were used for the work and various stations were occupied from the mouth of the river to a point opposite Poughkeepsie. Surface velocities were observed by current poles drawing 10 to 12 feet and directions by compass. While subsurface-currents were also observed by means of two cylinders connected by a small wire, the results were not very satisfactory and reductions were made for the surface currents only.

OBSERVATIONS OF 1885

Observations in 1885 were made by party of Assistant H. L. Marindin at sections of the river opposite Dobbs Ferry and Thirty-ninth Street, New York City. A Price current meter was used in the work. The direction of the current was determined by the boat-heading.

OBSERVATIONS OF 1901

Stations off Ossining and Peekskill were occupied by party of Assistant J. B. Boutelle in 1901. A 12-foot pole weighted to float with 10 feet submerged was used in this work.

OBSERVATIONS OF 1919

The observations of 1919 were taken under the direction of Isaac Winston, inspector at the New York field station, the work being carried on by Jack Senior, commanding the launch *Elsie III*. A number of stations were occupied between the Battery and Spuyten Duyvil. A 15-foot pole weighted to float with 14 feet submerged was used for surface velocities and directions. A Price current meter was used at three different depths at each station, namely at two tenths, five tenths, and seven tenths of total depth at the station occupied. Directions of the surface currents were obtained both by compass and pelorus.

OBSERVATIONS OF 1922

In the summer of 1922 a comprehensive current survey of New York Harbor was carried out jointly by the Coast and Geodetic Survey and the United States Army Engineers of the first district, New York. The work was in charge of H. C. Denson and included a number of current stations in the lower part of the Hudson River to Riverdale.

Current poles 15 feet long and weighted to float with 14 feet submerged were used for the surface currents. The poles gave the current conditions for an average depth of 7 feet. Price current meters were used to obtain the current velocities at three depths at each station, these depths approximating two tenths, five tenths, and eight tenths of the depth of water at the station. The direction of the current at different depths was obtained by a device called the bifilar direction indicator. It consisted essentially of a set of three vanes, each suspended by two parallel wires which actuated a pointer moving over a pelorus. Each vane could be set independently at any desired depth so that the directions of the current at three different depths were indicated simultaneously.

OBSERVATIONS OF 1929

The observations of 1929 were made under the direction of H. E. Finnegan and covered the section of the river from Riverdale to Troy. A 15-foot current pole was used for the surface currents except where insufficient depths made it necessary to use shorter poles. Price current meters were used to obtain subsurface velocities. A Pettersson current meter was also used to a limited extent.

OBSERVATIONS OF 1932

The current observations in the Hudson River during the year 1932 were obtained in connection with a general tide and current survey of New York Harbor which was undertaken by the United States Engineers with the cooperation of the Coast and Geodetic Survey as a result of unemployment relief activities of New York City whereby a large number of men became available to assist in the work.

The United States Engineers occupied five current stations in a cross section of the Hudson River near its mouth, this section being opposite Pier 9 near foot of Carlisle Street, New York City. At each station observations were taken at three depths, namely, 0.2, 0.5, and 0.8 of total depth. The observations were taken with an automatic current meter recently developed by the United States Engineers. This meter is a large Price meter to which a protective frame and a stabilizing vane have been added, and which is fitted with an electrical recording apparatus to take the place of the earphone ordinarily used by the observer in counting the revolutions of the meter wheel. The contact made during each revolution of the wheel actuates an electromagnet which moves a ratchet wheel forward one step. Through the use of an interchangeable cam keyed to the ratchet wheel shaft, a pen is caused to make a line on a time chart for a certain number of turns of the meter wheel. With a velocity of 3 to 5 knots, the cam generally used provides for the registering of each 50 turns of the meter wheel. The velocity of the current at any time may be readily determined by the frequency of these lines on the time chart.

A detailed description of this apparatus will be found in an article on Measuring Currents in New York Harbor, by Harold E. Libby, engineer, first New York district, which was published in the Military Engineer for September-October 1932.

The current observations of the Coast and Geodetic Survey during the year 1932 were taken under the direction of I. E. Rittenburg. In the Hudson River, cross sections of three stations each were occupied off Pier 52, foot of Gansevoort Street; off Pier 97 at Fifty-seventh Street; at George Washington Bridge; and off Riverdale. Two stations were also occupied near the entrance to Spuyten Duyvil Creek. Surface observations were taken with a 15-foot current pole. The Price current meter was used in obtaining the velocity at three different depths at each station, these depths being 0.2, 0.5, and 0.8 of the total depth. Observations with pole and meter were taken half hourly as is the usual practice.

TABULATION AND REDUCTION OF CURRENTS

For the reversing type of current, which prevails in the Hudson River, the usual method of reduction is as follows. The observed half hourly velocities are first plotted on cross-section paper, the flood velocities above and the ebb velocities below a horizontal line of zero velocity. Although individual velocities may plot somewhat irregularly, they usually roughly follow a sine curve having a period corresponding in length to that of the semidiurnal tide.

A curve is then drawn by hand which follows the general trend of the plotted velocities. The points where the curve intersects the line of zero velocity are tabulated as the times of slack water and the maximum and minimum points of the curve as the times of flood and ebb strength. The corresponding flood and ebb velocities are determined by the ordinates at the maximum and minimum points. The direction of the current at the time of each strength is taken from the original record.

The times of the slack water and strength of current are usually compared with the times of high and low water at some principal tide station. Comparisons may also be made with the times of slack water and strength of current at another current station if there should be one available with well-determined constants.

The time differences for each current phase, and the velocity and direction of flood and ebb strength are then averaged. The average time differences give the relation of the current at the secondary station to the tide or current at the standard station. Reference may afterwards be readily made to any other standard tide or current station or to the moon's transit by the application of known differences. The velocities of the flood and ebb strength are reduced to mean values by factors based upon the range of tide or velocity of the current at the standard station.

Table 105 contains the results from the various current surveys in the Hudson River. The station number in the first column corresponds to the designation of the station on the index charts (figs. 1 to 8). In a few cases where the station was occupied in another year under a different designation, the latter is given in parentheses. In the second column, the location of the station is described, the point on the shore opposite the station and also the latitude and longi-

tude being given. Following the location, the dates of the beginning and end of each series of observations and the length of the series to the nearest half day are given. Observations of 1 day usually included 25 hours and those of 2 days 50 hours in order to cover complete tidal cycles.

The results from the earlier series of observations are for surface currents only, which in this publication are taken to include any depth up to 15 feet. These observations were in general taken with a pole, but other devices were also sometimes used. For the observations of 1919, 1922, 1929, and 1932, the results for several different depths are given.

In this table all times are expressed in hours and hundredths. The times of slack water and flood and ebb strength are referred to either high or low water at the Battery according to the inscription at the top of the column. A minus sign before the difference indicates that the time of the current is earlier than the time of the corresponding tide.

The direction of the current at the times of flood and ebb strength is given in degrees as reckoned from the true north. The direction of the surface current was usually obtained from the position of the current line in passing over a pelorus or compass. Excepting the observations for 1922 when a bifilar direction indicator was used, the directions of the subsurface current were not generally obtained.

The mean current hour is the interval expressed in solar hours between the time of the moon's transit over the meridian of Greenwich and the time of strength of flood modified by the times of the other current phases.

ADJUSTED CURRENT DATA

Direct results as derived from current observations covering only a few days may be influenced to a large extent by temporary meteorological conditions. This is especially true for currents in a river which is subject to large fluctuations in the fresh-water discharge. Such results are therefore to be considered only as very rough approximations to true mean values. By correlating and adjusting the results from different series of observations in the same general locality closer approximations may be obtained. In such correlation consideration must be given to the fact that the current may sometimes differ considerably at points only a short distance apart. The current in the midchannel of a stream usually flows with a greater velocity and turns later than the current near shore. Eddies and counter currents may be created by shoals or other obstructions.

Table 106 contains adjusted data for the surface currents along the midchannel of the Hudson River. For the purposes of this table, the surface currents are taken to include those to a depth of 15 feet.

The adjustment was accomplished by plotting on cross-section paper the observational data, using the distance of each station from the mouth of the river as measured by its latitude as the abscissa and the result to be adjusted as the ordinate, separate adjustments being made for each current phase interval and for flood and ebb velocities. The stations used for the adjustment were those located well out in the stream, stations near the shore being excluded.

Smooth curves were drawn to follow as near as practicable the general trend of the plotted points. The resulting interval curves are illustrated in figure 9 and the velocity curves in figures 12 and 13.

The adjusted values for table 106 were then scaled off from these curves.

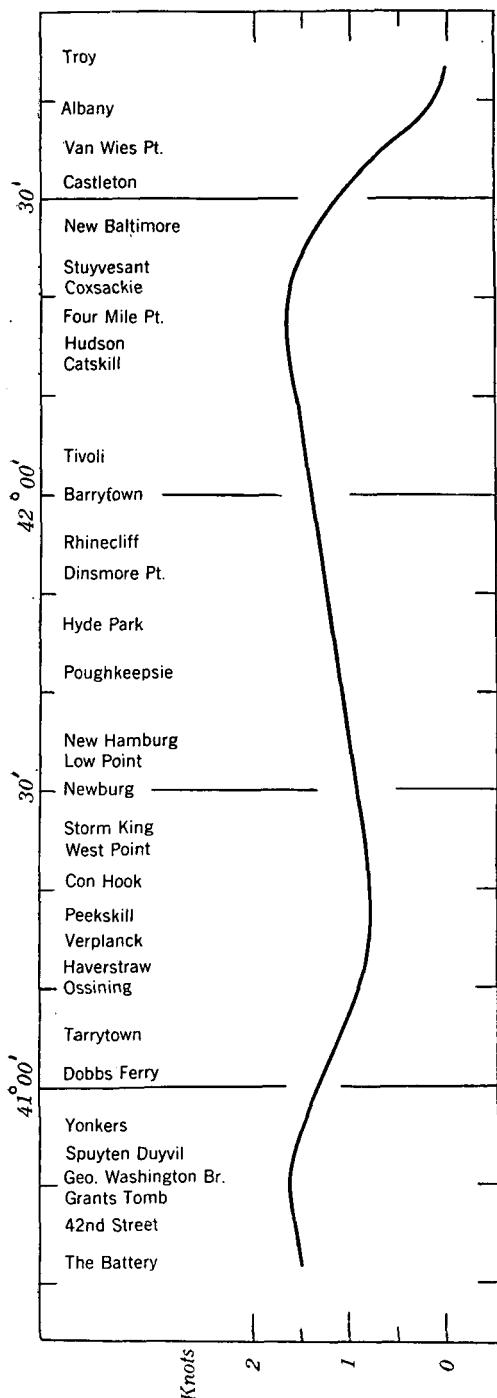


FIGURE 12.—Mean velocity of flood current, Hudson River.

For convenience in making comparisons between the times of the tide and the current phases, the values were taken for the same localities as those used for the adjusted tidal data in table 97. A direct comparison in the times may be made through the Greenwich intervals.

The times of slack water and flood and ebb strength are referred also to the times of the high and low water at the Battery, and through the application of these differences to the predicted tides at the latter place, the times of the current phases may be readily estimated. It should be kept in mind, however, that the differences represent average values and are subject to variations depending upon the special conditions which may prevail at the time. The last two columns of table 106 contain the average velocities at strength of flood and strength of ebb. Special attention is called to the fact that these adjusted values refer to the midchannel. Near the shore the currents may turn from a half hour to an hour earlier than in midchannel and the velocity may be considerably less.

HARMONIC REDUCTION

The process of the harmonic analysis used for the reduction of the

hourly heights of the tide is also applicable to the reduction of the

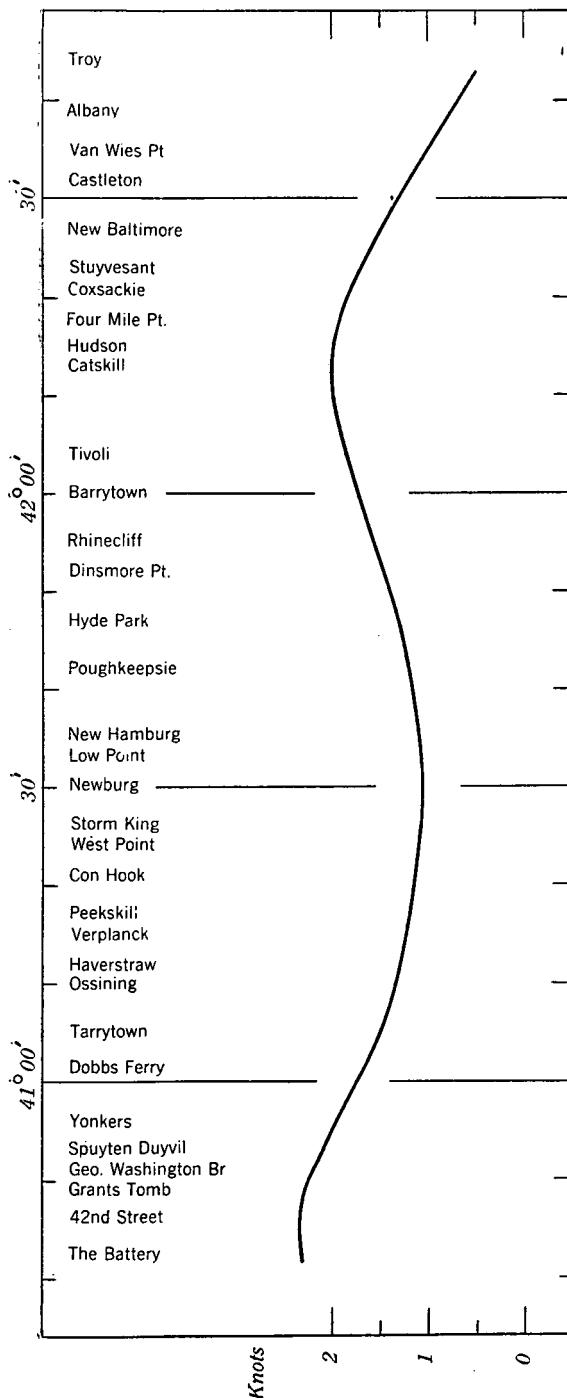


FIGURE 13.—Mean velocity of ebb current, Hudson River.

hourly velocities of the current. When applied to the reversing type of current, the flood current is usually considered as a movement in the positive direction and the ebb current as a movement in the negative direction, the epochs having reference to the times of the maximum flood strength of each constituent. Harmonic analyses have been made for two current stations in the lower part of the Hudson River, station D-14, where observations were taken in 1922, and station E-1, where observations were taken in 1932. The locations of these stations are shown on the index chart, figure 1. At station D-14, analyses were made for two overlapping 15-day series covering a total of 21 days. At station E-1 the series of observations analyzed covered a period of 27 days, which by extrapolation of hourly velocities was extended to the standard length of 29 days. The harmonic constants obtained from these analyses are given in table 107. In addition to the usual kappas (κ), which refer to the equilibrium arguments pertaining to the local meridian, the table includes also the corresponding Greenwich epochs which refer to the Greenwich arguments, the difference between the local kappas and the Greenwich epochs being equal to the product of the longitude by the subscript of the constituent. A general use of Greenwich epochs would permit a direct and convenient comparison between the times of constituent current phases for stations located in any part of the world.

DIAGRAMS OF HOURLY TIDE AND CURRENT CONDITIONS IN HUDSON RIVER

The 13 diagrams, figures 14 to 26, illustrate the average tide and current conditions in the axis of the main channel of the Hudson River during the summer months, as referred to the time of high water at the Battery. The scale at the top of each diagram represents latitude, and as the river runs nearly north and south this is approximately proportional to the distance as measured along the axis of the stream. The vertical scale on the side of the diagram indicates height as referred to the Sandy Hook sea-level datum.

Each curve represents a profile of the river surface from the Battery to Troy for the hour indicated. The slope of the river, however, is greatly exaggerated, as the vertical scale of heights is more than 60,000 times as great as the horizontal scale of distances. The vertical arrows indicate by their direction whether the tide is rising or falling at the various places along the river at the time represented by the curve.

The currents are represented by horizontal arrows which by their direction show whether the current is flooding or ebbing. The figures at each arrow show the velocity of the current in knots. Special attention is called to the fact that these currents refer to the main channel of the stream. In approaching the shore diminished velocities are to be expected. Moreover, the time of the turning of the current from flood to ebb or ebb to flood may be from a half hour to an hour earlier near the shore than is the case in mid-channel.

The tides and currents in the river are subject to large seasonal variations due primarily to fluctuations in the fresh-water discharge. Near the mouth of the river this variation in the tide is relatively small, but in advancing up the river the seasonal variations become more important and above George Washington Bridge the tides used were generally limited to those observed during the months of July, August, and September as the period when the tidal effects are most

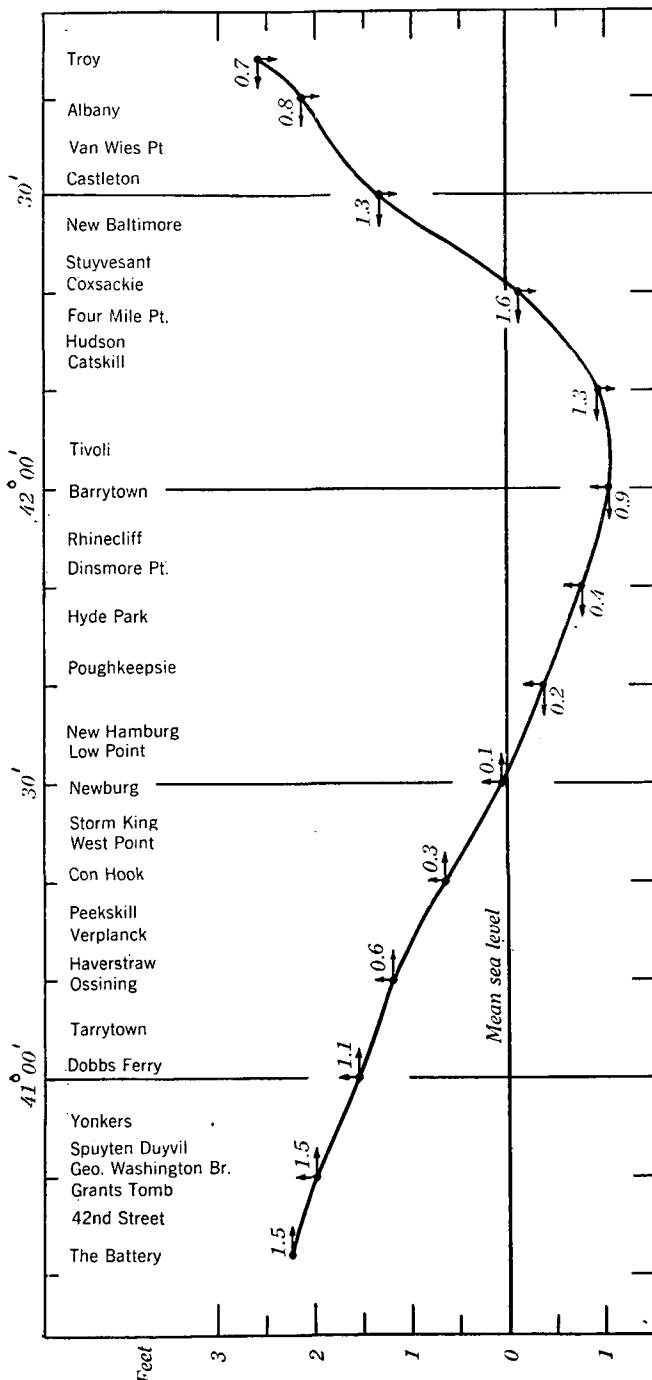


FIGURE 14.—Tide and current in Hudson River at time of high water at the Battery.

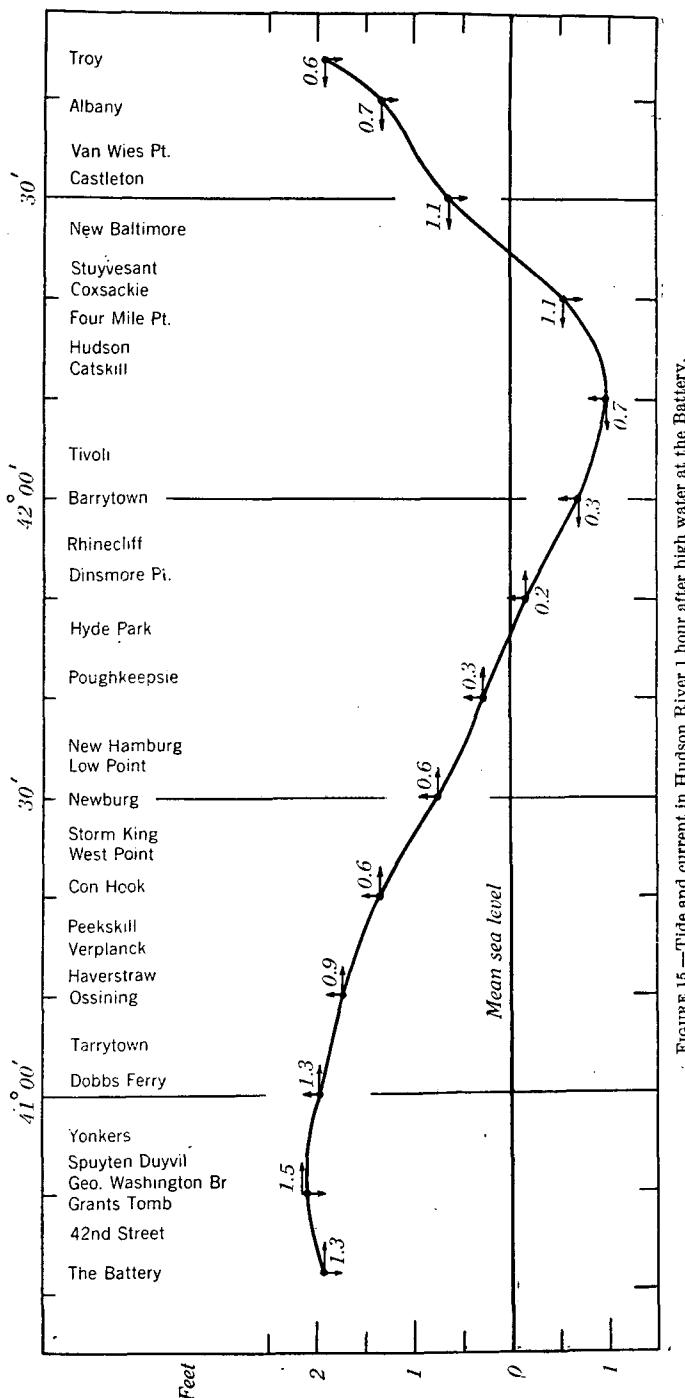


FIGURE 15.—Tide and current in Hudson River 1 hour after high water at the Battery.

TIDES AND CURRENTS IN HUDSON RIVER

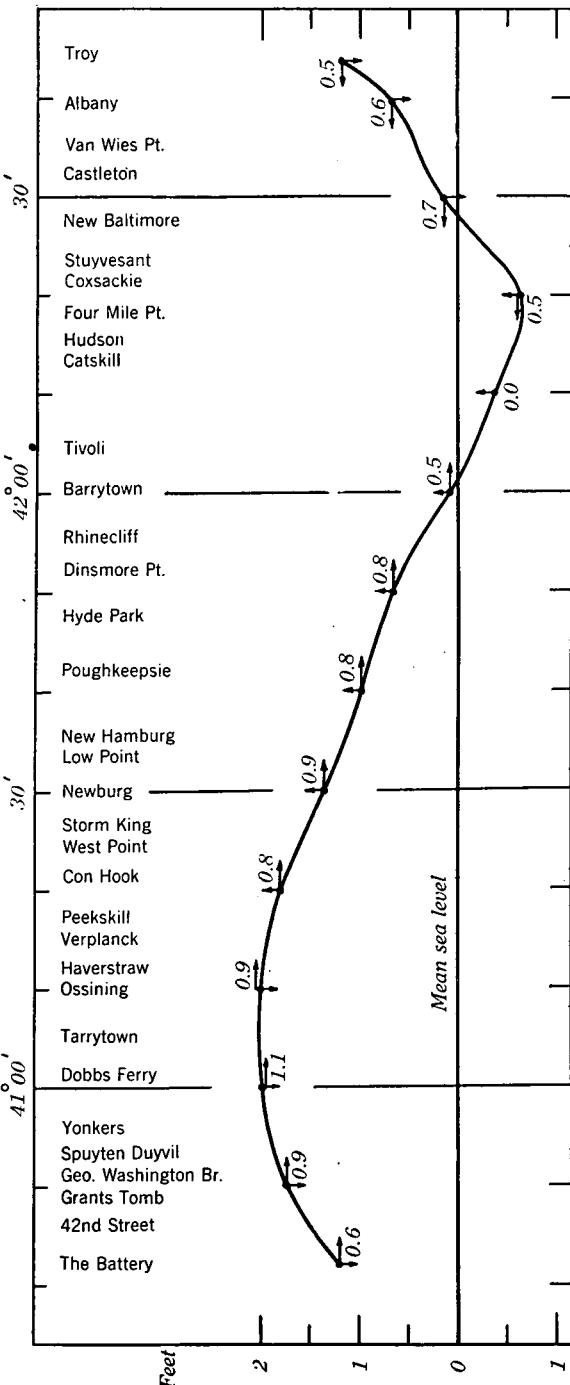


FIGURE 16.—Tide and current in Hudson River 2 hours after high water at the Battery.

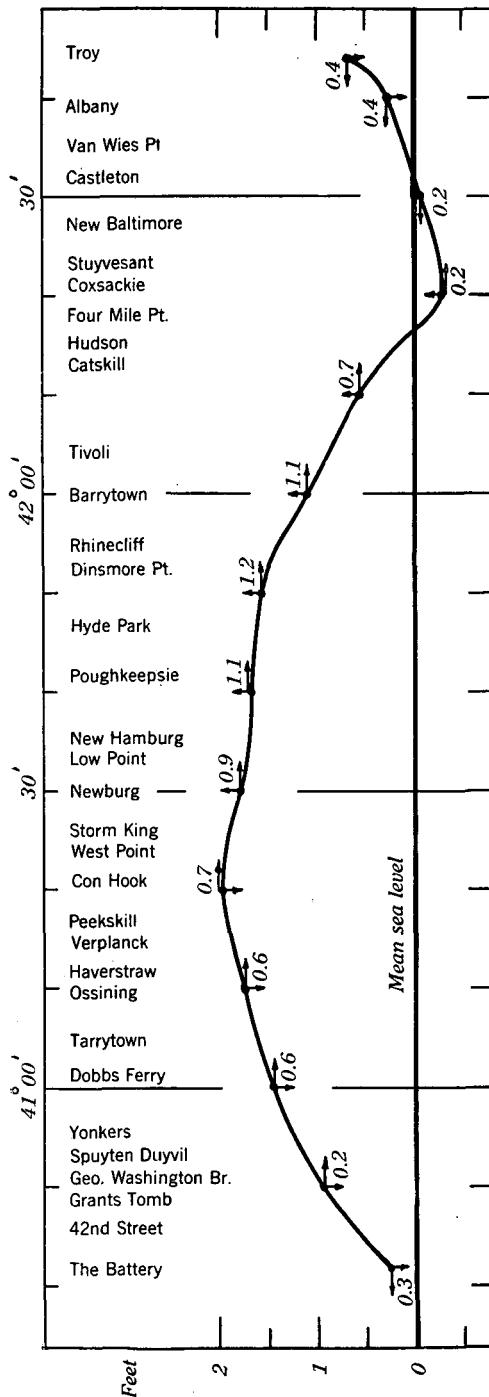


FIGURE 17.—Tide and current in Hudson River 3 hours after high water at the Battery.

TIDES AND CURRENTS IN HUDSON RIVER

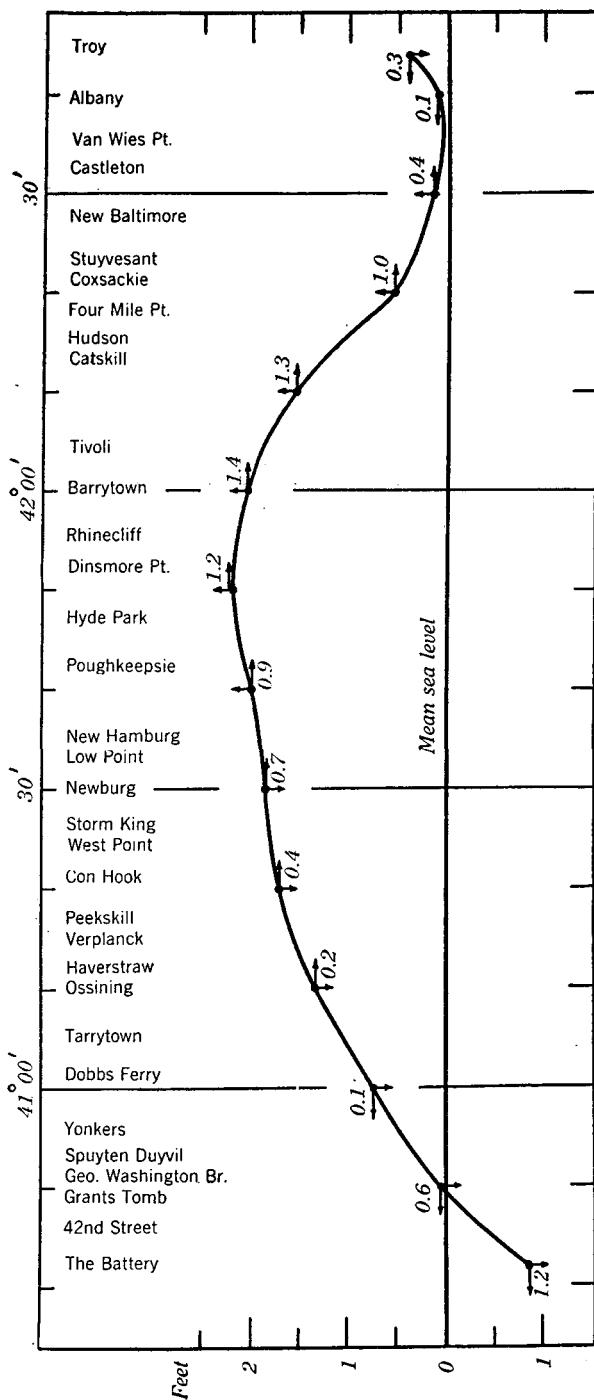


FIGURE 18.—Tide and current in Hudson River 4 hours after high water at the Battery.

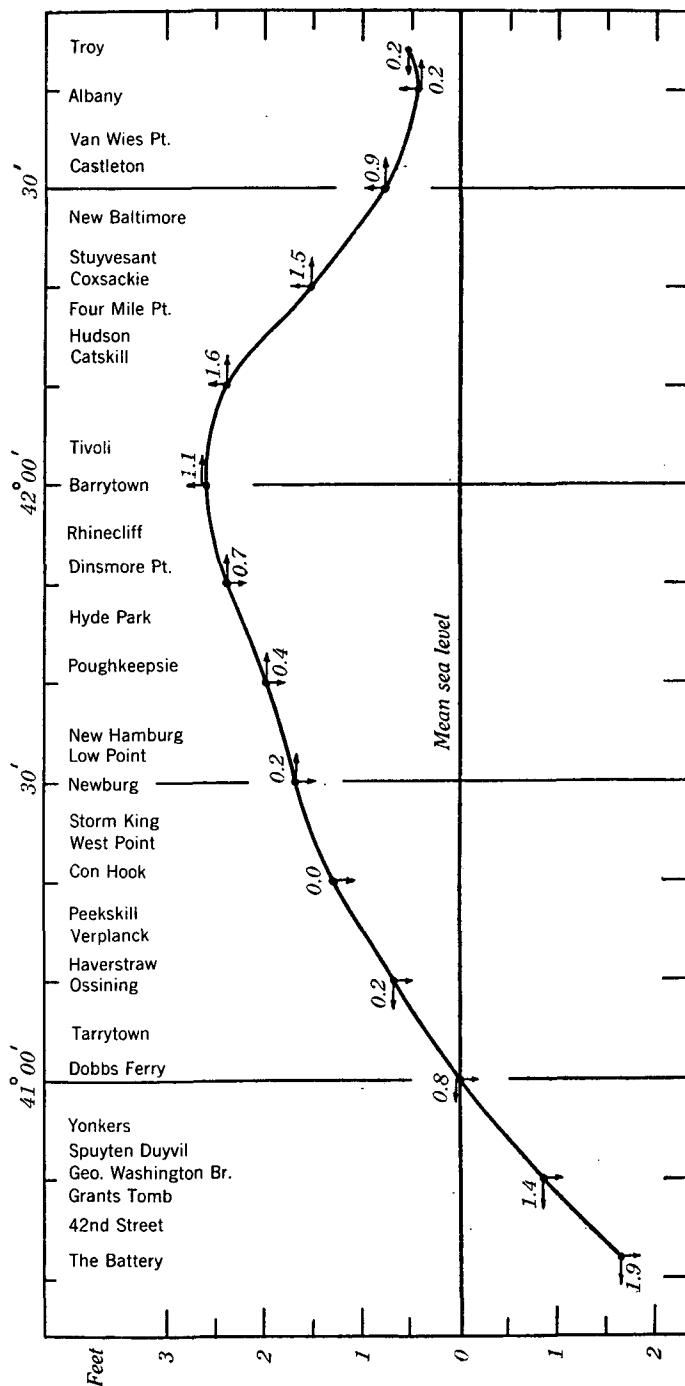


FIGURE 19.—Tide and current in Hudson River 5 hours after high water at the Battery.

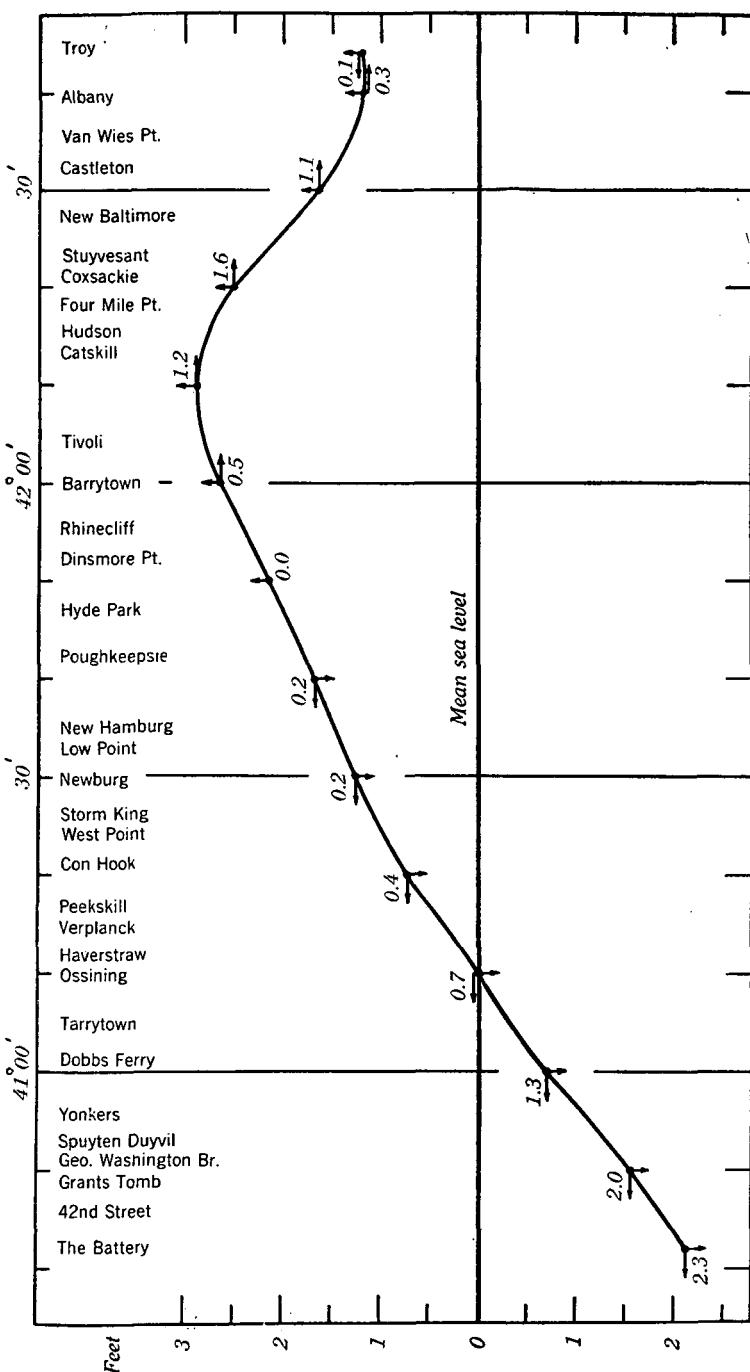


FIGURE 20.—Tide and current in Hudson River 6 hours after high water at the Battery.

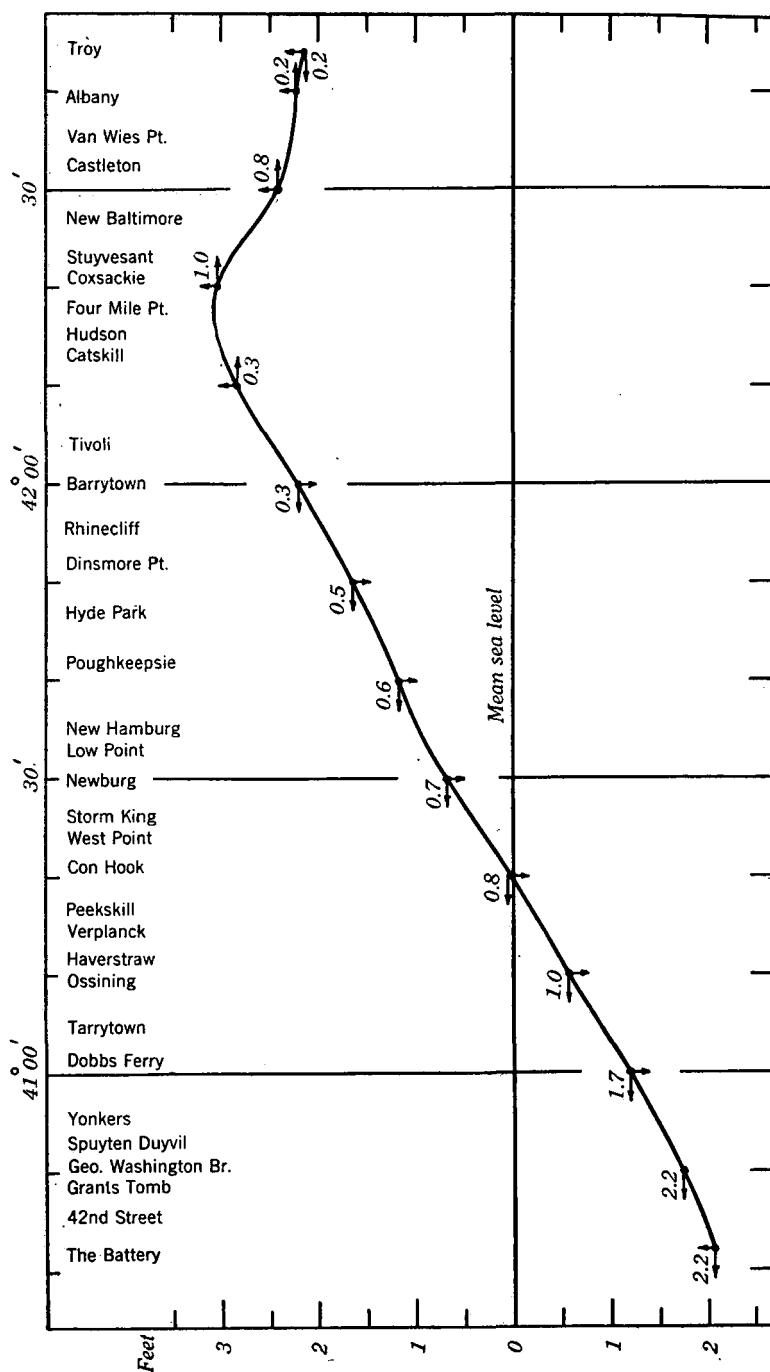


FIGURE 21.—Tide and current in Hudson River 7 hours after high water at the Battery.

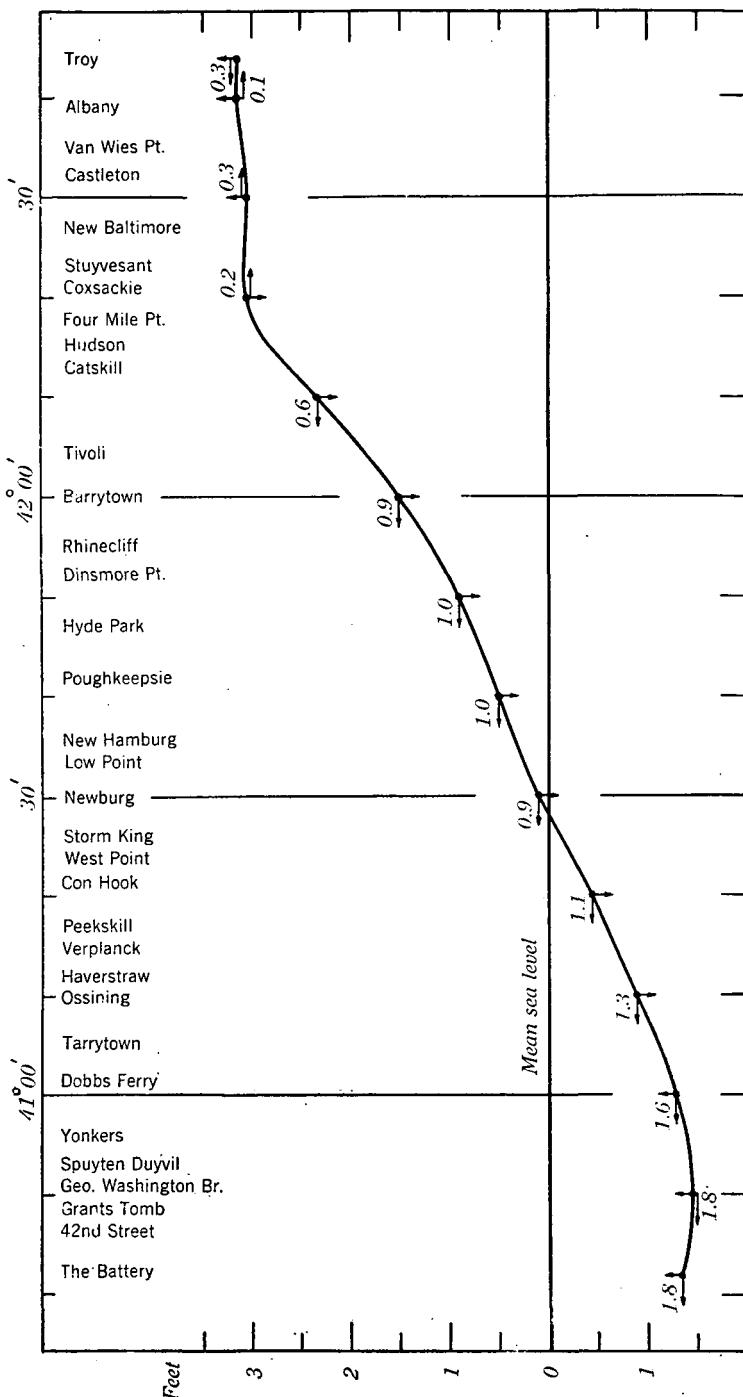


FIGURE 22.—Tide and current in Hudson River 8 hours after high water at the Battery.

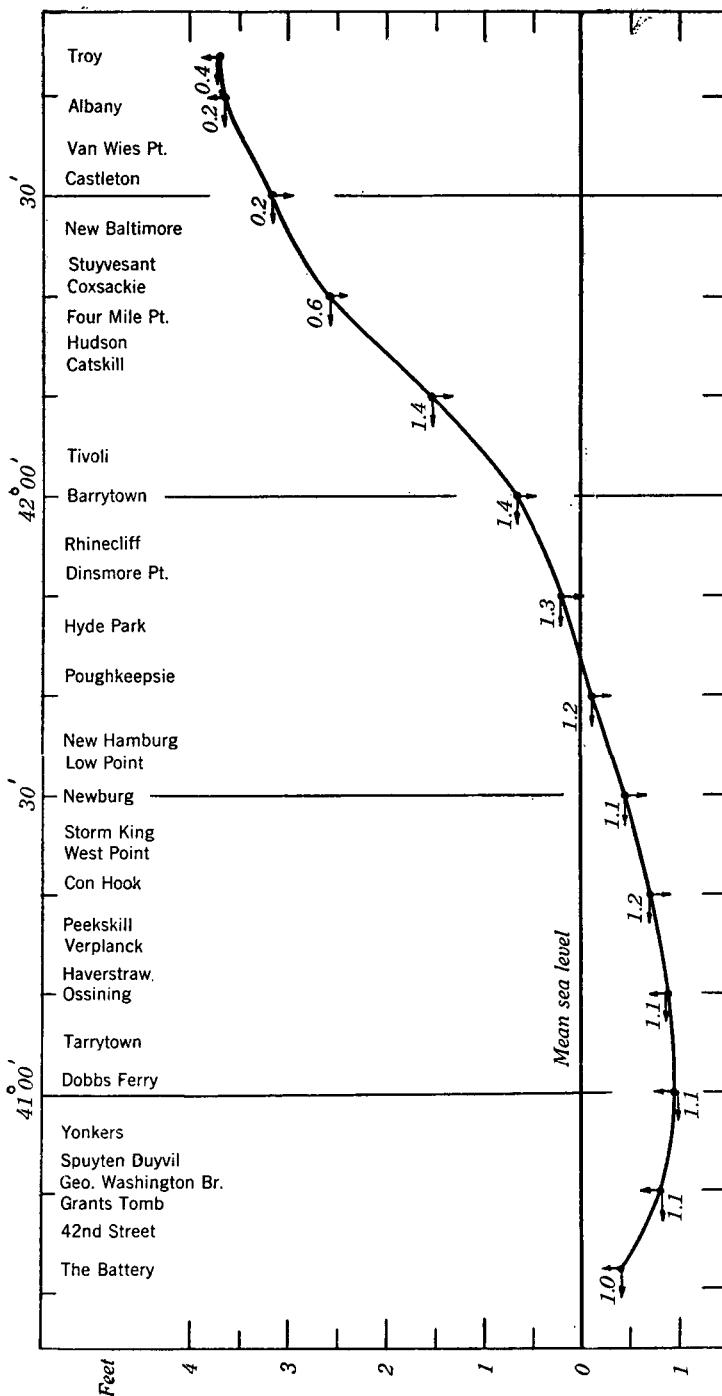


FIGURE 23.—Tide and current in Hudson River 9 hours after high water at the Battery.

TIDES AND CURRENTS IN HUDSON RIVER

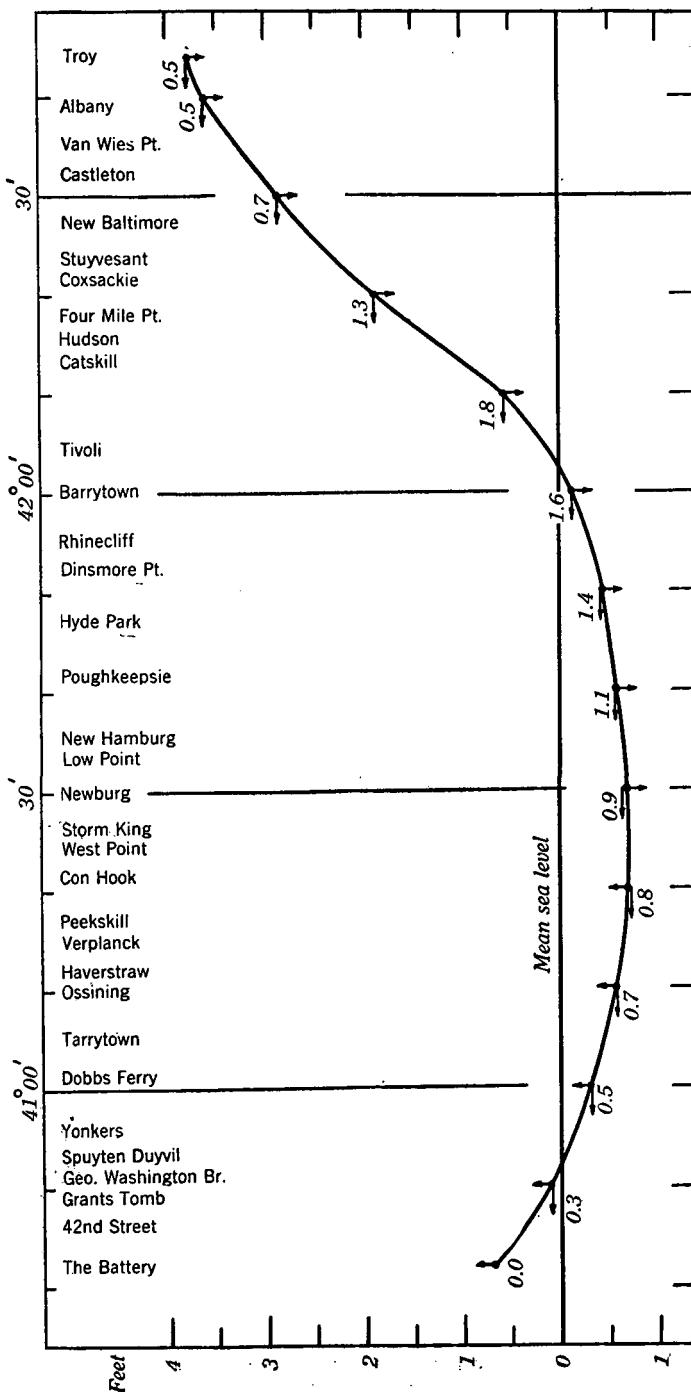


FIGURE 24.—Tide and current in Hudson River 10 hours after high water at the Battery.

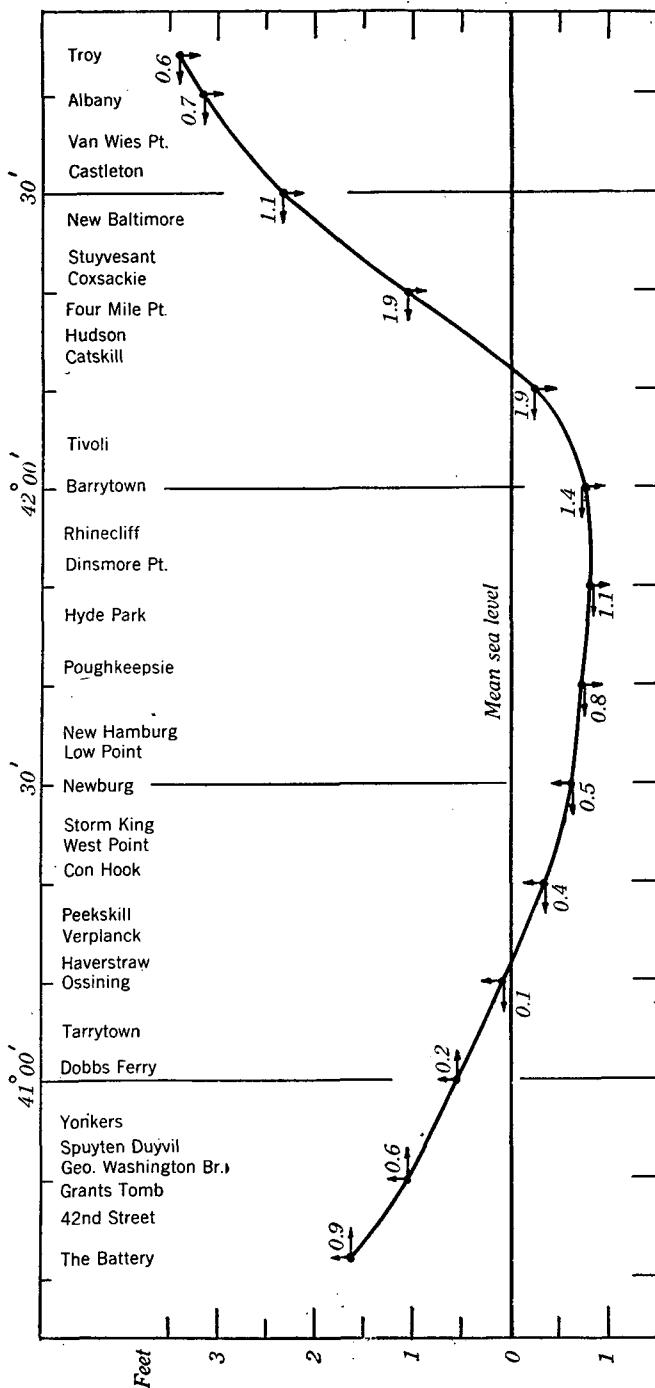


FIGURE 25.—Tide and current in Hudson River 11 hours after high water at the Battery.

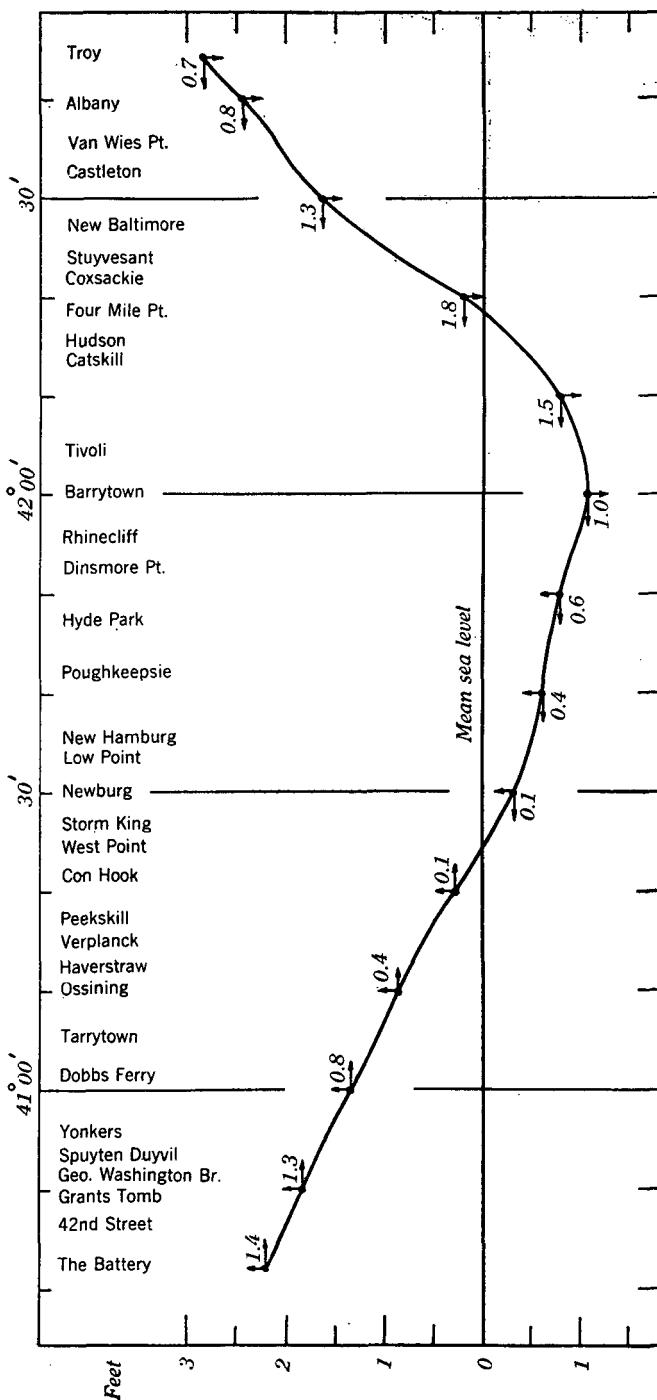


FIGURE 26.—Tide and current in Hudson River 12 hours after high water at the Battery.

pronounced and least masked by excessive river discharge. It is also the period when navigation on the river is usually the greatest.

Besides the seasonal variation in the tides of the river, there are other changes more or less permanent resulting from improvements in the river. The changes from year to year are somewhat irregular and there is a degree of uncertainty as to what extent any change may be considered as permanent and to what extent it may depend upon some special climatic conditions prevailing at the time. In the construction of the diagrams the tide records used have generally been limited to observations taken between the years 1920 and 1930.

The current data available for the construction of the diagrams consisted of observations taken at various times, usually during the summer months, between the years 1854 and 1932, inclusive. Above Poughkeepsie, current observations during the year 1929 only were available. The principal series were at station D-14 off the Battery, where a total of 31 days of observations were secured in 1922, and at station E-1 off Carlisle Street, New York City, where observations were taken over a period of 27 days in 1932. Other stations were occupied for periods from a few hours to 7 days, although in general each series consisted of from 1 to 2 days of observations.

In using these current diagrams it should be kept in mind that they represent only average conditions, and considerable variation arising from both astronomical and meteorological causes may be expected from day to day. At the time of spring tides velocities may be from 10 to 20 percent greater and at the time of neap tides 10 to 20 percent less than indicated on the diagrams. Changes in the stages of the river may greatly modify both tide and current.

The marked change in the tides in the upper portion of the river between the summer of 1929 and the summer of 1930, to which attention has already been called, may have been accompanied by corresponding changes in the currents, but as the current observations above Poughkeepsie are limited to those taken in 1929, no data are now available to determine the extent of such changes.

TEMPERATURE AND DENSITY OBSERVATIONS

Table 108 contains the monthly means and extremes of temperature and density observations taken at the primary tide station at the Battery. The observations were incidental to the main purpose of securing the tide record, and were taken once a day, Sundays and holidays excluded, by the observer on his regular visits to the tide station. There are no requirements that the station be visited at any specified hour and it may be assumed that the distribution of the observations is approximately uniform over all phases of the tide. The observed densities were reduced to a standard temperature of 15° C.

Tables 109 and 110 include temperature and density records from observations taken during the surveys of 1929 and 1932. These observations were incidental to the main purpose of the survey and were usually taken at three different depths at the same stations occupied for the current observations. The densities have been reduced to the standard temperature of 15° C.

Other temperature and density observations were made in the Hudson River in 1871 and 1885, these observations being taken in connection with the current surveys of those years. Tabular results

from the observations of 1871 were published on page 130 of the Annual Report of the Coast Survey for 1871 and those for the year 1885 on page 303 of the Annual Report of the Coast and Geodetic Survey for 1887.

It will be noted that in the lower portion of the river the density generally increases with the depth. This is to be expected as the upper strata of water would naturally be affected to some degree by the fresh water run-off. The density of pure water when reduced to a temperature of 15° C. is about 0.99913 according to the Smithsonian physical tables. During the observations of 1929 the water approximately reached this density in the vicinity of Cave Point a short distance above Poughkeepsie.

TABLE 1.—*High-water lunitaltid interval, Fort Hamilton, N.Y.*

Year	Janu- ary	Febr- uary	March	April	May	June	July	Au- gust	Sep- tem- ber	Octo- ber	Nov- ember	De- cem- ber	Mean
	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours
1893-----	7.73	7.77	7.62	7.57	7.60	7.72	7.72	7.73	7.70	7.70	7.80	7.85	7.71
1894-----	7.77	7.87	7.77	7.73	7.67	7.67	7.70	7.72	7.72	7.73	7.72	7.72	7.73
1895-----	7.67	7.77	7.73	7.58	7.57	7.67	7.67	7.63	7.75	7.75	7.77	7.57	7.68
1896-----	7.67	7.65	7.63	7.57	7.58	7.67	7.63	7.70	7.63	7.63	7.67	7.72	7.65
1897-----	7.72	7.67	7.60	7.55	7.62	7.67	7.67	7.63	7.67	7.73	7.68	7.63	7.66
1898-----	7.63	7.73	7.64	7.65	7.60	7.66	7.77	7.66	7.78	7.82	7.79	7.68	7.70
1899-----	7.72	7.78	7.78	7.61	7.64	7.72	7.74	7.83	7.79	7.87	7.90	7.67	7.75
1900-----	7.66	7.83	7.71	7.70	7.70	7.73	7.86	7.84	7.80	7.86	7.86	7.73	7.77
1901-----	7.81	7.74	7.72	7.74	7.72	7.72	7.67	7.76	7.78	7.81	7.82	7.77	7.76
1902-----	7.64	7.80	7.63	7.55	7.66	7.75	7.74	7.63	7.82	7.70	7.75	7.68	7.70
1903-----	7.81	7.72	7.55	7.61	7.62	7.68	7.65	7.67	7.61	7.69	7.67	7.66	7.66
1904-----	7.74	7.77	7.66	7.65	7.64	7.66	7.73	7.64	7.71	7.70	7.75	7.81	7.70
1905-----	7.83	7.66	7.75	7.64	7.70	7.69	7.73	7.73	7.70	7.79	7.75	7.67	7.72
1906-----	7.87	7.83	7.78	7.72	7.66	7.69	7.70	7.73	7.70	7.75	7.85	7.77	7.76
1907-----	7.66	7.78	7.73	7.70	7.64	7.67	7.69	7.67	7.70	7.78	7.64	7.64	7.69
1908-----	7.71	7.74	7.59	7.72	7.73	7.64	7.69	7.77	7.78	7.84	7.82	7.80	7.74
1909-----	7.75	7.68	7.78	7.64	7.62	7.62	7.74	7.75	7.70	7.78	7.84	7.85	7.73
1910-----	7.75	7.79	7.56	7.53	7.56	7.58	7.75	7.60	7.62	7.78	7.79	7.83	7.68
1911-----	7.56	7.69	7.65	7.61	7.59	7.66	7.67	7.74	7.67	7.66	7.71	7.66	7.66
1912-----	7.61	7.64	7.56	7.57	7.63	7.54	7.62	7.67	7.68	7.65	7.66	7.66	7.63
1913-----	7.51	7.56	7.56	7.56	7.60	7.52	7.62	7.69	7.78	7.66	7.66	7.76	7.62
1914-----	7.62	7.69	7.56	7.45	7.46	7.47	7.52	7.52	7.58	7.55	7.65	7.62	7.56
1915-----	7.51	7.48	7.50	7.44	7.51	7.58	7.67	7.59	7.65	7.57	7.63	7.59	7.56
1916-----	7.65	7.64	7.61	7.40	7.51	7.43	7.51	7.53	7.69	7.60	7.59	7.67	7.57
1917-----	7.65	7.50	7.56	7.50	7.57	7.51	7.69	7.55	7.67	7.73	7.65	7.82	7.62
1918-----	(7.61)	7.48	7.47	7.57	7.49	7.49	7.68	7.59	7.91	7.60	7.75	7.72	7.61
1919-----	7.64	7.64	7.63	7.54	7.63	7.60	7.63	7.75	7.74	7.80	7.65	7.79	7.67
1920-----	7.90	7.86	7.68	7.56	7.59	7.53	7.69	7.85	7.59	7.61	7.70	(7.68)	7.69
1921-----	(7.66)	(7.76)	(7.67)	7.69	7.90	7.83	7.73	7.72	7.81	7.84	7.86	7.72	7.77
1922-----	7.79	7.67	7.63	7.57	7.62	7.60	7.62	7.69	7.75	7.60	7.80	7.79	7.68
1923-----	7.68	7.80	7.59	7.65	7.61	7.70	7.66	7.68	7.72	7.73	7.82	7.63	7.69
1924-----	7.76	7.58	7.67	7.56	7.59	7.61	7.64	7.62	7.66	7.68	7.73	7.73	7.65
1925-----	7.80	7.76	7.55	7.36	7.52	7.61	7.65	7.60	7.63	7.72	7.58	7.63	7.62
1926-----	7.74	7.75	7.53	7.54	7.58	7.64	7.62	7.65	7.63	7.66	7.60	7.47	7.62
1927-----	7.74	7.57	7.64	7.62	7.64	7.68	7.81	7.66	7.55	7.49	7.57	7.86	7.65
1928-----	7.71	7.72	7.65	7.57	7.68	7.50	7.56	7.53	7.66	7.58	7.62	7.73	7.63
1929-----	7.78	7.59	7.52	7.46	7.52	7.66	7.69	7.69	7.71	7.76	7.75	7.68	7.65
1930-----	7.73	7.73	7.68	7.50	7.65	7.80	7.71	7.77	7.74	7.86	7.92	(7.91)	7.75
1931-----	7.71	7.60	7.74	7.69	7.74	7.68	7.54	7.63	7.67	7.67	7.71	7.53	7.66
1932-----	7.67	7.69	7.57	7.62	7.65	7.80	7.74	7.69	7.76	7.88	7.70	7.73	7.71
Mean ¹ -----	7.70	7.70	7.64	7.58	7.62	7.63	7.68	7.68	7.70	7.71	7.73	7.72	7.67

¹ Mean for 38 years (1893-1930).

NOTE.—Values in parentheses have been inferred. For reference to above table see p. 4.

TABLE 2.—Low-water lunital interval, Fort Hamilton, N.Y.

Year	Janu-	Febr-	March	April	May	June	July	Aug-	Sep-	Octo-	Nov-	De-	Mean
	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours
1893	1.67	1.65	1.60	1.47	1.56	1.70	1.68	1.73	1.68	1.65	1.72	1.67	1.65
1894	1.72	1.50	1.77	1.73	1.58	1.67	1.68	1.75	1.73	1.67	1.60	1.55	1.69
1895	1.62	1.70	1.50	1.45	1.03	1.62	1.67	1.67	1.62	1.60	1.65	1.63	1.61
1896	1.53	1.62	1.53	1.47	1.53	1.67	1.65	1.60	1.60	1.52	1.60	1.58	1.58
1897	1.63	1.52	1.47	1.50	1.60	1.60	1.60	1.60	1.60	1.58	1.62	1.58	1.57
1898	1.55	1.50	1.51	1.57	1.62	1.63	1.69	1.65	1.72	1.74	1.61	1.60	1.62
1899	1.67	1.63	1.61	1.54	1.59	1.73	1.71	1.72	1.74	1.72	1.79	1.77	1.68
1900	1.75	1.63	1.60	1.61	1.65	1.77	1.74	1.73	1.74	1.83	1.90	1.72	1.73
1901	1.70	1.65	1.72	1.62	1.65	1.71	1.70	1.81	1.73	1.77	1.73	1.64	1.70
1902	1.61	1.73	1.51	1.58	1.64	1.72	1.76	1.77	1.76	1.72	1.69	1.62	1.68
1903	1.59	1.69	1.53	1.52	1.62	1.63	1.62	1.67	1.73	1.64	1.68	1.60	1.63
1904	1.60	1.69	1.57	1.58	1.65	1.67	1.70	1.70	1.69	1.55	1.77	1.72	1.66
1905	1.66	1.64	1.61	1.59	1.67	1.69	1.69	1.75	1.73	1.74	1.81	1.75	1.69
1906	1.63	1.78	1.65	1.66	1.69	1.68	1.74	1.71	1.75	1.82	1.80	1.73	1.72
1907	1.62	1.77	1.72	1.59	1.62	1.67	1.71	1.73	1.73	1.80	1.57	1.66	1.68
1908	1.70	1.71	1.58	1.58	1.59	1.64	1.68	1.71	1.74	1.72	1.72	1.75	1.68
1909	1.65	1.58	1.52	1.53	1.64	1.59	1.74	1.67	1.67	1.68	1.82	1.79	1.66
1910	1.70	1.66	1.50	1.62	1.50	1.63	1.68	1.68	1.69	1.74	1.73	1.77	1.66
1911	1.54	1.67	1.60	1.51	1.46	1.60	1.66	1.66	1.67	1.69	1.72	1.54	1.62
1912	1.60	1.58	1.46	1.47	1.56	1.56	1.62	1.66	1.73	1.61	1.68	1.66	1.60
1913	1.44	1.50	1.55	1.45	1.53	1.56	1.59	1.61	1.71	1.61	1.61	1.59	1.56
1914	1.57	1.51	1.45	1.38	1.42	1.50	1.52	1.50	1.53	1.57	1.62	1.60	1.51
1915	1.43	1.47	1.43	1.39	1.55	1.55	1.55	1.62	1.68	1.59	1.59	1.56	1.54
1916	1.60	1.62	1.57	1.43	1.51	1.56	1.54	1.67	1.65	1.67	1.68	1.61	1.59
1917	1.60	1.60	1.68	1.58	1.53	1.50	1.59	1.65	1.69	1.66	1.60	1.77	1.62
1918	(1.46)	1.74	1.50	1.53	1.51	1.63	1.60	1.67	1.65	1.74	1.73	1.68	1.62
1919	1.52	1.61	1.61	1.62	1.53	1.71	1.60	1.80	1.79	1.83	1.74	1.68	1.66
1920	1.79	1.77	1.58	1.55	1.64	1.67	1.67	1.67	1.65	1.62	1.62	(1.63)	1.65
1921	(1.54)	(1.63)	(1.61)	1.60	1.79	1.86	1.70	1.76	1.84	1.81	1.80	1.76	1.72
1922	1.71	1.65	1.52	1.52	1.67	1.59	1.54	1.69	1.66	1.58	1.71	1.78	1.64
1923	1.58	1.56	1.54	1.56	1.66	1.60	1.72	1.77	1.83	1.71	1.91	1.59	1.67
1924	1.65	1.61	1.58	1.65	1.59	1.59	1.68	1.62	1.72	1.63	1.75	1.65	1.64
1925	1.73	1.73	1.60	1.47	1.54	1.64	1.64	1.62	1.68	1.70	1.54	1.66	1.63
1926	1.80	1.69	1.56	1.53	1.62	1.61	1.74	1.68	1.62	1.60	1.63	1.68	1.65
1927	1.75	1.59	1.53	1.63	1.65	1.66	1.77	1.73	1.55	1.47	1.53	1.61	1.62
1928	1.66	1.58	1.60	1.65	1.74	1.66	1.73	1.69	1.77	1.70	1.71	1.83	1.69
1929	1.72	1.54	1.42	1.53	1.51	1.60	1.63	1.73	1.72	1.75	1.59	1.56	1.61
1930	1.65	1.66	1.72	1.40	1.55	1.72	1.73	1.68	1.72	1.80	1.88	(1.82)	1.69
1931	1.59	1.51	1.54	1.53	1.54	1.60	1.59	1.50	1.63	1.60	1.66	1.53	1.57
1932	1.59	1.53	1.56	1.57	1.50	1.76	1.75	1.70	1.70	1.81	1.59	1.70	1.65
Mean ¹	1.63	1.64	1.57	1.54	1.59	1.64	1.66	1.69	1.70	1.68	1.70	1.67	1.64

¹ Mean for 38 years (1893–1930).

NOTE.—Values in parentheses have been inferred. For reference to above table see p. 4.

TABLE 3.—Duration of rise and fall of tide, Fort Hamilton, N.Y.

Yearly means		Yearly means		Yearly means		Annual variation			
Year	Duration of—		Year	Duration of—		Year	Duration of—		
	Rise	Fall		Rise	Fall		Rise	Fall	
	Hours	Hours		Hours	Hours		Hours	Hours	
1893	6.06	6.36	1906	6.04	6.38	1919	6.01	6.41	
1894	6.04	6.38	1907	6.01	6.41	1920	6.04	6.38	
1895	6.07	6.35	1908	6.06	6.36	1921	6.05	6.37	
1896	6.07	6.35	1909	6.07	6.35	1922	6.04	6.38	
1897	6.09	6.33	1910	6.02	6.40	1923	6.02	6.40	
1898	6.08	6.34	1911	6.04	6.38	1924	6.01	6.41	
1899	6.07	6.35	1912	6.03	6.39	1925	5.99	6.43	
1900	6.04	6.38	1913	6.06	6.36	1926	5.97	6.45	
1901	6.06	6.36	1914	6.05	6.37	1927	6.03	6.39	
1902	6.02	6.40	1915	6.02	6.40	1928	5.92	6.50	
1903	6.03	6.39	1916	5.98	6.44	1929	6.04	6.38	
1904	6.04	6.38	1917	6.00	6.42	1930	6.06	6.36	
1905	6.03	6.39	1918	5.99	6.43				
Mean duration of rise 38 years (1893–1930) = 6.03 hours.		Mean duration of fall 38 years (1893–1930) = 6.39 hours.							
For reference to above table see p. 4.									

TABLE 4.—*High water, Fort Hamilton, N.Y.*

{Referred to a plane 5 feet below Sandy Hook sea-level datum}

Year	January	February	March	April	May	June	July	August	September	October	November	December	Mean
	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet
1893	6.89	6.50	7.01	7.30	7.32	7.39	7.15	7.43	7.33	7.42	7.18	6.74	7.14
1894	7.14	6.86	7.00	7.46	7.40	7.20	7.22	7.32	7.45	7.32	6.77	7.03	7.18
1895	6.76	6.44	6.68	7.25	7.16	7.45	7.45	7.29	7.32	7.21	7.11	7.25	7.11
1896	7.16	6.78	6.57	7.17	7.36	7.36	7.23	7.37	7.43	7.67	7.29	7.33	7.23
1897	6.78	7.29	7.06	7.06	7.35	7.48	7.65	7.66	7.53	7.75	7.04	7.12	7.31
1898	7.00	7.04	7.10	7.47	7.70	7.49	7.52	7.48	7.44	7.60	7.35	6.89	7.34
1899	6.79	6.95	7.33	7.41	7.55	7.40	7.36	7.07	7.60	7.41	7.51	7.17	7.35
1900	6.63	6.75	6.96	7.18	7.39	7.49	7.38	7.61	7.64	7.57	7.26	7.21	7.25
1901	7.23	6.40	7.07	7.94	7.78	7.68	7.66	7.76	7.87	7.42	7.43	7.38	7.47
1902	7.04	7.18	7.58	7.52	7.42	7.55	7.72	7.78	7.79	7.81	7.73	7.52	7.55
1903	6.94	6.75	7.35	7.86	7.51	8.03	7.73	7.84	7.75	8.01	7.36	6.87	7.50
1904	7.08	6.76	7.17	7.37	7.49	7.64	7.55	7.50	7.61	7.52	7.45	7.25	7.37
1905	7.04	6.78	7.08	7.32	7.30	7.44	7.50	7.65	7.64	7.45	7.21	7.31	
1906	7.29	7.02	6.86	7.39	7.39	7.71	7.72	7.74	7.61	7.69	7.28	7.02	7.39
1907	7.02	6.81	7.13	7.37	7.43	7.70	7.55	7.51	7.41	7.35	7.53	7.36	7.35
1908	7.07	6.81	7.07	7.02	7.48	7.48	7.46	7.71	7.63	7.72	6.97	7.02	7.29
1909	7.14	7.13	7.13	7.24	7.78	7.53	7.47	7.69	7.64	7.35	7.42	7.39	
1910	7.23	7.03	7.35	7.69	7.53	7.69	7.62	7.46	7.71	7.50	7.47	7.21	7.46
1911	6.95	7.26	7.00	7.42	7.39	7.72	7.43	7.55	7.75	7.73	7.13	7.23	7.38
1912	6.73	6.84	7.06	7.22	7.40	7.28	7.20	7.44	7.67	7.48	7.27	6.87	7.20
1913	7.00	6.67	6.64	7.28	7.35	7.37	7.33	7.55	7.47	7.75	7.33	7.05	7.23
1914	7.39	6.83	7.13	7.37	7.47	7.43	7.59	7.49	7.54	7.58	7.10	7.25	7.35
1915	7.25	7.33	7.20	7.18	7.42	7.55	7.65	7.84	7.48	7.57	7.35	7.22	7.42
1916	7.03	7.03	7.29	7.76	7.56	7.80	7.42	7.64	7.60	7.54	7.37	6.89	7.41
1917	6.98	6.97	7.32	7.42	7.82	7.65	7.66	7.71	7.68	7.64	7.45	7.21	7.46
1918	(7.29)	(7.23)	7.43	7.70	7.23	7.64	7.67	7.66	7.53	7.40	7.42	7.53	7.48
1919	7.10	7.30	7.45	7.54	7.89	7.84	7.74	7.94	7.76	7.88	7.87	7.38	7.64
1920	7.19	7.38	7.01	7.81	7.79	7.90	7.69	7.80	7.75	7.77	7.66	(7.56)	7.61
1921	(7.16)	(7.58)	(7.28)	7.78	8.11	7.68	7.83	7.74	7.80	7.51	7.72	7.34	7.63
1922	6.84	7.25	7.40	7.51	7.66	7.76	7.83	7.81	7.83	7.79	7.56	7.40	7.55
1923	7.34	7.14	7.40	7.41	7.56	7.64	7.67	7.64	7.66	7.72	7.77	7.49	7.54
1924	6.99	7.51	7.78	7.62	7.86	7.65	7.54	7.68	7.66	7.67	7.36	6.91	7.52
1925	7.44	7.25	7.32	7.49	7.50	7.52	7.61	7.63	7.75	7.42	7.27	7.11	7.44
1926	6.90	7.28	6.96	7.27	7.47	7.49	7.57	7.80	7.82	7.66	7.27	7.16	7.39
1927	6.91	7.42	7.43	7.45	7.62	7.59	7.42	7.77	7.61	7.64	7.51	7.61	7.50
1928	6.80	7.03	7.07	7.20	7.57	7.77	7.66	7.77	7.78	7.39	7.19	7.02	7.35
1929	6.50	7.11	7.07	7.65	7.18	7.67	7.46	7.54	7.63	7.31	7.34	7.15	7.30
1930	6.96	7.01	7.06	7.12	7.36	7.36	7.60	7.71	7.61	7.73	7.14	(7.29)	7.33
1931	7.08	7.16	7.89	7.46	7.55	7.81	7.85	7.88	7.81	7.63	7.31	7.33	7.56
1932	7.67	7.48	7.00	7.50	7.39	7.56	7.61	7.58	7.84	7.60	7.91	7.43	7.55
Mean ¹	7.03	7.02	7.15	7.43	7.51	7.58	7.54	7.64	7.62	7.58	7.35	7.20	7.39

¹ Mean for 38 years (1893-1930)

NOTE.—Values in parentheses have been inferred. For reference to above table see p. 4.

TABLE 5.—*Low water, Fort Hamilton, N.Y.*

[Referred to a plane 5 feet below Sandy Hook sea-level datum]

Year	Janu- ary	Febr- uary	March	April	May	June	July	Au- gust	Sep- tem- ber	Octo- ber	Nov- em- ber	De- cem- ber	Mean
	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet
1893	2.52	2.06	2.50	2.64	2.74	3.04	2.78	2.93	2.77	2.93	2.67	2.17	2.65
1894	2.73	2.47	2.52	2.97	2.89	2.65	2.69	2.82	2.90	2.87	2.27	2.56	2.70
1895	2.29	2.04	2.15	2.66	2.58	2.86	2.80	2.79	2.87	2.78	2.74	2.86	2.62
1896	2.67	2.19	1.93	2.49	2.83	2.78	2.71	2.87	2.96	3.20	2.71	2.85	2.68
1897	2.31	2.86	2.44	2.37	2.72	2.92	3.09	3.00	2.94	3.18	2.52	2.43	2.73
1898	2.45	2.52	2.50	2.90	3.06	2.82	2.90	2.80	2.86	3.02	2.72	2.32	2.74
1899	2.26	2.39	2.68	2.67	2.87	2.74	2.74	3.08	2.97	2.85	2.95	2.54	2.73
1900	2.03	2.04	2.21	2.40	2.69	2.85	2.73	2.95	2.87	2.93	2.55	2.42	2.56
1901	2.55	1.80	2.41	3.13	3.05	2.94	2.99	3.04	3.07	2.66	2.78	2.55	2.75
1902	2.33	2.52	2.61	2.68	2.55	2.71	2.86	2.90	3.10	2.98	3.02	2.83	2.76
1903	2.24	1.95	2.43	3.01	2.73	3.18	2.79	3.01	2.85	3.17	2.57	2.13	2.67
1904	2.33	1.92	2.31	2.48	2.61	2.86	2.78	2.68	2.74	2.63	2.64	2.42	2.53
1905	2.28	1.97	2.27	2.39	2.46	2.70	2.66	2.92	2.74	2.62	2.42	2.51	2.50
1906	2.57	2.20	2.14	2.55	2.52	2.83	2.88	2.90	2.87	3.03	2.61	2.40	2.63
1907	2.25	2.13	2.45	2.56	2.58	2.81	2.72	2.78	2.74	2.57	2.74	2.54	2.57
1908	2.21	2.09	2.19	2.16	2.66	2.73	2.80	3.14	2.96	3.14	2.30	2.32	2.56
1909	2.49	2.35	2.35	2.37	2.93	2.90	2.90	3.17	3.02	2.72	2.88	2.83	2.74
1910	2.66	2.36	2.56	2.67	2.78	2.96	2.90	2.82	3.06	2.88	2.87	2.63	2.79
1911	2.35	2.70	2.40	2.65	2.76	2.98	2.74	2.95	3.23	3.19	2.43	2.55	2.74
1912	2.13	2.18	2.37	2.42	2.66	2.71	2.73	2.91	3.10	2.84	2.60	2.21	2.57
1913	2.29	2.15	1.99	2.64	2.78	2.80	2.75	2.97	2.94	3.23	2.71	2.52	2.65
1914	2.85	2.32	2.55	2.68	2.83	2.80	2.92	2.87	2.91	3.04	2.59	2.86	2.77
1915	2.80	2.71	2.60	2.46	2.75	2.96	2.99	3.09	2.86	3.01	2.78	2.51	2.79
1916	2.31	2.36	2.65	2.94	2.83	3.14	2.82	2.96	3.00	2.83	2.65	2.10	2.72
1917	2.24	2.28	2.58	2.68	3.05	2.86	2.98	2.99	2.95	2.92	2.74	2.52	2.73
1918	(2.61)	(2.49)	2.68	2.90	2.38	2.81	2.82	2.82	2.75	2.67	2.69	2.88	2.71
1919	2.41	2.51	2.66	2.70	3.01	3.05	2.91	3.18	3.04	3.13	3.10	2.55	2.85
1920	2.36	2.58	2.07	2.88	2.88	3.05	2.78	2.98	2.92	2.92	2.82	(2.64)	2.74
1921	(2.28)	(2.82)	(2.46)	2.80	3.23	2.84	2.95	2.82	2.96	2.62	2.95	2.50	2.77
1922	2.27	2.43	2.43	2.50	2.67	2.76	2.80	2.84	2.94	2.82	2.67	2.66	2.65
1923	2.61	2.35	2.49	2.50	2.52	2.77	2.83	2.84	2.88	2.93	2.96	2.46	2.68
1924	1.90	2.59	2.88	2.59	2.80	2.74	2.67	2.88	2.84	2.71	2.49	2.01	2.59
1925	2.70	2.35	2.39	2.63	2.61	2.65	2.69	2.70	2.94	2.51	2.45	2.27	2.57
1926	2.10	2.51	2.23	2.38	2.58	2.69	2.76	3.03	3.04	2.87	2.42	2.55	2.60
1927	2.31	2.81	2.60	2.54	2.73	2.88	2.85	3.09	2.95	2.98	2.73	2.74	2.77
1928	1.99	2.31	2.41	2.39	2.82	3.05	2.98	3.12	3.02	2.64	2.59	2.39	2.64
1929	1.84	2.44	2.24	2.97	2.42	2.97	2.72	2.85	3.00	2.68	2.69	2.52	2.61
1930	2.38	2.38	2.31	2.47	2.69	2.72	2.89	3.07	3.00	3.24	2.69	(2.82)	2.72
1931	2.55	2.60	3.28	2.71	2.82	3.17	3.28	3.31	3.21	3.07	2.74	2.74	2.96
1932	2.98	2.81	2.44	2.77	2.74	3.03	3.10	3.12	3.35	3.06	3.29	2.88	2.96
Mean	2.37	2.35	2.41	2.64	2.74	2.86	2.82	2.94	2.94	2.89	2.68	2.51	2.68

¹ Mean for 38 years (1893–1930).

NOTE.—Values in parentheses have been inferred. For reference to above table see p. 4.

TIDES AND CURRENTS IN HUDSON RIVER

TABLE 6.—*Range of tide, Fort Hamilton, N.Y.*

Year	Janu- ary	Febr- uary	March	April	May	June	July	Aug- ust	Sep- tem- ber	Octo- ber	Novem- ber	De- cem- ber	Mean
	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet
1893-----	4.37	4.44	4.51	4.66	4.58	4.35	4.37	4.44	4.56	4.49	4.51	4.57	4.49
1894-----	4.41	4.39	4.48	4.49	4.51	4.55	4.53	4.50	4.55	4.45	4.50	4.47	4.49
1895-----	4.47	4.40	4.53	4.59	4.58	4.59	4.59	4.50	4.45	4.43	4.37	4.39	4.49
1896-----	4.49	4.59	4.64	4.68	4.53	4.58	4.52	4.50	4.47	4.47	4.58	4.48	4.54
1897-----	4.47	4.43	4.62	4.69	4.63	4.56	4.56	4.66	4.59	4.57	4.52	4.69	4.58
1898-----	4.55	4.52	4.60	4.57	4.64	4.67	4.62	4.68	4.58	4.58	4.63	4.57	4.60
1899-----	4.54	4.56	4.65	4.74	4.68	4.68	4.62	4.59	4.63	4.56	4.56	4.63	4.62
1900-----	4.60	4.71	4.75	4.78	4.70	4.64	4.65	4.66	4.67	4.64	4.71	4.79	4.69
1901-----	4.68	4.60	4.66	4.81	4.73	4.74	4.67	4.72	4.80	4.76	4.65	4.83	4.72
1902-----	4.71	4.66	4.97	4.84	4.87	4.84	4.86	4.88	4.69	4.83	4.71	4.69	4.80
1903-----	4.70	4.80	4.92	4.85	4.78	4.85	4.94	4.83	4.90	4.84	4.79	4.74	4.83
1904-----	4.75	4.84	4.86	4.59	4.88	4.78	4.77	4.82	4.87	4.89	4.81	4.83	4.83
1905-----	4.76	4.81	4.81	4.93	4.84	4.74	4.84	4.73	4.90	4.88	4.79	4.80	4.82
1906-----	4.72	4.73	4.72	4.84	4.87	4.88	4.84	4.84	4.74	4.66	4.67	4.62	4.76
1907-----	4.77	4.68	4.68	4.81	4.85	4.89	4.83	4.73	4.67	4.78	4.79	4.82	
1908-----	4.86	4.72	4.88	4.86	4.82	4.75	4.66	4.57	4.67	4.58	4.67	4.70	4.73
1909-----	4.65	4.78	4.78	4.87	4.85	4.63	4.57	4.52	4.62	4.63	4.54	4.56	4.67
1910-----	4.57	4.67	4.79	4.72	4.75	4.73	4.72	4.64	4.65	4.62	4.60	4.58	4.67
1911-----	4.60	4.56	4.60	4.77	4.63	4.74	4.69	4.60	4.52	4.54	4.70	4.68	4.64
1912-----	4.60	4.66	4.69	4.80	4.74	4.57	4.47	4.53	4.57	4.64	4.67	4.68	4.63
1913-----	4.71	4.52	4.65	4.64	4.57	4.57	4.58	4.58	4.53	4.52	4.62	4.53	4.58
1914-----	4.54	4.51	4.58	4.69	4.64	4.63	4.67	4.62	4.63	4.54	4.51	4.59	4.58
1915-----	4.45	4.62	4.60	4.72	4.67	4.59	4.66	4.75	4.62	4.56	4.57	4.71	4.63
1916-----	4.72	4.67	4.64	4.82	4.73	4.66	4.60	4.63	4.60	4.71	4.72	4.79	4.69
1917-----	4.74	4.69	4.74	4.74	4.77	4.79	4.70	4.72	4.73	4.72	4.71	4.69	4.73
1918-----	(4.68)	(4.74)	4.75	4.80	4.85	4.83	4.85	4.84	4.78	4.73	4.73	4.65	4.77
1919-----	4.69	4.79	4.79	4.84	4.88	4.79	4.83	4.76	4.72	4.75	4.77	4.83	4.79
1920-----	4.83	4.80	4.94	4.93	4.91	4.85	4.91	4.82	4.83	4.85	4.84	(4.92)	4.87
1921-----	(4.88)	(4.76)	(4.82)	4.98	4.88	4.84	4.88	4.92	4.84	4.89	4.77	4.84	4.86
1922-----	4.57	4.82	4.97	5.01	4.99	5.00	5.03	4.97	4.89	4.97	4.89	4.74	4.90
1923-----	4.73	4.79	4.91	4.91	5.04	4.87	4.84	4.80	4.78	4.79	4.81	5.03	4.86
1924-----	5.09	4.92	4.90	5.03	5.06	4.91	4.87	4.80	4.82	4.96	4.87	4.90	4.93
1925-----	4.74	4.90	4.93	4.86	4.89	4.87	4.92	4.93	4.81	4.91	4.82	4.84	4.87
1926-----	4.80	4.77	4.73	4.89	4.89	4.80	4.81	4.77	4.78	4.79	4.85	4.61	4.79
1927-----	4.60	4.61	4.83	4.91	4.89	4.71	4.57	4.68	4.66	4.66	4.78	4.87	4.73
1928-----	4.81	4.72	4.66	4.81	4.75	4.72	4.68	4.65	4.76	4.75	4.60	4.63	4.71
1929-----	4.66	4.67	4.83	4.68	4.76	4.70	4.74	4.69	4.63	4.63	4.65	4.63	4.69
1930-----	4.58	4.63	4.75	4.65	4.67	4.64	4.71	4.64	4.61	4.49	4.45	(4.47)	4.61
1931-----	4.53	4.56	4.61	4.75	4.73	4.64	4.57	4.57	4.60	4.56	4.57	4.59	4.61
1932-----	4.69	4.67	4.56	4.73	4.65	4.53	4.51	4.46	4.49	4.54	4.62	4.55	4.58
Mean ¹ -----	4.66	4.67	4.74	4.79	4.77	4.72	4.72	4.70	4.69	4.68	4.68	4.69	4.71

¹ Mean for 38 years (1893-1930).

NOTE.—Values in parentheses have been inferred. For reference to above table see p. 4.

TABLE 7.—*Half-tide level, Fort Hamilton, N.Y.*

[Referred to a plane 5 feet below Sandy Hook sea-level datum]

Year	Janu- ary	Febru- ary	March	April	May	June	July	Aug- ust	Sep- tem- ber	Octo- ber	No- vem- ber	De- cem- ber	Mean
	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet
1893	4.70	4.28	4.78	4.97	5.03	5.22	4.96	5.21	5.05	5.18	4.93	4.46	4.90
1894	4.94	4.66	4.76	5.22	5.14	4.92	4.96	5.07	5.18	5.10	4.52	4.80	4.94
1895	4.52	4.24	4.42	4.96	4.87	5.16	5.16	5.04	5.10	5.00	4.92	5.08	4.87
1896	4.92	4.48	4.26	4.83	5.10	5.07	4.97	5.12	5.20	5.44	5.00	5.09	4.98
1897	4.54	5.08	4.75	4.72	5.04	5.20	5.37	5.33	5.24	5.46	4.78	4.78	5.02
1898	4.72	4.78	4.80	5.18	5.38	5.16	5.21	5.14	5.15	5.31	5.04	4.60	5.04
1899	4.52	4.67	5.00	5.04	5.21	5.07	5.05	5.38	5.28	5.13	5.23	4.86	5.04
1900	4.33	4.40	4.58	4.79	5.04	5.17	5.06	5.28	5.20	5.25	4.90	4.82	4.90
1901	4.89	4.10	4.74	5.64	5.42	5.31	5.32	5.40	5.47	5.04	5.10	4.96	5.11
1902	4.68	4.85	5.10	5.10	4.98	5.13	5.29	5.34	5.44	5.40	5.38	5.18	5.16
1903	4.59	4.35	4.89	5.44	5.12	5.60	5.26	5.42	5.30	5.59	4.96	4.50	5.08
1904	4.70	4.34	4.74	4.92	5.05	5.25	5.16	5.09	5.18	5.08	5.04	4.84	4.95
1905	4.66	4.38	4.68	4.86	4.88	5.07	5.08	5.28	5.19	5.04	4.82	4.91	4.90
1906	4.93	4.66	4.50	4.97	4.96	5.27	5.30	5.32	5.24	5.36	4.94	4.71	5.01
1907	4.64	4.47	4.79	4.96	5.00	5.26	5.14	5.14	5.08	4.96	5.14	4.95	4.96
1908	4.64	4.45	4.63	4.59	5.07	5.10	5.13	5.42	5.30	5.43	4.64	4.67	4.92
1909	4.81	4.74	4.74	4.80	5.36	5.22	5.18	5.43	5.33	5.04	5.15	5.11	5.08
1910	4.94	4.70	4.96	5.33	5.16	5.32	5.26	5.14	5.38	5.19	5.17	4.92	5.12
1911	4.65	4.98	4.70	5.04	5.08	5.35	5.08	5.25	5.49	5.46	4.78	4.89	5.06
1912	4.43	4.51	4.72	4.82	5.03	5.00	4.96	5.18	5.38	5.16	4.94	4.54	4.89
1913	4.65	4.41	4.31	4.96	5.07	5.09	5.04	5.26	5.20	5.49	5.02	4.78	4.94
1914	5.12	4.57	4.84	5.03	5.15	5.11	5.25	5.18	5.23	5.31	4.85	5.05	5.06
1915	5.03	5.02	4.90	4.82	5.08	5.25	5.32	5.47	5.17	5.29	5.07	4.87	5.11
1916	4.67	4.70	4.97	5.35	5.20	5.47	5.12	5.30	5.30	5.19	5.01	4.50	5.06
1917	4.61	4.63	4.95	5.05	5.44	5.26	5.31	5.35	5.32	5.28	5.10	4.86	5.10
1918	(4.95)	(4.86)	5.06	5.30	4.81	5.23	5.25	5.24	5.14	5.04	5.06	5.20	5.09
1919	4.76	4.91	5.05	5.12	5.45	5.45	5.33	5.56	5.40	5.50	5.48	4.96	5.25
1920	4.78	4.98	4.54	5.34	5.34	5.48	5.23	5.39	5.34	5.35	5.24	(5.10)	5.18
1921	(4.72)	(5.20)	(4.87)	5.29	5.67	5.26	5.39	5.28	5.38	5.07	5.34	4.92	5.20
1922	4.56	4.84	4.91	5.00	5.17	5.26	5.31	5.32	5.38	5.30	5.11	5.03	5.10
1923	4.98	4.74	4.94	4.96	5.04	5.20	5.25	5.24	5.27	5.32	5.36	4.97	5.11
1924	4.45	5.05	5.33	5.10	5.33	5.20	5.10	5.28	5.25	5.19	4.92	4.46	5.06
1925	5.07	4.80	4.86	5.06	5.06	5.08	5.15	5.16	5.34	4.96	4.86	4.69	5.01
1926	4.50	4.90	4.60	4.82	5.02	5.09	5.16	5.42	5.43	5.26	4.84	4.86	4.99
1927	4.61	5.12	5.02	5.00	5.18	5.24	5.14	5.43	5.28	5.31	5.12	5.18	5.14
1928	4.40	4.67	4.74	4.80	5.20	5.41	5.32	5.44	5.40	5.02	4.89	4.70	5.00
1929	4.17	4.78	4.66	5.31	4.80	5.32	5.09	5.20	5.32	5.00	5.02	4.84	4.96
1930	4.67	4.69	4.68	4.80	5.03	5.04	5.24	5.39	5.30	5.48	4.91	(5.06)	5.02
1931	4.82	4.88	5.58	5.09	5.18	5.49	5.56	5.59	5.51	5.34	5.02	5.04	5.26
1932	5.33	5.14	4.72	5.13	5.07	5.30	5.35	5.35	5.60	5.33	5.60	5.15	5.26
Mean ¹	4.70	4.68	4.78	5.03	5.13	5.22	5.18	5.29	5.28	5.24	5.02	4.86	5.03

¹ Mean for 38 years (1893-1930).

NOTE.—Values in parentheses have been inferred. For reference to above table see p. 4.

TIDES AND CURRENTS IN HUDSON RIVER

TABLE 8.—*Sea level, Fort Hamilton, N.Y.*

[Referred to a plane 5 feet below Sandy Hook sea-level datum]

Year	Janu-	Febr-	March	April	May	June	July	Au-	Sep-	Octo-	Nov-	De-	Mean
	January	February	March	April	May	June	July	August	September	October	November	December	
	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	<i>Feet</i>
1893.....	4.74	4.35	4.81	5.05	5.11	5.25	5.01	5.26	5.09	5.20	4.97	4.50	4.94
1894.....	4.98	4.70	4.79	5.30	5.17	4.98	5.00	5.10	5.18	5.15	4.59	4.88	4.98
1895.....	4.56	4.31	4.46	5.01	4.94	5.18	5.17	5.06	5.14	5.02	4.93	5.09	4.91
1896.....	4.93	4.55	4.30	4.88	5.14	5.12	5.00	5.14	5.23	5.44	5.03	5.08	4.99
1897.....	4.59	5.09	4.78	4.78	5.09	5.25	5.38	5.36	5.28	5.51	4.83	4.78	5.06
1898.....	4.70	4.81	4.84	5.26	5.41	5.23	5.23	5.16	5.19	5.31	5.06	4.64	5.08
1899.....	4.56	4.75	5.05	5.05	5.28	5.10	5.07	5.38	5.30	5.15	5.26	4.87	5.07
1900.....	4.36	4.46	4.61	4.83	5.10	5.22	5.11	5.28	5.22	5.24	4.93	4.84	4.93
1901.....	4.94	4.16	4.80	5.60	5.45	5.35	5.36	5.44	5.52	5.08	5.15	5.03	5.16
1902.....	4.76	4.89	5.17	5.15	5.04	5.18	5.33	5.38	5.47	5.42	5.42	5.16	5.20
1903.....	4.63	4.40	4.96	5.46	5.17	5.65	5.30	5.45	5.30	5.64	5.04	4.57	5.13
1904.....	4.72	4.37	4.77	4.97	5.09	5.29	5.19	5.11	5.18	5.10	5.09	4.85	4.98
1905.....	4.74	4.37	4.70	4.90	4.90	5.13	5.14	5.30	5.21	5.07	4.85	4.94	4.94
1906.....	4.98	4.67	4.55	5.02	5.01	5.31	5.33	5.36	5.27	5.39	4.96	4.73	5.05
1907.....	4.67	4.53	4.82	5.02	5.02	5.29	5.17	5.16	5.12	5.02	5.17	4.98	5.00
1908.....	4.68	4.51	4.89	4.64	5.12	5.14	5.15	5.50	5.35	5.45	4.69	4.72	4.97
1909.....	4.86	4.73	4.80	4.87	5.39	5.24	5.21	5.45	5.37	5.04	5.13	5.12	5.10
1910.....	5.01	4.75	4.97	5.38	5.21	5.37	5.32	5.18	5.40	5.21	5.22	4.98	5.16
1911.....	4.68	5.04	4.74	5.10	5.13	5.38	5.12	5.27	5.54	5.53	4.85	4.91	5.11
1912.....	4.46	4.54	4.75	4.88	5.09	5.02	5.02	5.20	5.43	5.19	5.00	4.60	4.93
1913.....	4.68	4.49	4.37	5.00	5.11	5.12	5.07	5.28	5.24	5.52	5.08	4.85	4.98
1914.....	5.17	4.61	4.90	5.09	5.22	5.16	5.31	5.21	5.27	5.35	4.90	5.11	5.11
1915.....	5.04	5.10	4.98	4.91	5.14	5.29	5.36	5.51	5.21	5.35	5.12	4.88	5.16
1916.....	4.76	4.78	5.00	5.42	5.25	5.51	5.17	5.36	5.33	5.23	5.06	4.56	5.12
1917.....	4.67	4.68	5.03	5.09	5.50	5.31	5.36	5.39	5.35	5.33	5.14	4.93	5.15
1918.....	(5.00)	(4.91)	5.12	5.34	4.86	5.26	5.27	5.27	5.17	5.06	5.09	5.26	5.13
1919.....	4.80	4.96	5.12	5.18	5.51	5.49	5.36	5.61	5.45	5.53	5.57	5.01	5.30
1920.....	4.83	5.03	4.60	5.38	5.39	5.54	5.27	5.42	5.38	5.40	5.33	(5.15)	5.23
Mean.....	4.77	4.66	4.80	5.09	5.17	5.26	5.21	5.31	5.29	5.28	5.05	4.89	5.07

NOTE.—Values in parentheses have been inferred. For reference to above table see p. 4.

TABLE 9.—*Tidal means for 19-year periods, Fort Hamilton, N.Y.*

Period	Intervals		Duration		Range of tide	High water	Low water	Half- tide level	Mean sea level
	High water	Low water	Rise	Fall					
1893-1911.....	Hours	Hours	Hours	Hours	Feet	Feet	Feet	Feet	Feet
1894-1912.....	7.71	1.66	6.05	6.37	4.67	7.34	2.67	5.00	5.04
1895-1913.....	7.70	1.66	6.04	6.38	4.68	7.34	2.66	5.00	5.04
1896-1914.....	7.70	1.65	6.05	6.37	4.68	7.34	2.66	5.00	5.04
1897-1915.....	7.69	1.64	6.05	6.37	4.69	7.35	2.67	5.01	5.05
1898-1916.....	7.68	1.64	6.04	6.38	4.70	7.37	2.67	5.02	5.06
1899-1917.....	7.68	1.64	6.04	6.38	4.71	7.38	2.67	5.02	5.07
1900-1918.....	7.67	1.64	6.03	6.39	4.71	7.38	2.67	5.03	5.07
1901-19.....	7.67	1.64	6.03	6.39	4.72	7.40	2.69	5.04	5.09
1902-20.....	7.66	1.63	6.03	6.39	4.73	7.41	2.69	5.05	5.09
1903-21.....	7.67	1.64	6.03	6.39	4.73	7.42	2.69	5.05	(5.09)
1904-22.....	7.67	1.64	6.03	6.39	4.73	7.42	2.68	5.05	(5.09)
1905-23.....	7.67	1.64	6.03	6.39	4.73	7.43	2.69	5.06	(5.10)
1906-24.....	7.66	1.63	6.03	6.39	4.74	7.44	2.70	5.07	(5.11)
1907-25.....	7.65	1.63	6.02	6.40	4.74	7.44	2.69	5.07	(5.11)
1908-26.....	7.65	1.63	6.02	6.40	4.75	7.44	2.70	5.07	(5.11)
1909-27.....	7.65	1.62	6.03	6.39	4.75	7.45	2.71	5.08	(5.12)
1910-28.....	7.64	1.63	6.01	6.41	4.75	7.45	2.70	5.08	(5.12)
1911-29.....	7.64	1.62	6.02	6.40	4.75	7.44	2.69	5.07	(5.11)
1912-30.....	7.64	1.63	6.01	6.41	4.75	7.44	2.69	5.07	(5.11)
1913-31.....	7.65	1.63	6.02	6.40	4.75	7.46	2.71	5.09	(5.13)
1914-32.....	7.65	1.63	6.02	6.40	4.75	7.48	2.73	5.10	(5.14)

NOTE.—The heights in the last 4 columns are referred to a plane 5 feet below Sandy Hook sea-level datum. Values for mean sea level in parentheses were inferred from half-tide level for same periods. For reference to above table see p. 4.

TABLE 10.—*Extreme high water, Fort Hamilton, N.Y.*

[Referred to a plane 5 feet below Sandy Hook sea-level datum]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Mean	Highest
		Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Date
1893	9.3	8.4	8.3	10.6	9.8	9.3	8.6	10.1	8.5	9.2	8.6	8.6	9.11	10.6 Apr. 20
1894	9.4	9.3	8.5	10.0	9.7	8.7	8.8	9.0	9.7	9.8	8.6	10.1	9.30	10.1 Dec. 27
1895	9.7	8.1	8.4	8.9	8.4	8.8	8.8	8.5	8.8	8.6	9.4	9.6	8.83	9.7 Jan. 26
1896	8.9	9.5	9.3	8.9	8.7	8.6	8.3	8.5	9.7	10.5	10.1	9.2	9.18	10.5 Oct. 12
1897	8.5	9.4	9.6	8.6	9.0	9.4	9.1	9.1	8.9	10.3	9.1	9.1	9.18	10.3 Oct. 25
1898	9.8	9.5	8.2	8.8	10.0	9.7	8.9	9.0	8.5	10.1	8.8	10.0	9.28	10.1 Oct. 19
1899	9.0	10.2	8.8	8.8	9.0	8.6	9.2	9.3	9.1	9.0	8.9	9.5	9.12	10.2 Feb. 8
1900	8.6	8.8	9.4	8.9	9.1	8.5	8.3	9.0	9.0	9.2	9.6	9.7	9.01	9.7 Dec. 4
1901	8.8	8.3	9.1	9.9	9.7	9.5	8.6	8.9	9.0	9.2	11.0	9.2	9.27	11.0 Nov. 24
1902	9.8	9.8	8.7	10.4	9.1	9.1	9.5	9.1	9.0	9.6	9.7	10.2	9.50	10.4 Apr. 8
1903	8.5	9.2	9.6	10.4	8.7	9.9	9.1	9.1	9.7	10.6	8.7	8.8	9.36	10.6 Oct. 10
1904	8.8	9.4	9.8	9.2	8.5	9.6	9.1	9.0	9.2	9.6	9.6	9.0	9.23	9.8 Mar. 1
1905	10.1	9.0	9.6	8.5	9.3	8.8	8.7	9.1	8.9	9.2	9.1	8.9	9.10	10.1 Jan. 25
1906	9.8	9.9	8.9	9.7	8.9	9.7	9.2	8.8	8.8	9.5	9.2	9.3	9.31	9.9 Feb. 9
1907	9.4	8.5	8.3	8.3	9.1	9.3	9.3	9.1	8.8	8.5	9.3	9.5	8.99	9.5 Dec. 14
1908	9.6	9.9	8.7	10.2	8.8	8.9	9.0	9.0	8.8	9.0	9.2	9.7	9.23	10.2 Apr. 30
1909	8.9	9.2	10.1	9.7	9.7	8.9	8.6	9.2	9.4	9.0	9.7	10.3	9.39	10.3 Dec. 26
1910	9.2	9.9	9.5	9.3	9.3	9.3	9.0	8.7	8.9	9.6	9.6	8.9	9.27	9.9 Feb. 12
1911	8.8	9.2	8.7	8.9	9.1	9.2	8.7	8.5	9.3	9.0	9.8	9.1	9.02	9.8 Nov. 7
1912	9.4	9.5	8.6	9.6	8.7	9.0	8.9	8.9	8.9	9.0	9.6	9.2	9.11	9.6 ¹ Apr. 2
1913	9.1	9.0	8.4	8.8	8.9	8.4	8.6	8.9	9.0	9.2	9.7	9.4	10.2	9.06 Dec. 26
1914	10.0	10.2	8.5	9.2	9.7	8.8	8.9	8.7	9.0	9.4	9.6	10.2	9.35	10.2 ¹ Feb. 14
1915	10.0	10.0	9.1	9.5	9.6	9.3	9.0	8.9	8.6	8.9	9.4	9.6	9.32	10.0 ¹ Jan. 13
1916	9.0	9.3	9.5	9.1	9.3	9.6	8.8	9.0	9.0	8.7	8.7	9.1	9.09	9.6 June 16
1917	8.9	8.9	9.3	8.9	9.4	8.9	9.0	8.9	9.0	9.2	10.3	8.6	9.2	9.12 Oct. 24
1918	(10.4)	9.0	9.8	11.2	8.9	8.8	8.7	8.5	8.7	9.3	9.8	9.6	9.38	11.2 Apr. 11
1919	8.7	9.4	8.7	9.4	9.6	9.5	8.8	8.8	9.6	9.2	9.4	10.6	9.9	9.40 Nov. 8
1920	8.9	10.8	9.3	9.4	9.2	10.7	9.3	9.0	9.3	8.9	9.9	(9.7)	9.53	10.8 Feb. 5
1921	(9.2)	(9.4)	(9.0)	9.3	9.8	8.7	9.6	9.2	9.3	9.3	10.1	8.6	9.29	10.1 Nov. 29
1922	10.3	9.2	9.3	9.8	9.0	9.8	9.3	8.9	9.7	9.2	9.4	9.2	9.35	10.3 Jan. 29
1923	9.6	9.3	9.8	9.0	9.6	9.3	9.2	8.8	8.5	8.7	10.2	9.2	9.35	10.2 ¹ Oct. 23
1924	8.8	10.2	10.4	10.0	9.0	9.3	9.2	8.9	9.5	9.6	9.2	8.5	9.40	10.4 Mar. 11
1925	9.2	8.9	8.3	8.7	8.9	9.3	8.9	9.2	9.0	9.1	8.9	9.8	9.02	9.8 Dec. 3
1926	9.5	9.6	8.9	8.7	8.9	8.7	9.0	9.3	9.2	9.6	9.3	8.5	9.10	9.6 ¹ Feb. 10
1927	8.9	11.2	9.2	9.9	9.1	8.9	8.7	9.1	8.9	9.4	9.3	10.3	9.41	11.2 Feb. 20
1928	8.7	8.8	9.1	9.2	9.2	9.3	8.9	9.4	9.7	9.2	8.9	9.0	9.12	9.7 Sept. 19
1929	9.1	8.9	8.3	10.4	8.4	9.3	9.0	9.1	8.8	10.3	9.8	9.3	9.22	10.4 Apr. 16
1930	9.4	8.8	9.2	9.1	9.3	9.0	9.1	9.8	8.9	8.9	9.4	(9.1)	9.17	9.8 Aug. 23
1931	10.2	8.6	10.7	9.7	9.1	8.9	9.2	9.3	9.2	9.1	8.9	9.1	9.33	10.7 Mar. 8
1932	10.6	9.2	10.0	9.2	8.7	9.3	8.9	8.6	9.6	9.1	11.4	9.5	9.51	11.4 Nov. 10
Mean ⁶	9.26	9.37	9.06	9.41	9.17	9.14	8.93	9.03	9.07	9.42	9.40	9.42	9.22	-----

¹ Also Nov. 24, 1912.² Also Dec. 7, 1914.³ Also Jan. 14 and Feb. 2, 1915.⁴ Also Dec. 6, 1923.⁵ Also Oct. 20, 1926.⁶ Means for 38 years (1893-1930).

NOTE.—Highest tide of series is 11.4 feet and occurred on Nov. 10, 1932. Values in parentheses have been inferred. For reference to above table see p. 11.

TIDES AND CURRENTS IN HUDSON RIVER

TABLE 11.—*Extreme low water, Fort Hamilton, N.Y.*
[Referred to a plane 5 feet below Sandy Hook sea-level datum]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Mean	Lowest	
	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Date	
1893	1.5	-0.7	0.1	1.5	1.9	1.9	1.8	1.6	1.7	0.8	0.3	1.25	-0.7	Feb. 20	
1894	0.4	0.2	1.4	1.7	1.8	1.8	1.8	1.9	1.8	0.8	0.3	1.22	0.2	Feb. 16	
1895	0.1	-0.9	0.3	0.8	1.4	2.0	2.0	1.3	1.8	1.0	1.0	0.96	-0.9	Feb. 8	
1896	0.4	-0.6	0.0	0.6	2.0	2.0	1.9	2.1	1.7	1.6	1.4	1.2	1.19	-0.6	Feb. 11
1897	0.5	0.9	0.8	0.9	1.5	2.0	2.1	1.9	1.5	2.1	0.9	0.4	1.29	0.4	Dec. 25
1898	-0.1	-0.8	1.5	1.3	2.1	2.0	1.6	1.6	1.5	1.3	1.4	0.7	1.18	-0.8	Feb. 16
1899	0.5	-0.8	0.5	1.6	1.7	1.7	2.0	2.1	1.7	1.9	1.5	1.1	1.29	-0.8	Feb. 11
1900	-0.7	-0.4	0.1	1.2	1.9	2.1	1.8	1.7	1.7	1.8	-0.3	0.1	0.92	-0.7	Jan. 26
1901	0.7	0.1	0.9	1.7	1.9	2.2	2.1	2.3	2.2	1.4	0.4	0.8	1.39	0.1	Feb. 5
1902	0.5	0.2	1.3	1.7	0.7	1.6	2.0	2.2	2.0	1.8	1.1	1.1	1.35	0.2	Feb. 3
1903	-0.2	0.0	0.7	1.7	1.8	2.0	1.7	1.5	1.8	1.1	1.3	0.5	1.16	-0.2	Jan. 13
1904	0.7	-0.5	0.7	1.2	1.8	1.9	1.9	1.4	1.4	1.4	1.1	0.7	1.14	-0.5	Feb. 3
1905	0.6	-0.3	1.4	0.6	1.7	1.8	1.7	2.0	1.7	1.7	0.2	0.3	1.12	-0.3	Feb. 18
1906	0.8	0.9	-0.5	1.6	1.1	1.6	1.7	2.1	1.6	1.6	0.9	0.3	1.14	-0.5	Mar. 11
1907	0.9	0.3	0.9	1.6	1.5	1.6	1.5	1.9	1.7	0.2	0.9	0.7	1.14	0.2	Oct. 8
1908	-0.1	-1.4	0.8	0.4	1.5	1.9	1.7	1.5	1.3	1.3	0.9	0.8	0.88	-1.4	Feb. 2
1909	1.3	-0.3	0.8	1.1	2.1	2.0	2.0	2.0	1.8	0.6	1.5	1.2	1.34	-0.3	Feb. 25
1910	0.9	0.6	1.3	1.4	1.5	1.8	1.6	1.8	1.8	1.7	0.6	-0.9	1.18	-0.9	Dec. 16
1911	0.9	0.8	-0.3	0.5	1.9	2.1	1.6	1.7	2.3	1.8	0.7	0.1	1.18	-0.3	Mar. 16
1912	-1.2	-1.2	0.2	1.5	1.3	2.1	1.8	1.8	1.5	2.0	0.6	0.6	0.92	-1.2	Jan. 6
1913	-0.9	0.7	-0.1	0.5	1.8	1.9	1.8	2.2	1.5	1.2	1.2	-0.1	0.98	-0.9	Jan. 4
1914	-1.2	-0.6	1.2	0.9	1.8	1.6	2.0	1.9	1.7	1.9	0.7	0.2	1.01	-1.2	Jan. 13
1915	1.4	1.2	0.3	1.3	1.3	1.8	2.1	2.1	0.6	1.8	1.3	0.0	1.27	0.0	Dec. 26
1916	0.6	0.1	1.2	1.5	2.0	2.3	1.7	1.6	2.1	1.3	1.0	-0.6	1.23	-0.6	Dec. 23
1917	0.6	0.2	1.2	1.5	1.8	2.0	1.8	1.6	1.6	1.1	1.2	0.1	1.22	0.1	Dec. 10
1918	(0.2)	0.8	0.6	1.6	1.4	1.7	1.9	1.3	1.0	1.5	1.4	0.7	1.18	0.2	Jan. 13
1919	0.6	0.6	-0.1	1.3	1.9	2.1	1.8	2.3	2.0	1.9	1.2	0.7	1.36	-0.1	Mar. 28
1920	0.6	0.9	0.3	1.8	1.4	2.4	1.7	1.8	2.4	1.7	1.7	(0.9)	1.47	0.3	Mar. 8
1921	(0.2)	(1.6)	(0.8)	0.9	1.8	2.0	2.0	1.8	1.6	1.8	1.6	0.7	1.40	(0.2)	Jan. 25
1922	0.4	0.5	1.3	1.6	1.4	1.9	2.1	1.5	2.0	0.7	1.2	0.7	1.28	0.4	Jan. 16
1923	1.3	0.2	0.7	0.4	1.5	1.7	2.1	1.6	2.0	1.6	0.9	1.2	1.28	0.2	Feb. 15
1924	-0.1	0.7	0.8	0.9	1.3	1.7	1.7	1.9	1.7	1.5	1.1	0.4	1.17	-0.1	Jan. 26
1925	-0.4	-0.6	1.1	1.5	1.5	1.6	1.6	1.4	1.6	1.0	-0.4	-0.5	0.78	-0.6	Feb. 27
1926	-0.1	0.7	0.7	1.2	1.1	1.8	1.9	2.1	1.8	1.4	1.3	0.5	1.20	-0.1	Jan. 24
1927	0.6	0.5	1.1	1.5	1.8	2.1	1.9	2.0	1.9	1.8	0.6	0.7	1.38	0.5	Feb. 4
1928	-1.2	0.3	0.5	0.4	1.8	1.9	1.9	2.2	1.2	1.3	1.0	0.9	1.02	-1.2	Jan. 26
1929	0.1	0.9	0.6	1.1	1.0	2.1	1.5	1.4	1.6	1.0	0.6	0.2	1.01	0.1	Jan. 20
1930	0.8	0.3	0.4	1.3	1.7	1.8	1.9	2.1	1.7	1.5	0.4	1.4	1.28	0.3	Feb. 16
1931	0.3	1.1	1.6	0.9	1.4	2.4	2.3	1.8	1.8	1.4	1.4	0.2	1.38	0.2	Dec. 8
1932	0.4	0.9	-0.9	1.2	1.4	2.3	2.3	2.4	1.8	0.9	1.1	1.4	1.27	-0.9	Mar. 8
Mean ³	0.31	0.13	0.67	1.21	1.62	1.91	1.83	1.83	1.69	1.44	0.94	0.50	1.18	-----	

¹ Also Jan. 14, 1903.² Also Feb. 22, 1912.³ Mean for 38 years (1893-1930).

NOTE.—Lowest tide of series is -1.4 feet and occurred on Feb. 2, 1908. Values in parentheses have been inferred. For reference to above table see p. 11.

TABLE 12.—*High-water lunital interval, New York (the Battery), N.Y.*

Year	Jan-	Febr-	March	April	May	June	July	Au-	Sep-	Oct-	Nov-	De-	Mean
	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours
1920	8.27	8.36	8.27	8.25	8.26	8.17	8.17	8.27	8.21	8.18	8.24	8.22	8.21
1921	8.48	8.25	8.20	8.11	8.18	8.10	8.23	8.23	8.32	8.33	8.31	8.27	8.26
1922	8.26	8.29	8.21	8.23	8.16	8.24	8.18	8.30	8.28	8.25	8.36	8.28	8.25
1923	8.24	8.23	8.14	8.14	8.10	8.15	8.20	8.17	8.26	8.31	8.22	8.22	8.20
1924	8.34	8.27	8.22	8.15	8.08	8.19	8.14	8.22	8.23	8.24	8.36	8.22	8.22
1925	8.13	8.31	8.09	8.08	8.12	8.12	8.27	8.23	8.35	8.32	8.19	8.34	8.21
1926	8.18	8.08	8.19	8.17	8.26	(8.28)	(8.41)	(8.26)	8.30	8.23	8.23	8.44	8.25
1927	8.32	8.32	8.34	8.17	8.20	8.15	8.13	8.21	8.28	8.23	8.29	8.26	8.24
1928	8.33	8.30	8.13	8.26	8.13	8.15	8.21	8.27	8.35	8.32	8.41	8.38	8.27
1929	8.31	8.32	8.29	8.37	8.27	8.29	8.27	8.40	8.36	8.41	8.46	8.48	8.35
1930	8.29	8.35	8.41	8.36	8.35	8.21	8.23	8.31	8.22	8.32	8.37	8.30	8.31
1931	8.21	8.24	8.23	8.24	8.27	8.26	8.25	8.24	8.30	8.38	8.37	8.19	8.27
1932	8.21	8.24	8.23	8.24	8.27	8.26	8.25	8.24	8.30	8.38	8.37	8.19	8.27

NOTE.—Values in parentheses have been inferred. Mean high-water lunital interval from 12 years (1921-32) is 8.26 hours. For reference to above table see p. 5.

TABLE 13.—*Low-water lunital interval, New York (the Battery), N.Y.*

Year	January	Febr-	March	April	May	June	July	Au-	Sep-	Octo-	Nov-	De-	Mean
	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours
1920						2.18	2.24	2.22	2.22	2.15	2.17	2.10	2.18
1921	2.15	2.21	2.24	2.20	2.20	2.36	2.15	2.20	2.29	2.21	2.30	2.29	2.23
1922	2.33	2.23	2.16	2.16	2.20	2.18	2.18	2.18	2.20	2.27	2.19	2.16	2.20
1923	2.07	2.10	2.18	2.07	2.19	2.19	2.26	2.32	2.32	2.26	2.17	2.18	2.19
1924	2.20	2.18	2.12	2.16	2.14	2.12	2.17	2.16	2.23	2.17	2.22	2.18	2.17
1925	2.26	2.18	2.21	2.10	2.06	2.14	2.12	2.19	2.18	2.24	2.22	2.21	2.18
1926	2.21	2.21	2.13	2.14	2.18	2.05	2.22	2.19	2.26	2.19	2.20	2.22	2.18
1927	2.27	2.15	2.11	2.17	2.16	(2.16)	(2.27)	(2.23)	2.14	2.11	2.15	2.18	2.18
1928	2.26	2.16	2.09	2.13	2.13	2.10	2.11	2.07	2.15	2.14	2.12	2.16	2.14
1929	2.24	2.25	2.05	2.15	2.05	2.10	2.22	2.28	2.29	2.31	2.30	2.21	2.20
1930	2.23	2.20	2.20	2.18	2.11	2.16	2.20	2.33	2.24	2.32	2.25	2.28	2.22
1931	2.22	2.22	2.22	2.15	2.15	2.15	2.18	2.15	2.19	2.19	2.21	2.14	2.18
1932	2.16	2.07	2.17	2.23	2.12	2.24	2.19	2.20	2.21	2.31	2.16	2.16	2.19

NOTE.—Values in parentheses have been inferred. Mean low-water lunital interval from 12 years (1921-32) is 2.19 hours. For reference to above table see p. 5.

TABLE 14.—*Duration of rise and fall of tide, New York (the Battery), N.Y.*

Year	Yearly means		Annual variation		
	Duration		Month	Duration	
	Rise	Fall		Rise	Fall
1920 ¹	Hours	Hours	January	Hours	Hours
1921	6.03	6.39	February	6.07	6.36
1922	6.05	6.37	March	6.10	6.32
1923	6.06	6.36	April	6.07	6.35
1924	6.06	6.36	May	6.06	6.36
1925	6.03	6.39	June	6.04	6.38
1926	6.04	6.38	July	6.03	6.39
1927	6.03	6.39	August	6.05	6.37
1928	6.07	6.35	September	6.07	6.35
1929	6.10	6.32	October	6.07	6.35
1930	6.07	6.33	November	6.12	6.30
1931	6.13	6.29	December	6.11	6.31
1932	6.08	6.34	Mean	6.07	6.35
Mean	6.07	6.35			

¹ Records for year 1920 include months of June to December only.

NOTE.—For reference to above table see p. 5.

TABLE 15.—*High water, New York (the Battery), N.Y.*

[Referred to a plane 5 feet below Sandy Hook sea-level datum]

Year	Janu-	Feb-	March	April	May	June	July	Aug-	Sep-	Octo-	Nov-	De-	Mean
	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet
1920						7.68	7.47	7.60	7.60	7.62	7.35	7.55	7.14
1921	7.09	7.46	7.18	7.56	7.91	7.48	7.61	7.52	7.62	7.57	7.36	7.46	
1922	6.86	7.07	7.17	7.27	7.46	7.54	7.62	7.57	7.61	7.57	7.36	7.21	7.36
1923	7.15	7.01	7.10	7.41	7.45	7.44	7.46	7.47	7.48	7.53	7.61	7.27	
1924	6.90	7.40	7.66	7.47	7.71	7.54	7.42	7.58	7.54	7.52	7.30	6.85	7.41
1925	7.36	7.10	6.90	7.31	7.38	7.40	7.49	7.50	7.65	7.33	7.16	7.00	7.30
1926	6.74	7.18	6.80	7.09	7.31	7.39	7.44	7.68	7.68	7.48	7.17	7.16	7.26
1927	6.73	7.28	7.30	7.34	7.51	(7.44)	(7.26)	(7.59)	7.41	7.49	7.28	7.31	7.33
1928	6.67	6.78	6.89	7.01	7.32	7.41	7.35	7.54	7.65	7.22	6.97	6.88	7.14
1929	6.47	7.10	7.03	7.52	7.01	7.50	7.30	7.38	7.50	7.28	7.18	6.98	7.19
1930	6.85	6.92	6.87	6.91	7.16	7.18	7.38	7.46	7.37	7.49	6.93	7.07	7.13
1931	6.82	6.92	7.65	7.20	7.35	7.52	7.55	7.57	7.51	7.39	7.05	6.92	7.29
1932	7.28	7.13	6.79	7.11	7.16	7.34	7.38	7.38	7.60	7.34	7.63	7.16	7.28

NOTE.—Values in parentheses are inferred. Mean high water from 12 years (1921-32) of observations reduced for longitude of moon's node is 7.28 feet. For reference to above table see p. 5.

TABLE 16.—*Low water, New York (the Battery,) N.Y.*
 [Referred to a plane 5 feet below Sandy Hook sea-level datum]

Year	Janu-	Febr-	March	April	May	June	July	Aug-	Sept-	Octo-	Nov-	De-	Mean
	ary	uary						ust	ember	ber	ember	cem-	
		Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet
1920	2.49	2.99	2.63	2.99	3.37	3.15	2.91	3.08	3.04	3.05	2.90	2.86	3.00
1921	2.38	2.55	2.63	2.72	2.83	2.93	2.91	2.90	2.99	2.88	2.74	2.74	2.77
1922	2.76	2.49	2.56	2.80	2.76	2.90	2.93	2.93	2.88	3.01	3.05	2.60	2.81
1923	2.20	2.82	3.09	2.76	3.09	2.98	2.88	3.05	2.99	2.89	2.69	2.26	2.81
1924	2.90	2.56	2.48	2.79	2.82	2.84	2.87	2.86	3.03	2.68	2.69	2.50	2.75
1925	2.28	2.65	2.41	2.61	2.81	2.56	2.90	3.14	3.16	3.04	2.64	2.74	2.77
1926	2.37	2.89	2.85	2.70	2.90	(3.04)	(3.02)	(3.27)	3.13	3.13	2.92	2.94	2.93
1927	2.28	2.51	2.61	2.69	2.98	3.13	3.13	3.24	3.20	2.75	2.57	2.47	2.80
1928	2.16	2.78	2.72	3.34	2.78	3.15	2.94	3.01	3.12	2.84	2.85	2.68	2.86
1929	2.69	2.68	2.49	2.61	2.78	2.80	2.97	3.18	3.10	3.35	2.71	2.86	2.85
1930	2.61	2.67	3.35	2.81	2.91	3.22	3.27	3.30	3.20	3.09	2.73	2.59	2.98
1931	2.91	2.84	2.52	2.87	2.86	3.10	3.18	3.10	3.26	2.92	3.32	2.85	2.98

NOTE.—Values in parentheses are inferred. Mean low water from 12 years (1921-32) of observations reduced for longitude of moon's node is 2.85 feet. For reference to above table see p. 5.

TABLE 17.—*Range of tide, New York (the Battery), N.Y.*

Year	Janu-	Febr-	March	April	May	June	July	Aug-	Sept-	Octo-	Nov-	De-	Mean
	ary	uary						ust	ember	ber	ember	cem-	
		Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet
1920	4.60	4.47	4.55	4.57	4.54	4.53	4.56	4.52	4.56	4.57	4.70	4.64	4.58
1921	4.48	4.52	4.54	4.55	4.63	4.61	4.71	4.67	4.57	4.61	4.50	4.46	4.41
1922	4.39	4.52	4.54	4.61	4.69	4.54	4.53	4.54	4.60	4.62	4.62	4.47	4.59
1923	4.70	4.58	4.57	4.71	4.62	4.56	4.54	4.53	4.55	4.64	4.61	4.59	4.48
1924	4.46	4.54	4.42	4.52	4.50	4.56	4.62	4.64	4.62	4.65	4.47	4.50	4.46
1925	4.46	4.53	4.39	4.48	4.50	4.50	4.54	4.54	4.52	4.44	4.55	4.42	4.49
1926	4.36	4.39	4.51	4.64	4.61	(4.40)	(4.24)	(4.32)	4.28	4.36	4.36	4.37	4.40
1927	4.39	4.27	4.28	4.32	4.34	4.28	4.22	4.30	4.45	4.47	4.40	4.41	4.39
1928	4.31	4.32	4.31	4.18	4.23	4.35	4.36	4.37	4.38	4.44	4.33	4.30	4.32
1929	4.16	4.24	4.38	4.30	4.38	4.36	4.41	4.28	4.27	4.14	4.22	4.21	4.28
1930	4.21	4.25	4.30	4.39	4.44	4.30	4.28	4.27	4.31	4.30	4.32	4.33	4.31
1931	4.37	4.29	4.27	4.24	4.30	4.24	4.20	4.28	4.34	4.42	4.31	4.31	4.42

(A) Direct mean of monthly values.

(B) Mean reduced for longitude of moon's node.

NOTE.—Mean range of tide from 12 years (1921-32) reduced for longitude of moon's node is 4.43 feet. Values in parentheses have been inferred. For reference to above table see p. 5.

TABLE 18.—*Half-tide level, New York (the Battery), N.Y.*

[Referred to a plane 5 feet below Sandy Hook sea-level datum]

Year	Janu-	Febr-	March	April	May	June	July	Aug-	Sept-	Octo-	Nov-	De-	Mean
	ary	uary											
		Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet
1920	4.79	5.22	4.90	5.28	5.64	5.42	5.19	5.34	5.32	5.34	5.30	5.18	5.29
1921	4.62	4.81	4.90	5.00	5.14	5.24	5.26	5.24	5.30	5.22	5.05	4.98	5.06
1922	4.96	4.75	4.83	5.10	5.10	5.17	5.20	5.20	5.18	5.27	5.33	4.94	5.09
1923	4.55	5.11	5.38	5.12	5.40	5.26	5.15	5.32	5.26	5.21	5.00	4.56	5.11
1924	5.13	4.83	4.69	5.05	5.10	5.12	5.18	5.18	5.34	5.00	4.92	4.75	5.02
1925	4.51	4.92	4.60	4.85	5.06	5.12	5.17	5.41	5.42	5.26	4.90	4.95	5.01
1926	4.55	5.09	5.11	5.02	5.21	(5.24)	(5.14)	(5.43)	5.27	5.31	5.10	5.12	5.13
1927	4.48	4.64	4.75	4.85	4.88	5.15	5.27	5.24	5.39	5.42	4.98	4.77	4.68
1928	4.32	4.94	4.88	5.43	4.90	5.32	5.12	5.20	5.31	5.06	5.02	4.83	5.03
1929	4.77	4.80	4.68	4.76	4.97	4.98	5.17	5.32	5.23	5.42	4.82	4.96	4.99
1930	4.71	4.79	5.50	5.01	5.13	5.37	5.41	5.43	5.35	5.24	4.89	4.75	5.13
1931	5.10	4.98	4.66	4.99	5.01	5.22	5.28	5.24	5.43	5.13	5.48	5.00	5.13

NOTE.—Values in parentheses are inferred. Half tide level from 12 years (1921-32)=5.07 feet. For reference to above table see p. 5.

TABLE 19.—*Sea level, New York (the Battery) N.Y.*

[Referred to a plane 5 feet below Sandy Hook sea-level datum]

Year	January	Febr-	March	April	May	June	July	Aug-	Sept-	Octo-	Nov-	De-	Mean
	February	uary	March	April	May	June	July	ust	tem-	ber	ember	cem-	Mean
1920													
	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet
1921	4.91	5.31	5.04	5.37	5.74								
1922	4.61	5.16	5.17	5.10	5.30								
1923	4.53	4.72	4.88	4.94	5.24	5.35	5.33	5.49	5.50	5.08	4.86	4.71	5.05
1924	4.34	5.03	4.99	5.51	4.98	5.39	5.21	5.28	5.39	5.12	5.10	4.90	5.10
1925	4.85	4.87	4.80	4.85	5.05	5.06	5.23	5.38	5.32	5.49	4.86	5.01	5.06
1926	4.79	4.86	5.57	5.10	5.23	5.45	5.50	5.53	5.43	5.30	4.96	4.83	5.21
1927	5.16	5.08	4.75	5.06	5.08	5.30	5.35	5.34	5.51	5.20	5.55	5.06	5.20

NOTE.—For reference to above table see p. 5.

TABLE 20.—*Extreme high water, by months, New York (the Battery), N.Y.*

[Referred to a plane 5 feet below Sandy Hook sea-level datum]

Year	January	Febr-	March	April	May	June	July	August	September	October	November	December	Highest	
	February	uary	March	April	May	June	July	August	September	October	November	December	Mean	
1920														
	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Date	
1921	9.0	9.2	8.8	9.1	9.5	8.6	9.2	8.9	9.0	9.1	9.9	8.6	9.34	
1922	10.1	9.0	9.1	9.6	8.9	8.8	9.1	8.6	9.4	8.9	9.1	8.9	10.1 Jan. 29	
1923	9.4	9.0	9.7	9.1	9.0	9.1	9.2	8.3	8.6	10.0	9.1	10.1	9.19 Dec. 6	
1924	8.8	10.3	10.4	10.0	9.0	9.2	9.0	8.8	9.5	9.5	9.1	8.5	9.34 Mar. 11	
1925	9.0	8.7	8.3	8.5	8.7	9.1	8.7	9.0	8.8	8.9	8.8	9.5	8.83 Dec. 3	
1926	9.2	9.5	8.8	8.5	8.8	8.5	8.8	9.1	9.0	9.3	9.1	8.6	8.93 Feb. 10	
1927	8.7	11.0	9.1	9.4	8.9	(8.7)	(8.5)	(8.9)	8.7	9.1	9.0	10.0	9.17	11.0 Feb. 20
1928	8.3	8.1	8.5	9.1	9.0	8.9	8.5	9.0	9.8	9.2	8.3	8.8	8.79	9.8 Sept. 19
1929	8.9	8.9	8.4	10.2	8.2	9.0	8.8	8.8	8.6	10.2	9.7	9.2	9.08	10.2 Apr. 16
1930	9.1	8.7	8.9	8.8	9.2	8.7	8.7	9.4	8.5	8.7	9.2	8.9	8.90	9.4 Aug. 22
1931	9.9	8.3	10.6	9.6	8.8	8.6	8.8	8.9	8.7	8.9	8.6	8.5	9.02	10.6 Mar. 8
1932	10.2	8.9	9.5	8.8	8.4	9.0	8.6	8.3	9.0	8.8	11.0	9.1	9.13	11.0 Nov. 10

¹ Also Oct. 2, 1929.

NOTE.—See also table 22. Values in parentheses have been inferred. For reference to above table see p. 11.

TABLE 21.—*Extreme low water, by months, New York (the Battery), N.Y.*

[Referred to a plane 5 feet below Sandy Hook sea-level datum]

Year	January	Febr-	March	April	May	June	July	August	September	October	November	December	Lowest
	February	uary	March	April	May	June	July	August	September	October	November	December	Mean
1920													
	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Date
1921	0.3	1.8	1.0	2.1	1.9	2.1	2.1	2.0	1.7	1.9	1.7	0.8	1.79
1922	0.5	1.5	2.0	1.6	2.1	2.2	1.6	2.1	2.1	1.8	1.4	0.6	1.42
1923	1.5	0.4	0.6	0.5	1.7	1.9	2.3	1.9	2.1	1.8	1.0	1.3	1.42
1924	0.3	1.0	1.1	1.1	1.6	2.1	2.0	2.2	2.0	1.7	1.3	0.7	1.42
1925	-0.2	0.0	1.1	1.6	1.7	1.8	1.8	1.6	1.8	0.3	0.1	-0.3	0.94
1926	-0.1	0.8	0.9	1.4	1.7	2.0	2.0	2.2	1.9	1.5	1.5	0.5	1.36
1927	0.5	0.3	1.2	1.5	1.9	(2.3)	(2.1)	(2.2)	2.1	1.9	0.8	1.2	1.50
1928	-0.8	0.6	0.8	0.6	1.9	1.9	2.2	2.3	1.3	1.4	1.1	0.6	1.16
1929	0.3	1.2	0.9	1.6	1.2	2.3	1.8	1.6	1.8	1.2	0.9	0.3	1.26
1930	1.0	0.9	0.5	1.4	1.8	1.8	2.0	2.2	1.8	1.5	0.4	1.4	1.39
1931	0.5	1.2	1.9	1.1	1.5	2.4	2.3	1.8	1.8	1.4	1.3	0.0	1.43
1932	0.2	1.0	-0.9	1.2	1.5	2.4	2.4	2.5	1.7	0.9	1.2	1.3	1.28

¹ Also Dec. 21, 1929.

NOTE.—See also table 23. Values in parentheses have been inferred. For reference to above table see p. 11.

TABLE 22.—*Extreme high water by years, New York (the Battery), N.Y.*

[Above Sandy Hook sea-level datum]

Year	Date	Height	Year	Date	Height	Year	Date	Height
<i>Feet</i>								
1886.....	Dec. 13	4.1	1902.....	Apr. 8	5.6	1918.....	Apr. 11	6.1
1887.....	Nov. 15	4.2	1903.....	Oct. 10	5.7	1919.....	Nov. 8	5.2
1888.....	Nov. 26	4.4	1904.....	Mar. 1	4.8	1920.....	Feb. 5	6.1
1889.....	Sept. 10	5.2	1905.....	Jan. 25	4.8	1921.....	Nov. 29	4.9
1890.....	Oct. 25	5.0	1906.....	Jan. 14	5.1	1922.....	Jan. 29	5.1
1891.....	Oct. 20	4.7	1907.....	Dec. 14	4.5	1923.....	Dec. 6	5.1
1892.....	Mar. 1	4.5	1908.....	Apr. 30	5.2	1924.....	Mar. 11	5.4
1893.....	Apr. 21	5.6	1909.....	Mar. 4	4.9	1925.....	Dec. 3	4.5
1894.....	Dec. 27	5.3	1910.....	Feb. 12	4.9	1926.....	Feb. 10	4.5
1895.....	Jan. 26	4.8	1911.....	Nov. 7	4.7	1927.....	Feb. 20	6.0
1896.....	Oct. 12	5.6	1912.....	Nov. 24	4.6	1928.....	Sept. 19	4.8
1897.....	Oct. 25	5.5	1913.....	Dec. 26	5.0	1929.....	(Apr. 16	5.2
1898.....	Oct. 19	5.3	1914.....	Dec. 7	5.7	1930.....	(Oct. 2	5.2
1899.....	Feb. 8	5.6	1915.....	Dec. 7	4.8	1931.....	Aug. 22	4.4
1900.....	Dec. 4	5.0	1916.....	June 16	4.3	1932.....	Mar. 8	5.6
1901.....	Nov. 24	5.9	1917.....	Oct. 24	5.2	1932.....	Nov. 10	6.0

NOTE.—Highest recorded 6.1 feet, above sea-level datum on Apr. 11, 1918, and Feb. 5, 1920. For reference, to above table, see p. 11.

TABLE 23.—*Extreme low water by years, New York (the Battery), N.Y.*

[Below Sandy Hook sea-level datum]

Year	Date	Height	Year	Date	Height	Year	Date	Height
<i>Feet</i>								
1886.....	Feb. 27	6.1	1901.....	Feb. 11	4.9	1919.....	Mar. 28	5.0
	(Feb. 28	5.1	1902.....	Feb. 3	4.3	1920.....	Mar. 7	5.3
1887.....	Dec. 30	5.1	1903.....	Jan. 13	5.0	1921.....	Jan. 25	4.7
1888.....	Mar. 13	5.2	1904.....	Feb. 3	5.1	1922.....	Jan. 16	4.5
1889.....	Feb. 1	4.5	1905.....	Feb. 18	4.9	1923.....	Feb. 15	4.6
1890.....	Jan. 26	5.6	1906.....	Mar. 11	5.4	1924.....	Jan. 6	4.7
1891.....	Mar. 14	4.8	1907.....	Feb. 12	4.4	1925.....	Dec. 28	5.3
1892.....	Mar. 12	5.0	1908.....	Feb. 2	6.1	1926.....	Jan. 24	5.1
1893.....	Feb. 20	5.7	1909.....	Feb. 25	5.0	1927.....	Feb. 4	4.7
	(Feb. 24	4.4	1910.....	Dec. 16	5.3	1928.....	Jan. 26	5.8
1894.....	(Dec. 13	4.4	1911.....	Mar. 16	4.7	1929.....	(Jan. 20	4.7
	Feb. 8	6.2	1912.....	Jan. 6	5.9		(Dec. 21	4.7
1896.....	Feb. 12	5.3	1913.....	Jan. 4	5.6	1930.....	Nov. 7	4.6
1897.....	Dec. 24	4.9	1914.....	Jan. 13	5.8	1931.....	Dec. 8	5.0
1898.....	Feb. 16	5.7	1915.....	Dec. 26	4.8	1932.....	Mar. 8	5.9
1899.....	Feb. 10	5.1	1916.....	Dec. 23	5.1			
1900.....	Jan. 26	5.5	1917.....	Feb. 5	4.4			
1901.....	Feb. 5	4.9	1918.....	Mar. 15	4.4			

NOTE.—Lowest recorded, 6.2 feet, below sea-level datum on Feb. 8, 1895. For reference to above table, see p. 11.

TABLE 24.—*High-water lunitaltidal interval, Spuyten Duyvil, N.Y.*

Year	January	February	March	April	May	June	July	August	September	October	November	December	Mean
	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours
1919.....	9.05	9.36	9.26	9.24	9.25	9.15	9.10	9.12	9.22	9.29	9.35	9.23	9.20
1921.....	9.49	9.35	9.30	9.22	9.25	9.16	9.18	9.15	9.18	9.18	9.27	9.23	9.25
1922.....													
1926.....													
1927.....	9.41	9.40	9.23	9.04	9.24	9.27	9.19	9.18	9.22	9.19	9.14	9.23	9.23
1928.....	9.11	9.22	9.13	9.04	9.08	9.13	9.17	9.27	9.29	9.09	9.35	9.26	9.18
1929.....	9.29	9.51	9.30	9.19	9.17	9.21	9.26	9.12	9.16	9.26	9.24	9.20	9.24
1930.....	9.32	9.30	9.13	9.23	9.07	9.18	9.10	9.23	9.25	9.16	9.28	9.29	9.21
Mean.....	9.28	9.36	9.22	9.14	9.18	9.18	9.19	9.22	9.21	9.28	9.24	9.22	9.22

NOTE.—For reference to above table see p. 5.

TABLE 25.—*Low-water lunital interval, Spuyten Duyvil, N.Y.*

Year	January	February	March	April	May	June	July	August	September	October	November	December	Mean
	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours
1919													
1921	2.94	3.23	3.06	3.11	3.06	3.08	3.00	3.05	3.06	3.10	2.94	3.03	3.03
1922	3.26	3.25	3.11	2.98	3.13	3.02	3.14	3.06	3.07	3.09	3.13	3.15	3.12
1926													
1927	3.26	3.10	2.99	3.04	3.06	3.09	3.01	3.10	3.02	3.00	2.85	3.05	
1928	3.03	3.06	2.98	2.88	3.02	3.03	3.05	2.98	3.05	2.96	3.18	3.14	3.03
1929	3.24	3.20	3.07	3.08	2.98	2.98	3.03	3.03	3.05	3.10	2.99	3.04	3.27
1930	3.12	3.08	2.97	2.94	2.94	3.05	3.04	3.11	3.09	3.13	3.11	3.12	3.06
Mean	3.14	3.15	3.03	2.99	3.04	3.03	3.06	3.07	3.08	3.08	3.10	3.09	3.07

NOTE.—For reference to above table see p. 5.

TABLE 26.—*High water, Spuyten Duyvil, N.Y.*

[Referred to a plane 5 feet below Sandy Hook sea-level datum]

Year	Janu- ary	Febr- uary	March	April	May	June	July	August	Septem- ber	Octo- ber	Novem- ber	De- cem- ber	Mean
	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet
1919													
1921	6.80	7.15	7.14	7.47	7.74	7.26	7.45	7.31	7.45	7.54	7.71	7.27	
1922	6.67	6.85	7.10	7.30	7.32	7.46	7.52	7.44	7.43	7.39	7.18	6.97	7.22
1926													
1927	6.67	7.20	7.33	7.20	7.37	7.31	7.24	7.51	7.51	7.40	7.14	6.93	7.26
1928	6.63	6.89	7.00	7.11	7.36	7.43	7.51	7.62	7.68	7.15	6.97	6.98	7.19
1929	6.33	7.09	7.09	7.67	7.18	7.51	7.30	7.34	7.45	7.19	7.05	6.99	7.18
1930	6.84	6.96	7.00	6.99	7.13	7.17	7.27	7.43	7.35	7.48	6.95	7.03	7.13
Mean	6.66	7.02	7.11	7.27	7.33	7.34	7.37	7.44	7.47	7.33	7.19	7.03	7.21

NOTE.—For reference to above table see p. 5.

TABLE 27.—*Low water, Spuyten Duyvil, N.Y.*

[Referred to a plane 5 feet below Sandy Hook sea-level datum]

Year	Janu- ary	Febr- uary	March	April	May	June	July	August	Septem- ber	Octo- ber	Novem- ber	De- cem- ber	Mean
	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet
1919													
1921	3.09	3.52	3.22	3.54	3.90	3.49	3.62	3.48	3.59	3.31	3.63	3.24	3.46
1922	2.89	3.04	3.21	3.32	3.35	3.46	3.48	3.56	3.64	3.53	3.49	3.28	3.35
1926													
1927	3.00	3.53	3.47	3.29	3.53	3.63	3.51	3.78	3.75				
1928	2.81	3.13	3.29	3.20	3.63	3.59	3.79	3.98	3.87	3.50	3.19	3.18	3.43
1929	2.72	3.45	3.32	3.00	3.38	3.77	3.52	3.59	3.68	3.46	3.36	3.37	3.46
1930	3.30	3.29	3.20	3.25	3.43	3.46	3.60	3.70	3.65	3.82	3.27	3.41	3.45
Mean	2.97	3.33	3.29	3.39	3.52	3.55	3.57	3.68	3.70	3.58	3.42	3.32	3.44

NOTE.—For reference to above table see p. 5.

TABLE 28.—*Range of tide, Spuyten Duyvil, N.Y.*

Year	January	February	March	April	May	June	July	August	September	October	November	December	Mean
	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet
1919													
1921	3.71	3.63	3.92	3.93	3.84	3.77	3.83	3.83	3.68	3.71	3.74	3.69	3.81
1922	3.78	3.81	3.88	3.98	3.97	4.00	4.04	3.88	3.79	3.86	3.78	3.69	3.87
1926													
1927	3.67	3.67	3.86	3.91	3.84	3.68	3.73	3.62	3.75			3.85	3.76
1928	3.82	3.76	3.71	3.91	3.73	3.84	3.72	3.66	3.81	3.65	3.78	3.78	3.76
1929	3.61	3.64	3.77	3.77	3.80	3.74	3.78	3.75	3.77	3.73	3.69	3.62	3.72
1930	3.54	3.67	3.80	3.74	3.70	3.71	3.67	3.73	3.70	3.66	3.68	3.62	3.69
Mean													
	3.69	3.70	3.82	3.88	3.82	3.79	3.80	3.76	3.77	3.75	3.77	3.71	3.77

NOTE.—For reference to above table see p. 5.

TABLE 29.—*Half-tide level, Spuyten Duyvil, N.Y.*

[Referred to a plane 5 feet below Sandy Hook sea-level datum]

Year	January	February	March	April	May	June	July	August	September	October	November	December	Mean
	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet
1919													
1921	4.94	5.34	5.18	5.50	5.82	5.38	5.54	5.40	5.50	5.23	5.44	5.12	5.37
1922	4.78	4.94	5.16	5.31	5.34	5.46	5.50	5.50	5.46	5.29	5.12	5.28	
1926													
1927	4.84	5.36	5.40	5.24	5.45	5.47	5.38	5.59	5.62			5.38	5.37
1928	4.72	5.01	5.14	5.15	5.50	5.51	5.65	5.79	5.77	5.32	5.08	5.31	
1929	4.52	5.27	5.20	5.78	5.28	5.64	5.41	5.46	5.56	5.32	5.21	5.18	5.32
1930	5.07	5.13	5.10	5.12	5.28	5.32	5.43	5.57	5.50	5.65	5.11	5.22	5.29
Mean													
	4.81	5.18	5.20	5.33	5.43	5.44	5.47	5.56	5.59	5.45	5.31	5.17	5.33

NOTE.—For reference to above table see p. 5.

TABLE 30.—*Tidal means, July to September, Spuyten Duyvil, N.Y.*

Year	Intervals		Duration		Range		High water	Low water	Half-tide level
	High water	Low water	Rise	Fall	(A)	(B)			
					Hours	Hours			
1921	9.15	3.07	6.08	6.34	3.83	3.72	7.39	3.56	5.48
1922	9.17	3.09	5.08	6.34	3.90	3.79	7.46	3.56	5.51
1926	9.25	3.13	6.12	6.30	3.82	3.79	7.43	3.61	5.52
1927	9.20	3.04	6.16	6.26	3.70	3.70	7.38	3.68	5.53
1928	9.24	3.03	6.21	6.21	3.73	3.77	7.61	3.88	5.74
1929	9.18	3.04	6.14	6.28	3.77	3.85	7.36	3.60	5.48
1930	9.19	3.08	6.11	6.31	3.70	3.80	7.35	3.65	5.50
Mean (C)	9.20	3.07	6.13	6.29	3.78	3.77	7.43	3.65	5.54
Mean (D)					3.77		7.17	3.40	5.28

Range (A) directly from observations.

Range (B) reduced for longitude of moon's node.

Mean (C) obtained directly from values above.

Mean (D) reduced by comparison with observations at the Battery.

NOTE.—Heights in last 3 columns are referred to a plane 5 feet below the Sandy Hook sea-level datum. For reference to above table see p. 6.

TABLE 31.—*High water, Yonkers (Recreation Pier), N.Y.*

[Referred to a plane 5 feet below Sandy Hook sea-level datum]

Year	January	February	March	April	May	June	July	August	September	October	November	December	Mean
	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet
1909													
1910			7.17	7.39	7.14	7.27	7.18	7.03	7.24	6.63	6.96		6.98
1911					6.92	7.18	6.80	6.97	7.21	7.30	6.63	6.80	6.99
1912			7.01	6.98	7.09	6.79	6.74	6.69	6.96	7.03	7.10	6.54	6.89
1913	6.85		6.21	7.06	6.95	6.91	6.91	7.00	6.94	7.22	7.05		6.91
1914				7.09	7.09	6.82	7.00	6.94	7.01	7.16	6.63	6.89	6.96
1915	6.80	6.21	6.72	6.99	7.08	7.10	7.30	7.52	6.98	7.62	7.12	6.58	7.00
1916				7.44	7.18	7.37	6.97	7.14	7.07	7.40	7.08	6.89	7.17
1917				6.96	6.98	6.79	7.33	7.23	7.19	7.28	7.36	7.18	
1918				7.43	7.20	7.30	7.24	7.28	6.91			7.33	7.24
1919		6.81	7.39		7.61	7.55	(7.50)	7.48	7.62				7.42
1920			7.82	7.61	7.52	7.49	7.28						7.54
1921					7.76	7.27	7.46	7.30	7.47	7.12	7.27	7.14	7.35
1922	6.88	7.07	7.25	7.45	7.41	7.54	7.53	7.45	7.45	7.42	7.15	6.91	7.29
1923	7.21		7.04	7.64	7.47	7.30	7.22	7.33	7.22	7.28	7.52	7.38	7.33
1924	6.87		7.49	7.52	7.81	7.39	7.26	7.38	7.39	7.40	7.04	6.60	7.28
1925	6.64		7.11	7.31	7.19	7.24	7.55	7.40	7.48	7.14	7.35	7.19	7.24
1926			6.82	7.25	7.40	7.29	7.24	7.48	7.52	7.40	7.25	7.06	7.27
1927			7.29	7.36	7.30	7.08	6.62	6.98	7.35	7.40	7.37	7.26	6.90
1928	6.15		6.80	7.11	7.57	7.38	7.24	7.53	7.38	6.86	6.71	6.66	7.03
1929	5.88	6.48	6.95	7.49	7.01	7.24	7.08	6.86	7.74	7.16	7.27	6.61	6.98
1930	6.70	6.82	6.55	6.40	6.79	6.94	7.07	7.03	7.02	7.09	6.53	6.64	6.80
Mean	6.66	6.78	7.04	7.25	7.24	7.20	7.18	7.22	7.26	7.22	7.05	6.89	7.08

NOTE.—For reference to above table see p. 5.

TABLE 32.—*Low water, Yonkers (Recreation Pier), N.Y.*

[Referred to a plane 5 feet below Sandy Hook sea-level datum]

Year	January	February	March	April	May	June	July	August	September	October	November	December	Mean
	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet
1909													
1910			3.31	3.87	3.66	3.79	3.77	3.70	3.97	3.42	3.70		3.69
1911					3.46	3.77	3.55	3.71	3.97	4.00	3.21	3.44	3.64
1912			3.40	3.52	3.65	3.54	3.64	3.74	3.71	3.70	3.60	3.14	3.55
1913	3.56		3.06	3.50	3.59	3.62	3.65	3.75	3.73	4.02	3.79		3.63
1914					3.86	3.72	3.60	3.81	3.69	3.77	3.92	3.58	3.73
1915	3.92	3.16	3.46	3.49	3.83	3.82	3.87	4.07	3.89	4.33	3.89	3.30	3.75
1916					4.03	3.75	4.04	3.66	3.81	3.80	3.80	3.76	3.78
1917					3.59	3.41	3.30	3.80	3.87	3.85	3.64	4.10	3.62
1918					3.87	3.65	3.91	3.83	3.89	3.60			4.02
1919			3.43	3.83		4.01	4.07	3.68	4.02	4.18			3.89
1920			3.76	3.91	3.86	3.91	3.66						3.82
1921					4.19	3.74	3.91	3.74					3.82
1922	3.62	3.29	3.65	3.75		3.72	3.76	3.75	3.89	3.75	3.80	3.68	3.68
1923	3.36		3.79	3.85	3.69	3.78	3.68	3.81	3.73	3.76	4.00	3.61	3.73
1924			3.26	4.01	3.71	4.09	3.80	3.72	3.91	3.86	3.76	3.47	3.18
1925	3.61		3.30	3.69	3.58	3.79	4.00	3.74	3.92	3.67	3.80	3.69	3.71
1926			3.34	3.68	3.75	3.77	3.68	3.92	3.98	3.88	3.60	3.70	3.73
1927			3.87	3.79	3.65	3.50	3.13	3.52	3.87	3.90	3.84	3.64	3.28
1928	2.87		3.31	3.48	3.99	3.77	3.65	4.04	3.76	3.46	3.37	3.36	
1929			2.56	3.01	3.51	4.00	3.45	3.79	3.49	3.40	4.30	3.70	3.33
1930			3.30	3.44	3.06	3.17	3.37	3.48	3.66	3.60	3.59	3.72	3.18
Mean	3.34	3.37	3.51	3.69	3.70	3.75	3.72	3.80	3.85	3.80	3.63	3.51	3.64

NOTE.—For reference to above table see p. 5.

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 TABLE 33.—*Range of tide, Yonkers (Recreation Pier), N.Y.*

Year	Janu- ary	Feb- ruary	March	April	May	June	July	Aug- ust	Sep- tem- ber	Octo- ber	Nov- em- ber	De- cem- ber	Mean	
	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	
1909														
1910				3.86	3.52	3.48	3.48	3.41	3.33	3.27	3.21	3.26	3.31	
1911					3.46	3.41	3.25	3.26	3.24	3.30	3.42	3.36	3.34	
1912				3.61	3.46	3.54	3.25	3.10	2.95	3.25	3.33	3.50	3.40	
1913	3.29		3.15	3.56	3.36	3.29	3.26	3.25	3.21	3.20	3.26	3.28	3.28	
1914				3.23	3.37	3.22	3.19	3.25	3.24	3.24	3.05	3.16	3.22	
1915		2.88	3.05	3.26	3.50	3.25	3.28	3.43	3.45	3.09	3.29	3.23	3.28	
1916				3.41	3.43	3.33	3.31	3.33	3.27	3.60	3.32	3.55	3.39	
1917				3.37	3.57	3.49	3.53	3.36	3.34	3.64	3.26	3.56	3.46	
1918				3.36	3.55	3.39	3.41	3.39	3.31	-----	3.31	3.42	3.42	
1919			3.38	3.56		3.60	3.45	(3.82)	3.46	3.44	-----	-----	3.53	
1920			4.06	3.70	3.66	3.58	3.62				3.53	3.53	3.72	
1921					3.57	3.53	3.55	3.56	3.62	3.53	3.53	3.34	3.53	
1922	3.26	3.78	3.60	3.70	3.69	3.78	3.78	3.70	3.56	3.62	3.49	3.40	3.61	
1923	3.85		3.25	3.79	3.78	3.52	3.54	3.52	3.49	3.52	3.52	3.77	3.60	
1924			3.61	3.48	3.81	3.72	3.59	3.54	3.47	3.53	3.64	3.57	3.44	
1925		3.03		3.81	3.62	3.61	3.45	3.55	3.66	3.56	3.47	3.55	3.50	
1926				3.48	3.57	3.65	3.52	3.56	3.56	3.54	3.52	3.65	3.54	
1927			3.42	3.57	3.65	3.58	3.49	3.46	3.48	3.50	3.53	3.62	3.54	
1928			3.28	3.49	3.63	3.58	3.61	3.59	3.49	3.62	3.40	3.34	3.30	
1929	3.32	3.47	3.44	3.49	3.56	3.45	3.59	3.46	3.46	3.44	3.46	3.39	3.28	
1930	3.40	3.38	3.53	3.23	3.42	3.46	3.41	3.43	3.43	3.37	3.35	3.23	3.39	
Mean			3.32	3.41	3.53	3.56	3.54	3.46	3.46	3.42	3.41	3.42	3.38	3.44

NOTE.—For reference to above table see p. 5.

 TABLE 34.—*Half-tide level, Yonkers (Recreation Pier), N.Y.*

[Referred to a plane 5 feet below Sandy Hook sea-level datum]

Year	Janu- ary	Feb- ruary	March	April	May	June	July	Aug- ust	Sep- tem- ber	Octo- ber	Nov- em- ber	De- cem- ber	Mean	
	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	
1909														
1910			5.24	5.63	5.40	5.53	5.48	5.36	5.60	5.02	5.33	5.21	5.44	
1911				5.19	5.19	5.48	5.18	5.34	5.59	5.65	4.92	5.12	5.31	
1912			5.20	5.25	5.32	5.16	5.19	5.22	5.34	5.36	5.35	4.84	5.22	
1913	5.20		4.64	5.28	5.27	5.26	5.28	5.38	5.34	5.62	5.42	-----	5.27	
1914				5.48	5.40	5.21	5.40	5.32	5.39	5.54	5.10	5.31	5.35	
1915		5.36	4.68	5.09	5.24	5.46	5.46	5.58	5.80	5.44	5.98	5.50	4.94	
1916				5.74	5.46	5.70	5.32	5.48	5.44	5.60	5.42	5.12	5.48	
1917				5.28	5.20	5.04	5.56	5.55	5.52	5.46	5.73	5.40	5.42	
1918				5.65	5.42	5.60	5.54	5.58	5.26	-----	-----	5.68	5.53	
1919			5.12	5.61		5.81	5.80	(5.59)	5.75	5.90	-----	-----	5.65	
1920			5.79	5.76	5.69	5.70	5.47				-----	-----	5.68	
1921					5.98	5.50	5.68	5.52	5.66	5.36	5.50	5.47	5.58	
1922	5.25	5.18	5.45	5.60	5.56	5.65	5.64	5.60	5.67	5.61	5.40	5.21	5.48	
1923	5.28		5.42	5.74	5.58	5.54	5.45	5.57	5.48	5.52	5.76	5.50	5.53	
1924	5.06			5.75	5.62	5.95	5.60	5.49	5.64	5.62	5.58	5.26	4.88	
1925	5.12			5.20	5.50	5.38	5.52	5.78	5.57	5.70	5.40	5.58	5.47	
1926			5.08	5.46	5.58	5.53	5.40	5.70	5.75	5.64	5.42	5.38	5.50	
1927			5.58	5.58	5.48	5.29	4.88	5.25	5.61	5.65	5.60	5.45	5.09	
1928	4.51		5.06	5.30	5.78	5.58	5.44	5.78	5.57	5.16	5.04	5.01	5.29	
1929	4.22	4.74	5.23	5.74	5.23	5.52	5.28	5.13	6.02	5.43	5.58	4.97	5.28	
1930	5.00	5.13	4.82	4.78	5.08	5.21	5.36	5.32	5.30	5.40	4.85	5.03	5.11	
Mean			5.00	5.07	5.28	5.47	5.47	5.48	5.45	5.51	5.56	5.51	5.34	5.20

NOTE.—For reference to above table see p. 5.

TABLE 35.—*Tidal means, July to September, Yonkers (Recreation Pier), N.Y.*

Year	Range		High water		Low water		Half-tide level
	(A)	(B)	(A)	(B)	(A)	(B)	
1910	3.34	3.40	7.15	7.18	3.81	3.78	5.48
1911	3.25	3.33	6.99	7.03	3.74	3.70	5.37
1912	3.10	3.19	6.80	6.85	3.70	3.66	5.25
1913	3.24	3.33	6.95	6.99	3.71	3.66	5.33
1914	3.23	3.32	6.98	7.03	3.76	3.71	5.37
1915	3.32	3.40	7.27	7.31	3.94	3.91	5.61
1916	3.30	3.35	7.06	7.09	3.76	3.74	5.41
1917	3.45	3.47	7.23	7.25	3.79	3.78	5.51
1918	3.37	3.35	7.14	7.13	3.77	3.78	5.46
1919	3.57	3.52	7.53	7.51	3.96	3.99	5.75
1921	3.58	3.48	7.41	7.36	3.83	3.88	5.62
1922	3.68	3.57	7.48	7.43	3.80	3.86	5.64
1923	3.52	3.42	7.26	7.21	3.74	3.79	5.50
1924	3.51	3.42	7.34	7.29	3.83	3.87	5.58
1925	3.59	3.52	7.48	7.44	3.89	3.92	5.68
1926	3.55	3.52	7.41	7.40	3.86	3.88	5.64
1927	3.48	3.48	7.24	7.24	3.76	3.76	5.50
1928	3.57	3.61	7.38	7.41	3.82	3.80	5.60
1929	3.50	3.57	7.23	7.27	3.73	3.70	5.48
1930	3.42	3.51	7.04	7.09	3.62	3.58	5.33
Mean	3.43	3.44	7.22	7.23	3.79	3.79	5.51

Columns (A) contain direct means from observations.

Columns (B) contain values which have been reduced for longitude of moon's node.

NOTE.—Heights in last 5 columns are referred to a plane 5 feet below the Sandy Hook sea-level datum. For reference to above table see 6.

TABLE 36.—*Extreme high water, Yonkers (Recreation Pier), N.Y.*

[Referred to a plane 5 feet below Sandy Hook sea-level datum]

Year	Jan-	Febr-	March	April	May	June	July	Au-	Sep-	Octo-	Nov-	De-	Highest
	uary	uary						gust	tem-	ber	em-	cem-	
1909													
	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Date
1910	8.5	6.1	8.8	8.8	8.8	8.3	8.0	7.8	8.1	7.8	8.5	9.1	Dec. 26
1911	7.7	7.8	7.5	7.9	8.5	8.1	7.8	7.5	8.1	8.4	8.7	7.9	Mar. 12
1912	7.7	7.7	7.9	8.7	8.3	7.9	8.0	7.9	7.7	8.4	8.8	8.1	May 1
1913	8.4	7.7	8.2	7.8	7.9	7.7	7.9	8.1	7.6	8.4	8.5	9.0	Nov. 24
1914	9.1	7.9	7.9	8.7	8.9	7.8	7.7	7.7	8.0	8.1	8.3	9.5	Dec. 7
1915	8.6	8.8	8.4	8.6	8.3	8.4	8.3	8.4	7.8	9.2	8.9	8.5	Sept. 8
1916	8.3	8.3	7.4	8.5	8.0	8.7	7.9	8.0	8.0	8.5	9.0	9.9	Dec. 9
1917	8.1	7.1	8.5	8.7	8.0	8.1	8.1	7.8	8.3	9.6	8.1	8.6	Oct. 24
1918	7.0	7.9	10.1	8.3	8.1	8.0	8.0	8.0	8.1	7.3	8.4	10.1	Apr. 11
1919	8.2	8.0	8.4	8.3	8.7	8.7	8.1	8.6	8.7	8.4	7.5	9.1	Dec. 7
1920			9.0	8.8	8.2	9.3	8.0					9.3	June 19
1921					9.0	8.0	8.5	8.0	8.4	8.3	9.7	8.3	Sept. 29
1922	8.6	8.4	8.8	9.6	8.6	8.5	8.5	8.1	8.7	8.2	8.5	9.2	Apr. 11
1923	8.9		8.1	8.9	8.9	8.4	8.0	8.0	8.2	8.5	8.5	9.7	Dec. 6
1924	8.5	8.8	9.7	9.4	9.0	8.5	8.4	8.3	8.2	8.4	8.3	7.8	Mar. 11
1925	8.1	8.6	8.1	8.2	8.2	8.5	8.4	8.5	8.3	8.5	9.1	9.2	Dec. 3
1926	8.0	7.2	8.1	8.5	8.7	8.4	8.1	8.7	8.4	8.6	9.3	8.1	Nov. 19
1927	7.3	10.5	8.5	9.2	8.5	7.7	7.9	8.4	8.6	8.9	8.7	9.5	Feb. 20
1928	8.0	8.2	8.7	8.8	8.9	8.6	8.2	8.6	9.1	8.5	8.0	7.7	Sept. 19
1929	8.6	7.6	8.1	9.3	8.2	8.4	8.1	7.9	9.1	9.3	8.9	8.3	Apr. 11
1930	8.7	8.1	7.8	8.3	8.3	8.2	8.0	8.7	7.9	8.0	8.2	7.7	Jan. 15

¹ Also Apr. 11 and May 8, 1910.² Also Oct. 2, 1929.³ Also Aug. 22, 1930.

NOTE.—For reference to above table, see p. 5.

TABLE 37.—*Extreme low water, Yonkers (Recreation Pier), N.Y.*

[Referred to a plane 5 feet below Sandy Hook sea-level datum]

Year	Janu-	Febr-	March	April	May	June	July	Au-	Sep-	Octo-	Nov-	De-	Lowest	
	ary	uary	ary	ary	ay	une	ly	gust	tem-	ber	em-	cember	Feet	Date
1909														
1910	3.1	2.1	2.7	2.7	2.9	2.9	3.0	3.1	3.1	2.3	2.0	1.7	2.4	Nov. 18 Dec. 16
1911	2.1	2.5	2.2	2.4	2.9	3.1	2.7	3.0	3.1	2.9	1.7	1.1	2.6	Dec. 28
1912	2.1		2.3	2.7	2.5	2.7	2.7	2.7	2.7	2.7	2.1	1.6	1.6	Dec. 28
1913	1.3	1.6	1.4	1.8	2.8	2.6	2.9	3.1	2.9	3.1	2.4	2.6	1.3	Jan. 5
1914	3.9	1.3	2.6	2.7	2.9	2.7	3.2	3.2	3.0	3.2	2.4	2.0	1.3	Feb. 9
1915	3.0	2.1	2.3	2.6	2.1	2.9	3.3	3.4	2.2	3.3	2.6	1.2	1.2	Dec. 26
1916	2.7	2.1	0.3	2.8	2.9	3.4	2.8	3.0	3.0	2.6	2.2	1.3	0.3	Mar. 1
1917	1.8	3.1	1.9	2.2	2.0	3.0	3.1	3.0	3.0	2.8	2.2	2.3	1.8	Jan. 23
1918		1.1	1.1	3.0	2.7	3.1	3.2	3.0	1.7	3.7		3.4	1.1	Feb. 27
1919	2.5	1.8	2.5	3.1	3.1	3.4	3.2	3.3	3.2	3.8	2.1	2.3	1.8	Feb. 2
1920		2.4	3.1	2.6	3.3	3.3	2.8						2.4	Mar. 18
1921			3.0	3.1	3.3	2.8	2.9				2.6	1.9	1.9	Dec. 19
1922	1.6	1.9	2.3	2.9	2.6	3.1	3.2	3.0	3.2	2.3	2.7	1.9	1.6	Jan. 22
1923	2.2		2.4	2.5	3.0	2.8	3.1	3.1	2.9	2.8	3.0	2.7	2.2	Jan. 13
1924	1.3	2.8	2.5	1.9	2.9	3.1	3.0	3.4	3.0	3.1	1.8	1.7	1.3	Jan. 6
1925	2.4	1.1	2.5	2.6	2.4	3.0	3.1	3.0	2.9	1.0	1.5	1.9	1.0	Oct. 10
1926	1.8	2.1	2.0	2.5	2.9	3.0	3.0	3.3	2.9	2.9	2.3	1.6	1.6	Dec. 17
1927	1.2	2.2	2.5	3.0	2.5	2.9	3.1	3.0	3.0	2.9	2.1	0.9	0.9	Dec. 18
1928		1.4	1.7	2.0	2.9	2.8	2.9	3.1	2.3	2.3	2.1	1.2	1.2	Dec. 30
1929	0.3	1.6	1.7	2.1	2.3	2.7	2.6	2.3	2.8	2.5	2.1	1.4	0.3	Jan. 24
1930	2.1	1.7	1.4	1.6	2.3	2.4	3.0	2.9	2.6	2.4	1.0	2.1	1.0	Nov. 7

¹ Also Mar. 11, 1918.

NOTE.—For reference to above table see p. 5.

TABLE 38.—*High-water lunitald interval, Verplanck, N.Y.*

Year	Janu-	Febr-	March	April	May	June	July	Au-	Sep-	Octo-	Nov-	De-	
	ary	uary	ary	ary	ay	une	ly	gust	tem-	ber	em-	cember	Hours
1919						10.60		10.55	10.58	10.61	10.67	10.88	
1920						10.60		10.52	10.62		10.58	10.71	
1927				10.49	10.47	10.50	10.45	10.51	10.71		10.24		
1928				10.28	10.44	10.42	10.54	10.51	10.35		10.22	10.39	10.35
1929	10.86	10.88	10.60	10.50	10.52	10.58	10.65	10.49	10.41		10.49		
1930			10.72	10.72	10.61	10.48	10.40	10.39	10.32		10.45	10.52	10.64
Mean	10.86	10.88	10.66	10.50	10.53	10.52	10.52	10.52	10.48		10.44	10.62	10.50

NOTE.—For reference to above table see p. 5.

TABLE 39.—*Low-water lunitald interval, Verplanck, N.Y.*

Year	Janu-	Febr-	March	April	May	June	July	Au-	Sep-	Octo-	Nov-	De-	
	ary	uary	ary	ary	ay	une	ly	gust	tem-	ber	em-	cember	Hours
1919						4.92		5.00	5.01	5.06	5.09	5.04	
1920						5.02		5.03	5.08		5.05	5.05	
1927				4.85	4.93	4.91	4.81	4.85	5.13		4.96		
1928				4.61	4.80	4.88	4.87	4.85	4.82		4.76	4.84	4.85
1929	5.19	4.03	4.92	4.76	4.80	4.87	4.98	4.86	4.89		4.93		
1930			5.06	5.05	5.01	4.91	4.92	4.90	4.75		4.79	4.91	5.03
Mean	5.19	4.03	4.99	4.82	4.89	4.92	4.94	4.94	4.93		4.93	4.96	4.94

NOTE.—For reference to above table see p. 5.

TABLE 40.—*High water, Verplank, N.Y.*

[Referred to a plane 5 feet below Sandy Hook sea-level datum]

Year	Janu-	Febr-	March	April	May	June	July	Au-	Sep-	Octo-	Nov-	De-
	ary	uary						gust	tem-	ber	ember	cem-
	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	ber
1919					7.55		7.27	7.30	7.32	7.39	7.52	
1920						7.35	7.14	7.26		7.36	7.22	
1927				7.01	7.38	7.33	7.18	7.40	7.40	7.52		
1928				7.21	7.46	7.57	7.55	7.62	7.56	7.13	6.87	7.32
1929	6.33	6.65	7.33	7.85	7.22	7.50	7.25	7.24	7.40	7.13		
1930			6.72	7.08	7.20	7.32	7.40	7.53	7.45	7.51	6.98	7.05
Mean.....	6.33	6.65	7.03	7.29	7.36	7.41	7.30	7.39	7.43	7.34	7.15	7.19

NOTE.—For reference to above table see p. 5.

TABLE 41.—*Low water, Verplank, N.Y.*

[Referred to a plane 5 feet below Sandy Hook sea-level datum]

Year	Janu-	Febr-	March	April	May	June	July	Au-	Sep-	Octo-	Nov-	De-
	ary	uary						gust	tem-	ber	ember	cem-
	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	ber
1919					4.69		4.49	4.61	4.57	4.60	4.73	
1920						4.49	4.30	4.46		4.54	4.44	
1927				4.10	4.49	4.62	4.32	4.56	4.56	4.72		
1928				4.44	4.59	4.63	4.69	4.77	4.70	4.32	4.07	4.48
1929	3.62	4.17	4.62	4.18	4.46	4.53	4.37	4.39	4.54	4.42		
1930			4.20	4.27	4.34	4.44	4.48	4.61	4.56	4.65	4.19	4.23
Mean.....	3.62	4.17	4.41	4.50	4.51	4.54	4.44	4.57	4.59	4.54	4.36	4.36

NOTE.—For reference to above table see p. 5.

TABLE 42.—*Range of tide, Verplanck, N.Y.*

Year	Janu-	Febr-	March	April	May	June	July	Au-	Sep-	Octo-	Nov-	De-
	ary	uary						gust	tem-	ber	ember	cem-
	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	ber
1919					2.86		2.78	2.69	2.75	2.79	2.79	
1920						2.86	2.84	2.80		2.82	2.78	
1927				2.91	2.89	2.71	2.86	2.84	2.84	2.80		
1928			2.77	2.87	2.94	2.86	2.85	2.86	2.86	2.81	2.80	2.84
1929	2.71	2.48	2.71	2.67	2.76	2.97	2.88	2.85	2.86	2.71		
1930			2.52	2.81	2.86	2.88	2.92	2.92	2.89	2.86	2.79	2.82
Mean.....	2.71	2.48	2.62	2.79	2.85	2.87	2.86	2.82	2.84	2.80	2.79	2.83

NOTE.—For reference to above table see p. 5.

TABLE 43.—*Half-tide level, Verplanck, N.Y.*

[Referred to a plane 5 feet below Sandy Hook sea-level datum]

Year	Janu-	Febr-	March	April	May	June	July	Au-	Sep-	Octo-	Nov-	De-
	ary	uary						gust	tem-	ber	ember	cem-
	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	ber
1919					6.12		5.88	5.96		5.94	6.00	
1920						5.92	5.72	5.86		5.95	5.83	
1927				5.56	5.93	5.97	5.75	5.98		5.98	6.12	
1928				5.82	6.02	6.11	6.12	6.19		6.13	5.72	5.47
1929	4.97	5.41	5.97	6.52	5.84	6.01	5.81	5.82	5.97	5.78		5.90
1930			5.46	5.88	5.77	5.88	5.94	6.07	6.00	6.08	5.58	5.64
Mean.....	4.97	5.41	5.72	5.90	5.94	5.98	5.87	5.98	6.00	5.94	5.75	5.77

NOTE.—For reference to above table see p. 5.

TABLE 44.—*Tidal means, July to September, Verplanck, N.Y.*

Year	Intervals		Duration		Range		High water	Low water	Half-tide level
	High water	Low water	Rise	Fall	(A)	(B)			
1919.....	<i>Hours</i>	<i>Hours</i>	<i>Hours</i>	<i>Hours</i>	<i>Feet</i>	<i>Feet</i>	<i>Feet</i>	<i>Feet</i>	<i>Feet</i>
1919.....	10.58	5.02	5.58	6.86	2.74	2.70	7.30	4.56	5.93
1920.....	10.57	5.06	5.51	6.91	2.82	2.76	7.20	4.38	5.79
1927.....	10.56	4.96	5.60	6.82	2.85	2.85	7.33	4.48	5.90
1928.....	10.47	4.85	5.62	6.80	2.86	2.89	7.58	4.72	6.15
1929.....	10.52	4.91	5.61	6.81	2.86	2.92	7.30	4.43	5.87
1930.....	10.37	4.86	5.51	6.91	2.91	2.99	7.46	4.55	6.00
Mean (C).....	10.51	4.94	5.57	6.85	2.84	2.85	7.36	4.52	5.94
Mean (D).....					2.94	-----	7.19	4.25	5.72

Range (A) directly from observations.

Range (B) reduced for longitude of moon's node.

Mean (C) obtained directly from values above.

Mean (D) reduced by comparison with observations at the Battery.

NOTE.—Heights in last 3 columns are referred to a plane 5 feet below the Sandy Hook sea-level datum. For reference to above table see p. 6.

TABLE 45.—*High-water lunitalid interval, Rhinecliff, N.Y.*

Year	May	June	July	August	Septem-	October	Novem-
	Hours	Hours	Hours	Hours	Hours	Hours	Hours
1919.....	1.18	-----	-----	-----	1.18	1.22	1.23
1920.....	1.10	1.22	1.14	1.18	1.19	1.14	1.20
1927.....	-----	1.26	1.08	1.12	1.09	1.09	0.94
1928.....	-----	0.99	0.97	0.96	1.01	0.96	1.16
1929.....	-----	1.08	1.13	1.06	1.02	1.08	1.01
1930.....	1.01	0.99	1.05	1.01	1.00	1.09	1.24
Mean.....	1.10	1.11	1.07	1.07	1.08	1.10	1.13

NOTE.—For reference to above table, see p. 5.

TABLE 46.—*Low-water lunitalid interval, Rhinecliff, N.Y.*

Year	May	June	July	August	Septem-	October	Novem-
	Hours	Hours	Hours	Hours	Hours	Hours	Hours
1919.....	7.93	-----	-----	-----	7.85	7.87	7.91
1920.....	7.82	7.87	7.86	7.84	7.86	7.85	7.87
1927.....	-----	7.86	7.66	7.76	7.70	7.78	7.81
1928.....	-----	7.77	7.74	7.72	7.72	7.68	7.76
1929.....	-----	7.71	7.62	7.71	7.68	7.73	7.62
1930.....	7.65	7.70	7.68	7.68	7.69	7.68	7.81
Mean.....	7.80	7.78	7.71	7.74	7.75	7.76	7.80

NOTE.—For reference to above table, see p. 5.

TABLE 47.—*High water, Rhinecliff, N.Y.*
 [Referred to a plane 5 feet below Sandy Hook sea-level datum]

Year	May	June	July	August	Septem- ber	October	Novem- ber
	<i>Feet</i>	<i>Feet</i>	<i>Feet</i>	<i>Feet</i>	<i>Feet</i>	<i>Feet</i>	<i>Feet</i>
1919	7.93				7.89	7.95	7.86
1920	7.76	7.74	7.62	7.77	7.71	7.86	7.70
1927		7.74	7.65	7.78	7.72	7.94	7.95
1928			7.94	7.91	8.01	7.91	7.55
1929			7.90	7.70	7.69	7.79	7.52
1930		7.37	7.50	7.58	7.70	7.63	7.16
Mean	7.69	7.76	7.69	7.79	7.77	7.74	7.58

NOTE.—For reference to above table, see p. 5.

TABLE 48.—*Low water, Rhinecliff, N.Y.*
 [Referred to a plane 5 feet below Sandy Hook sea-level datum]

Year	May	June	July	August	Septem- ber	October	Novem- ber
	<i>Feet</i>	<i>Feet</i>	<i>Feet</i>	<i>Feet</i>	<i>Feet</i>	<i>Feet</i>	<i>Feet</i>
1919	4.64				4.38	4.47	4.52
1920	4.34	4.22	4.01	4.20	4.16	4.34	4.27
1927		4.06	4.06	4.26	4.28	4.47	4.71
1928		4.43	4.48	4.48	4.35	4.00	3.78
1929		4.36	4.03	4.08	4.21	4.12	4.17
1930		3.91	4.35	3.99	4.17	4.13	3.79
Mean	4.30	4.28	4.11	4.24	4.25	4.27	4.21

NOTE.—For reference to above table, see p. 5.

TABLE 49.—*Range of tide, Rhinecliff, N.Y.*

Year	May	June	July	August	Septem- ber	October	Novem- ber
	<i>Feet</i>	<i>Feet</i>	<i>Feet</i>	<i>Feet</i>	<i>Feet</i>	<i>Feet</i>	<i>Feet</i>
1919	3.29				3.51	3.48	3.34
1920	3.42	3.52	3.61	3.57	3.55	3.52	3.43
1927		3.68	3.59	3.52	3.44	3.47	3.24
1928		3.51	3.43	3.53	3.56	3.55	3.50
1929		3.54	3.67	3.61	3.58	3.40	3.37
1930		3.46	3.15	3.59	3.53	3.50	3.37
Mean	3.39	3.48	3.58	3.55	3.52	3.47	3.37

NOTE.—For reference to above table see p. 5.

TABLE 50.—*Half-tide level, Rhinecliff, N.Y.*
 [Referred to a plane 5 feet below Sandy Hook sea-level datum]

Year	May	June	July	August	Septem- ber	October	Novem- ber
	<i>Feet</i>	<i>Feet</i>	<i>Feet</i>	<i>Feet</i>	<i>Feet</i>	<i>Feet</i>	<i>Feet</i>
1919	6.28				6.14	6.21	6.19
1920	6.05	5.98	5.82	5.98	5.94	6.10	5.98
1927		5.90	5.85	6.02	6.00	6.20	6.33
1928		6.19	6.20	6.24	6.13	5.78	5.53
1929		6.13	5.87	5.89	6.00	5.82	5.86
1930		5.64	5.92	5.78	5.94	5.88	5.48
Mean	5.99	6.02	5.90	6.01	6.02	6.01	5.90

NOTE.—For reference to above table see p. 5.

TABLE 51.—*Tidal means, July to September, Rhinecliff, N.Y.*

Year	Intervals		Duration		Range		High water	Low water	Half-tide level
	High water	Low water	Rise	Fall	(A)	(B)			
	<i>Hours</i>	<i>Hours</i>	<i>Hours</i>	<i>Hours</i>	<i>Feet</i>	<i>Feet</i>	<i>Feet</i>	<i>Feet</i>	<i>Feet</i>
1920	1.17	7.85	5.74	6.68	3.58	3.50	7.70	4.12	5.91
1927	1.10	7.71	5.81	6.61	3.52	3.52	7.72	4.20	5.96
1928	0.98	7.73	5.67	6.75	3.50	3.54	7.94	4.44	6.19
1929	1.07	7.67	5.82	6.60	3.62	3.69	7.73	4.11	5.92
1930	1.02	7.68	5.76	6.66	3.54	3.63	7.64	4.10	5.87
Mean (C)	1.07	7.73	5.76	6.66	3.55	3.58	7.75	4.19	5.97
Mean (D)					3.62		7.54	3.92	5.73

Range (A) directly from observations.

Range (B) reduced for longitude of moon's node.

Mean (C) obtained directly from values above.

Mean (D) reduced by comparison with observations at the Battery.

NOTE.—Heights in last 3 columns are referred to a plane 5 feet below the Sandy Hook sea-level datum. For reference to above table see p. 6.

TABLE 52.—*High-water lunitalid interval, Hudson, N.Y.*

Year	May	June	July	August	Sept-	Octo-	Novem-	De-	
	Hours	Hours	Hours	Hours	Hours	Hours	Hours	<i>Hours</i>	<i>December</i>
1919					2.71	2.72	2.74	2.71	
1920	2.64	2.70	2.68	2.71	2.70	2.70	2.74	2.74	2.61
1921		2.63	2.61	2.64	2.66	2.71		2.78	
1927		2.55	2.52	2.47	2.54	2.54	2.52		
1928		2.50	2.41	2.38	2.46	2.48		2.53	
1929		2.44	2.41	2.58	2.58	2.53			
1930	2.65	2.65	2.70	2.71	2.65	2.84	3.02		
Mean	2.64	2.58	2.58	2.60	2.61	2.67	2.72	2.61	

NOTE.—For reference to above table see p. 5.

TABLE 53.—*Low-water lunitalid interval, Hudson, N.Y.*

Year	May	June	July	August	Sept-	Octo-	Novem-	De-	
	Hours	Hours	Hours	Hours	Hours	Hours	Hours	<i>Hours</i>	<i>December</i>
1919					9.35	9.40	9.51	9.62	
1920	9.55	9.46	9.38	9.38	9.37	9.50	9.59	9.72	
1921		9.28	9.29	9.27	9.30	9.27	9.51		
1927		9.37	9.21	9.24	9.30	9.38	9.56		
1928		9.38	9.32	9.18	9.26	9.17	9.21		
1929		9.25	9.27	9.14	9.14				
1930	9.38	9.36	9.33	9.29	9.30	9.31	9.38		
Mean	9.46	9.35	9.30	9.26	9.30	9.36	9.48	9.72	

NOTE.—For reference to above table see p. 5.

TABLE 54.—*High water, Hudson N.Y.*

[Referred to a plane 5 feet below Sandy Hook sea-level datum]

Year	May	June	July	August	September	October	November	December
	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet
1919								
1920	8.31	8.21	8.03	8.35	8.28	8.32	8.49	
1921		8.07	8.33	8.13	8.24	7.97	8.23	
1927		7.92	7.90	8.04	8.00	8.21	8.56	
1928		8.25	8.26	8.25	8.14	7.78	7.52	
1929		8.08	7.84	7.79	7.87			
1930	7.53	7.70	7.69	7.78	7.71	7.69	7.29	
Mean	7.92	8.04	8.01	8.07	8.04	8.05	8.04	8.44

NOTE.—For reference to above table see p. 5.

TABLE 55.—*Low water, Hudson, N.Y.*

[Referred to a plane 5 feet below Sandy Hook sea-level datum]

Year	May	June	July	August	September	October	November	December
	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet
1919								
1920	4.33	4.17	3.91	4.26	4.30	4.39	4.58	
1921		3.87	4.25	3.97	4.19	3.92	4.34	
1927		3.94	3.80	4.01	4.07	4.34	4.84	
1928		4.32	4.30	4.28	4.09	3.70	3.45	
1929		3.99	3.70	3.68	3.83			
1930	3.59	3.79	3.70	3.84	3.83	3.93	3.50	
Mean	3.96	4.01	3.94	4.02	4.05	4.10	4.16	4.80

NOTE.—For reference to above table see p. 5.

TABLE 56.—*Range of tide, Hudson, N.Y.*

Year	May	June	July	August	September	October	November	December
	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet
1919								
1920	3.98	4.04	4.12	4.09	3.98	3.93	3.91	
1921		4.20	4.08	4.16	4.05	4.05	3.88	
1927		3.98	4.10	4.03	3.93	3.87	3.72	
1928		3.93	3.96	3.97	4.05	4.08	4.07	
1929		4.09	4.14	4.11	4.04			
1930	3.94	3.91	3.99	3.94	3.88	3.76	3.79	
Mean	3.96	4.03	4.07	4.05	3.99	3.95	3.88	3.64

NOTE.—For reference to above table see p. 5.

TABLE 57.—*Half-tide level, Hudson, N.Y.*

[Referred to a plane 5 feet below Sandy Hook sea-level datum]

Year	May	June	July	August	September	October	November	December
	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet
1919								
1920	6.32	6.19	5.97	6.30	6.29	6.36	6.54	
1921		5.97	6.29	6.05	6.22	5.95	6.28	
1927		5.93	5.85	6.02	6.04	6.28	6.70	
1928		6.29	6.28	6.27	6.12	5.74	5.49	
1929		6.03	5.77	5.74	5.85			
1930	5.56	5.74	5.70	5.81	5.77	5.81	5.40	
Mean	5.94	6.02	5.98	6.04	6.05	6.08	6.10	6.62

NOTE.—For reference to above table see p. 5.

TABLE 58.—*Tidal means, July to September, Hudson, N.Y.*

Year	Intervals		Duration		Range		High water		Low water		Half-tide level
	High water	Low water	Rise	Fall	(A)	(B)	(A)	(B)	(A)	(B)	
1920.....	Hours 2.70	Hours 9.38	Hours 5.74	Hours 6.68	Feet 4.06	Feet 3.97	Feet 8.07	Feet 8.03	Feet 4.01	Feet 4.06	Feet 6.04
1921.....	2.64	9.29	5.77	6.65	4.10	3.99	8.23	8.19	4.14	4.20	6.19
1927.....	2.51	9.25	5.68	6.74	4.02	4.02	7.98	7.98	3.96	3.96	5.97
1928.....	2.42	9.25	5.58	6.83	3.99	4.03	8.22	8.23	4.22	4.20	6.22
1929.....	2.56	9.18	5.80	6.62	4.10	4.18	7.83	7.88	3.74	3.70	5.79
1930.....	2.69	9.31	5.80	6.62	3.94	4.04	7.73	7.78	3.79	3.74	5.76
Mean.....	2.59	9.28	5.73	6.69	4.03	4.04	8.01	8.02	3.98	3.98	6.00

Columns (A) contain direct means from observations.

Columns (B) contain values which have been reduced for longitude of moon's node.

NOTE.—Heights in last 5 columns are referred to a plane 5 feet below the Sandy Hook sea-level datum. For reference to above table, see p. 5.

TABLE 59.—*High-water lunitalid interval, Four Mile Point, N.Y.*

Year	May	June	July	August	Septem-	October	Novem-
	Hours 2.98	Hours	Hours	Hours	Hours	Hours	Hours
1919.....	2.98	3.10	2.98	3.01	3.06	3.09	3.06
1921.....	—	2.78	2.93	2.85	3.08	3.09	3.10
1927.....	—	2.91	—	2.90	2.88	2.88	2.75
1928.....	—	3.03	3.06	3.03	3.09	3.04	3.02
1929.....	—	3.29	3.29	3.29	3.28	3.39	2.54
1930.....	—	—	—	—	—	—	3.36
Mean.....	2.98	3.02	3.09	3.03	3.06	3.08	2.97

NOTE.—For reference to above table, see p. 5.

TABLE 60.—*Low-water lunitalid interval, Four Mile Point, N.Y.*

Year	May	June	July	August	Septem-	October	Novem-
	Hours 10.08	Hours	Hours	Hours	Hours	Hours	Hours
1919.....	10.08	9.88	9.77	9.79	9.95	10.02	—
1921.....	—	9.64	9.64	9.64	9.69	9.68	9.90
1927.....	—	9.59	9.51	9.56	9.53	9.56	9.88
1928.....	—	9.53	—	9.64	—	9.61	9.59
1929.....	—	9.77	9.64	9.65	9.72	9.64	9.51
1930.....	—	9.78	9.67	9.67	9.63	9.70	9.76
Mean.....	10.08	9.72	9.67	9.66	9.67	9.69	9.70

NOTE.—For reference to above table, see p. 5.

TABLE 61.—*High water, Four Mile Point, N.Y.*

[Referred to a plane 5 feet below Sandy Hook sea-level datum]

Year	May	June	July	August	Septem-	October	Novem-
	Feet 8.68	Feet	Feet	Feet	Feet	Feet	Feet
1919.....	8.68	7.88	8.09	8.11	8.06	8.12	8.37
1921.....	—	7.73	8.14	7.91	8.01	7.74	8.08
1927.....	—	8.37	7.80	7.89	7.84	7.94	8.59
1928.....	—	8.08	7.95	7.89	7.99	7.85	7.59
1929.....	—	7.89	7.96	8.06	8.02	7.76	7.87
1930.....	—	—	—	—	—	7.98	7.58
Mean.....	8.68	7.99	7.99	8.02	7.98	7.90	8.01

NOTE.—For reference to above table see p. 5.

TABLE 62.—*Low water, Four Mile Point, N.Y.*

[Referred to a plane 5 feet below Sandy Hook sea-level datum]

Year	May	June	July	August	September	October	November
	Feet	Feet	Feet	Feet	Feet	Feet	<i>Feet</i>
1919.....	4.82		4.21	4.23	4.28	4.38	4.58
1921.....		4.08	4.27	3.96	4.17	3.89	4.36
1927.....		4.13	3.96	4.16	4.13	4.43	5.07
1928.....		4.62		4.62		4.02	3.76
1929.....		4.42	4.08	4.05	4.19	4.02	4.16
1930.....		4.29	4.07	4.20	4.19	4.25	3.84
Mean.....	4.82	4.31	4.12	4.20	4.19	4.17	4.29

NOTE.—For reference to above table see p. 5.

TABLE 63.—*Range of tide, Four Mile Point, N.Y.*

Year	May	June	July	August	September	October	November
	Feet	Feet	Feet	Feet	Feet	Feet	<i>Feet</i>
1919.....	3.86		3.88	3.88	3.78	3.74	3.79
1921.....		3.80	3.87	3.95	3.84	3.85	3.72
1927.....		3.60	3.84	3.73	3.71	3.51	3.52
1928.....		3.75		3.67		3.83	3.83
1929.....		3.66	3.87	3.84	3.80	3.74	3.71
1930.....		3.60	3.89	3.86	3.83	3.73	3.74
Mean.....	3.86	3.68	3.87	3.82	3.79	3.73	3.72

NOTE.—For reference to above table, see p. 5.

TABLE 64.—*Half tide level, Four Mile Point, N.Y.*

[Referred to a plane 5 feet below Sandy Hook sea-level datum]

Year	May	June	July	August	September	October	November
	Feet	Feet	Feet	Feet	Feet	Feet	<i>Feet</i>
1919.....	6.75		6.15	6.17	6.17	6.25	6.48
1921.....		5.98	6.20	5.93	6.09	5.82	6.22
1927.....		5.93	5.88	6.02	5.99	6.19	6.83
1928.....		6.49		6.46		5.93	5.67
1929.....		6.25	6.02	5.97	6.09	5.89	6.02
1930.....		6.09	6.01	6.13	6.11	6.11	5.71
Mean.....	6.75	6.15	6.05	6.11	6.09	6.03	6.15

NOTE.—For reference to above table, see p. 5.

TABLE 65.—*Tidal means, July to September, Four Mile Point, N.Y.*

Year	Intervals		Duration		Range		High water		Low water		Half-tide level
	High Water	Low Water	Rise	Fall	(A)	(B)	(A)	(B)	(A)	(B)	
	<i>Hours</i>	<i>Hours</i>	<i>Hours</i>	<i>Hours</i>	Feet	Feet	Feet	Feet	Feet	Feet	<i>Feet</i>
1919.....	3.12	9.81	5.73	6.69	3.85	3.79	8.09	8.05	4.24	4.26	6.16
1921.....	3.02	9.66	5.78	6.64	3.89	3.78	8.02	7.96	4.13	4.18	6.07
1927.....	2.86	9.53	5.75	6.67	3.76	3.76	7.84	7.84	4.08	4.08	5.96
1928.....	2.00	9.64	5.68	6.74	3.67	3.71	8.29	8.31	4.62	4.60	6.46
1929.....	3.06	9.67	5.81	6.61	3.84	3.92	7.94	7.99	4.11	4.07	6.03
1930.....	3.29	9.66	6.05	6.37	3.86	3.96	8.01	8.06	4.15	4.10	6.08
Mean.....	3.04	9.66	5.80	6.62	3.81	3.82	8.03	8.04	4.22	4.22	6.13

Columns (A) contain direct means from observations.

Columns (B) contain values which have been reduced for longitude of moon's node.

NOTE.—Heights in last 5 columns are referred to a plane 5 feet below the Sandy Hook sea-level datum.
For reference to above table, see p. 5.

TABLE 66.—*High-water lunital interval, Stonehouse Bar, N.Y.*

Year	May	June	July	August	Septem- ber	October	Novem- ber
	Hours	Hours	Hours	Hours	Hours	Hours	Hours
1918	3.68	4.19	4.15	4.22	4.17	4.09	3.99
1919		4.14	4.19	4.12	4.20	4.26	3.94
1927					4.06	4.00	3.79
1928				3.93	4.11	4.05	4.02
1929		4.18		4.15	4.14	4.07	4.02
1930	3.78	3.90	4.05	4.04	3.99	4.08	
Mean	3.73	4.10	4.13	4.09	4.11	4.09	3.95

NOTE.—For reference to above table see p. 5.

TABLE 67.—*Low-water lunital interval, Stonehouse Bar, N.Y.*

Year	May	June	July	August	Septem- ber	October	Novem- ber
	Hours	Hours	Hours	Hours	Hours	Hours	Hours
1918					10.85	10.82	11.08
1919	11.25	10.97	10.86	10.89	10.98	11.04	11.25
1927		10.94	10.89	10.82	10.86	10.98	11.09
1928				10.77	10.69	10.62	10.65
1929		11.00		10.82	10.84	10.83	10.76
1930	10.63	10.95	10.69	10.64	10.53	10.71	
Mean	10.94	10.96	10.81	10.79	10.79	10.83	10.97

NOTE.—For reference to above table see p. 5.

TABLE 68.—*High water, Stonehouse Bar, N.Y.*

[Referred to a plane 5 feet below Sandy Hook sea-level datum]

Year	May	June	July	August	Septem- ber	October	Novem- ber
	Feet	Feet	Feet	Feet	Feet	Feet	Feet
1918					8.15	8.14	8.26
1919	9.09	7.32	8.22	8.25	8.29	8.42	8.78
1927		8.13	7.95	8.05	8.16	8.51	9.25
1928				8.48	8.24	7.85	7.64
1929		8.44		8.02	8.17	8.04	8.24
1930	8.12	8.27	8.14	8.20	8.22	8.12	
Mean	8.60	8.04	8.10	8.20	8.20	8.18	8.43

NOTE.—For reference to above table see p. 5.

TABLE 69.—*Low water, Stonehouse Bar, N.Y.*

[Referred to a plane 5 feet below Sandy Hook sea-level datum]

Year	May	June	July	August	Septem- ber	October	Novem- ber
	Feet	Feet	Feet	Feet	Feet	Feet	Feet
1918					4.98	4.91	5.06
1919	5.89	4.98	4.96	4.97	5.08	5.30	5.62
1927		4.84	4.69	4.83	4.95	5.35	6.42
1928				5.23	5.01	4.02	4.41
1929		5.08		4.79	4.81	4.58	4.63
1930	4.34	4.45	4.26	4.28	4.29	4.26	
Mean	5.11	4.84	4.64	4.80	4.85	4.84	5.23

NOTE.—For reference to above table see p. 5.

TABLE 70.—*Range of tide, Stonehouse Bar, N.Y.*

Year	May	June	July	August	Septem- ber	October	Novem- ber
	Feet	Feet	Feet	Feet	Feet	Feet	Feet
1918.....	3.20	2.34	3.26	3.28	3.17	3.23	3.20
1919.....		3.29	3.26	3.22	3.21	3.12	3.16
1927.....					3.21	3.16	2.83
1928.....				3.25	3.23	3.24	3.23
1929.....		3.36		3.33	3.36	3.47	3.61
1930.....	3.78	3.82	3.88	3.92	3.93	3.86	
Mean.....	3.49	3.20	3.47	3.40	3.35	3.34	3.21

NOTE.—For reference to above table see p. 5.

TABLE 71.—*Half-tide level, Stonehouse Bar, N.Y.*

[Referred to a plane of 5 feet below Sandy Hook sea-level datum]

Year	May	June	July	August	Septem- ber	October	Novem- ber
	Feet	Feet	Feet	Feet	Feet	Feet	Feet
1918.....					6.59	6.52	6.66
1919.....	7.49	6.15	6.59	6.61	6.68	6.86	7.20
1927.....		6.48	6.32	6.44	6.55	6.93	7.84
1928.....				6.86	6.63	6.23	6.03
1929.....		6.76		6.36	6.49	6.31	6.43
1930.....	6.23	6.36	6.20	6.24	6.26	6.19	
Mean.....	6.86	6.44	6.37	6.50	6.53	6.61	6.83

NOTE.—For reference to above table see p. 5.

TABLE 72.—*Tidal means, July to September, Stonehouse Bar, N.Y.*

Year	Intervals		Duration		Range		High water		Low water		Half- tide level
	High water	Low water	Rise	Fall	(A)	(B)	(A)	(B)	(A)	(B)	
1919.....	Hours	Hours	Hours	Hours	Feet	Feet	Feet	Feet	Feet	Feet	Feet
1927.....	4.19	10.91	5.70	6.72	3.25	3.20	8.25	8.23	5.00	5.03	6.63
1928.....	4.12	10.86	5.68	6.74	3.23	3.23	8.05	8.05	4.82	4.82	6.44
1929.....	4.02	10.73	5.71	6.71	3.24	3.28	8.36	8.38	5.12	5.10	6.74
1930.....	4.14	10.83	5.73	6.69	3.34	3.41	8.09	8.13	4.75	4.72	6.42
Mean.....	4.03	10.62	5.83	6.59	3.91	4.01	8.19	8.23	4.28	4.22	6.23

Columns (A) contain direct means from observations.

Columns (B) contain values which have been reduced for longitude of moon's node.

NOTE.—Heights in last 5 columns are referred to a plane 5 feet below the Sandy Hook sea-level datum.
For reference to above table see p. 5.

TABLE 73.—*High-water lunitald interval, Barren Island, N.Y.*

Year	May	June	July	August	Septem- ber	October	Novem- ber
	Hours	Hours	Hours	Hours	Hours	Hours	Hours
1918.....							4.23
1919.....	3.92	4.46	4.46	4.48	4.42	4.39	4.11
1920.....	4.14	4.43		4.51	4.47	4.36	4.30
1921.....		4.44	4.32	4.36	4.49	4.42	4.30
1927.....		4.35	4.43	4.26	4.28	4.20	
1928.....				4.20	4.30	4.32	4.29
1929.....		4.30	4.39	4.41	4.29	4.25	4.22
1930.....	3.88	4.05		3.99	4.15	4.29	4.31
Mean.....	3.98	4.34	4.40	4.32	4.34	4.32	4.25

NOTE.—For reference to above table see p. 5.

TABLE 74.—*Low-water lunital interval, Barren Island, N.Y.*

Year	May	June	July	August	Septem- ber	October	Novem- ber
	Hours	Hours	Hours	Hours	Hours	Hours	Hours
1918							
1919	11.59	11.29	11.21	11.21	11.27	11.40	11.56
1920	11.48	11.31	11.12	11.22	11.23	11.32	11.48
1921			11.12	11.07	11.12	11.15	11.43
1927		11.21	11.20	11.13	11.23	11.37	
1928				11.22	11.21	11.13	11.18
1929		11.32	11.21	11.02	11.04	11.10	11.43
1930	10.81	11.06		10.65	10.80	10.90	10.93
Mean	11.29	11.22	11.18	11.07	11.13	11.20	11.34

NOTE.—For reference to above table see p. 5.

TABLE 75.—*High water, Barren Island, N.Y.*
[Referred to a plane 5 feet below Sandy Hook sea-level datum]

Year	May	June	July	August	Septem- ber	October	Novem- ber
	Feet	Feet	Feet	Feet	Feet	Feet	Feet
1918							
1919	9.29	8.51	8.38	8.38	8.47	8.55	8.36
1920	8.69	8.35		8.24	8.13	8.51	8.48
1921		7.93	8.45	8.02	8.15	7.84	8.42
1927		8.30	8.02	8.15	8.19	8.54	
1928				8.58	8.31	7.93	7.70
1929		8.48	8.32	7.95	8.20	8.07	8.20
1930	8.24	8.37		8.52	8.45	8.40	8.03
Mean	8.74	8.32	8.29	8.26	8.27	8.26	8.30

NOTE.—For reference to above table see p. 5.

TABLE 76.—*Low water, Barren Island, N.Y.*
[Referred to a plane 5 feet below Sandy Hook sea-level datum]

Year	May	June	July	August	Septem- ber	October	Novem- ber
	Feet	Feet	Feet	Feet	Feet	Feet	Feet
1918							
1919	6.56	5.28	5.21	5.24	5.43	5.49	6.07
1920	5.66	5.16		5.12	5.03	5.42	5.56
1921		4.79	5.28	4.82	5.03	4.76	5.53
1927		5.12	4.87	4.99	5.09	5.62	
1928				5.41	5.16	4.79	4.62
1929		5.19	4.93	4.61	4.81	4.54	4.57
1930	4.37	4.57		4.51	4.47	4.39	4.02
Mean	5.53	5.02	5.07	4.96	5.00	5.00	5.11

NOTE.—For reference to above table see p. 5.

TABLE 77.—*Range of tide, Barren Island, N.Y.*

Year	May	June	July	August	Septem- ber	October	Novem- ber
	Feet	Feet	Feet	Feet	Feet	Feet	Feet
1918							
1919	2.73	3.23	3.17	3.14	3.04	3.06	2.85
1920	3.03	3.19		3.12	3.10	3.09	2.92
1921		3.14	3.17	3.20	3.12	3.08	2.89
1927		3.18	3.15	3.16	3.10	2.92	
1928				3.17	3.15	3.13	3.08
1929		3.28	3.39	3.34	3.38	3.53	3.63
1930	3.87	3.80		4.01	3.98	4.01	4.01
Mean	3.21	3.30	3.22	3.31	3.27	3.26	3.19

NOTE.—For reference to above table see p. 5.

TABLE 78.—*Half-tide level, Barren Island, N.Y.*
 [Referred to a plane 5 feet below Sandy Hook sea-level datum]

Year	May	June	July	August	Septem-	October	Novem-
	Feet	Feet	Feet	Feet	Feet	Feet	Feet
1918							
1919	7.92	6.90	6.78	6.81	6.95	7.02	6.87
1920	7.18	6.76	6.36	6.86	6.42	6.58	7.50
1921							7.02
1927		6.71	6.44	6.57	6.64	7.08	6.98
1928				7.00	6.73	6.36	6.16
1929		6.83	6.63	6.28	6.50	6.30	6.38
1930	6.30	6.47		6.52	6.46	6.39	6.02
Mean	7.13	6.67	6.68	6.61	6.64	6.63	6.70

NOTE.—For reference to above table see p. 5.

TABLE 79.—*Tidal means, July to September, Barren Island, N.Y.*

Year	Intervals		Duration		Range		High water		Low water		Half-tide level
	High Water	Low Water	Rise	Fall	(A)	(B)	(A)	(B)	(A)	(B)	
					Hours	Hours	Hours	Hours	Feet	Feet	
1919	4.45	11.23	5.64	6.78	3.12	3.07	8.41	8.39	5.29	5.32	6.85
1920	4.49	11.22	5.69	6.73	3.11	3.04	8.18	8.15	5.07	5.11	6.63
1921	4.39	11.10	5.71	6.71	3.16	3.07	8.21	8.15	5.04	5.08	6.62
1927	4.32	11.19	5.55	6.87	3.14	3.14	8.12	8.12	4.98	4.98	6.55
1928	4.25	11.22	5.45	6.97	3.16	3.19	8.44	8.45	5.28	5.28	6.86
1929	4.36	11.09	5.69	6.73	3.37	3.44	8.16	8.19	4.78	4.75	6.47
1930	4.07	10.72	5.77	6.65	4.00	4.10	8.49	8.54	4.49	4.44	6.49
Mean	4.33	11.11	5.64	6.78	3.29	3.29	8.29	8.28	4.99	4.99	6.64

Columns (A) contain direct means from observations.

Columns (B) contain values which have been reduced for longitude of moon's node.

NOTE.—Heights in last 5 columns are referred to a plane 5 feet below the Sandy Hook sea-level datum.
 For reference to above table, see p. 5.

TABLE 80.—*High-water lunitaltidal interval, Castleton, N.Y.*

Year	May	June	July	August	Septem-	October	Novem-
	Hours	Hours	Hours	Hours	Hours	Hours	Hours
1918							
1919	4.47	4.84	4.84	4.96	4.84	4.78	4.59
1927		4.81	4.85	4.75	4.60	4.44	4.28
1928	4.15	4.45	4.44	4.42	4.61	4.64	4.66
1929	4.24	4.51	4.67	4.62	4.58	4.49	4.39
1930	4.20	4.25	4.39	4.46	4.39	4.49	4.71
Mean	4.26	4.57	4.64	4.64	4.60	4.57	4.54

NOTE.—For reference to above table, see p. 5.

TABLE 81.—*Low-water lunitaltidal interval, Castleton, N.Y.*

Year	May	June	July	August	Septem-	October	Novem-
	Hours	Hours	Hours	Hours	Hours	Hours	Hours
1918							
1919	12.35	11.93	11.77	11.80	11.87	12.02	12.11
1927		11.89	11.62	11.62	11.64	11.77	11.91
1928	11.85	12.03	11.83	11.64	11.61	11.59	11.65
1929	12.08	11.69	11.74	11.44	11.40	11.45	11.37
1930	11.27	11.26	11.18	11.21	11.10	11.17	11.41
Mean	11.89	11.76	11.63	11.54	11.52	11.60	11.78

NOTE.—For reference to above table, see p. 5.

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TABLE 82.—*High-water, Castleton, N.Y.*

[Referred to a plane 5 feet below Sandy Hook sea-level datum]

Year	May	June	July	August	Septem- ber	October	Novem- ber
	Feet	Feet	Feet	Feet	Feet	Feet	Feet
1918.....							
1919.....	9.41	8.54	8.39	8.36	8.48	8.63	9.05
1927.....		8.28	8.01	8.15	8.27	8.70	9.47
1928.....	8.89	8.94	8.86	8.73	8.45	8.05	7.85
1929.....	8.62	8.47	8.24	8.06	8.22	8.10	8.31
1930.....	8.30	8.56	8.35	8.45	8.40	8.38	7.97
Mean.....	8.81	8.56	8.37	8.35	8.36	8.37	8.52

NOTE.—For reference to above table see p. 5.

TABLE 83.—*Low water, Castleton, N.Y.*

[Referred to a plane 5 feet below Sandy Hook sea-level datum]

Year	May	June	July	August	Septem- ber	October	Novem- ber
	Feet	Feet	Feet	Feet	Feet	Feet	Feet
1918.....							
1919.....	7.18	5.36	5.28	5.24	5.47	5.68	6.59
1927.....		4.95	4.69	4.87	4.96	5.56	6.78
1928.....	6.07	5.86	5.64	5.37	5.07	4.74	4.59
1929.....	6.09	5.00	4.74	4.49	4.60	4.36	4.42
1930.....	4.46	4.42	4.10	4.12	4.18	4.11	3.75
Mean.....	5.95	5.12	4.89	4.82	4.86	4.89	5.32

NOTE.—For reference to above table see p. 5.

TABLE 84.—*Range of tide, Castleton, N.Y.*

Year	May	June	July	August	Septem- ber	October	Novem- ber
	Feet	Feet	Feet	Feet	Feet	Feet	Feet
1918.....							
1919.....	2.23	3.18	3.11	3.12	3.01	2.95	2.46
1927.....		3.33	3.32	3.28	3.31	3.14	2.69
1928.....	2.82	3.07	3.22	3.36	3.38	3.31	3.26
1929.....	2.53	3.46	3.50	3.57	3.62	3.74	3.89
1930.....	3.84	4.14	4.25	4.33	4.22	4.27	4.22
Mean.....	2.86	3.44	3.48	3.53	3.51	3.48	3.20

NOTE.—For reference to above table see p. 5.

TABLE 85.—*Half-tide level, Castleton, N.Y.*

[Referred to a plane 5 feet below Sandy Hook sea-level datum]

Year	May	June	July	August	Septem- ber	October	Novem- ber
	Feet	Feet	Feet	Feet	Feet	Feet	Feet
1918.....							
1919.....	8.30	6.95	6.84	6.80	6.98	7.16	7.82
1927.....		6.62	6.35	6.51	6.62	7.13	8.12
1928.....	7.48	7.40	7.25	7.05	6.76	6.39	6.22
1929.....	7.36	6.74	6.49	6.27	6.41	6.23	6.37
1930.....	6.38	6.49	6.22	6.28	6.29	6.24	5.86
Mean.....	7.38	6.84	6.63	6.58	6.61	6.63	6.92

NOTE.—For reference to above table see p. 5.

TABLE 86.—*Tidal means, July to September, Castleton, N.Y.*

Year	Intervals		Duration		Range		High water		Low water		Half-tide level
	High water	Low water	Rise	Fall	(A)	(B)	(A)	(B)	(A)	(B)	
1919	4.88	11.81	5.49	6.93	3.03	3.08	8.41	8.39	5.33	5.36	6.87
1927	4.73	11.63	5.52	6.90	3.30	3.30	8.14	8.14	4.84	4.84	6.49
1928	4.49	11.69	5.22	7.20	3.32	3.36	8.68	8.70	5.36	5.34	7.02
1929	4.62	11.53	5.51	6.91	3.56	3.63	8.17	8.21	4.61	4.58	6.39
1930	4.41	11.16	5.67	6.75	4.27	4.38	8.40	8.45	4.13	4.07	6.26
Mean.....	4.63	11.56	5.49	6.93	3.51	3.54	8.36	8.38	4.85	4.84	6.61

Columns (A) contain direct means from observations.

Columns (B) contain values which have been reduced for longitude of moon's node.

NOTE.—Heights in last 5 columns are referred to a plane 5 feet below the Sandy Hook sea-level datum.
For reference to above table see p. 5.

TABLE 87.—*High-water lunital interval, Albany, N.Y.*

Year	Janu-	Febr-	March	April	May	June	July	Au-	Sep-	Octo-	Nov-	De-	Mean
	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Septem-	tem-	ber	ber	ber	ber
1899	—	—	—	—	5.23	5.63	5.76	5.92	5.90	5.75	5.38	5.68	5.66
1900	—	—	—	—	5.85	5.53	5.45	5.70	5.69	5.81	5.77	5.82	5.70
1901	—	—	—	—	5.94	5.48	5.52	5.73	5.56	5.62	5.60	5.77	5.65
1902	—	—	—	—	—	—	5.51	5.59	5.34	5.59	5.32	5.43	5.46
1903	—	—	—	—	5.53	5.69	5.60	5.37	5.47	5.56	5.50	5.52	5.53
1904	—	—	—	—	—	—	5.43	5.61	5.59	5.63	5.55	—	5.56
1910	6.19	7.31	6.31	4.90	5.27	5.31	5.60	5.50	5.57	5.43	5.14	5.77	5.69
1911	5.93	5.92	5.72	5.79	5.17	5.21	5.57	5.56	5.42	5.19	5.09	5.37	5.50
1914	5.84	6.13	5.95	5.50	5.28	5.57	5.49	5.55	5.49	5.57	5.57	5.79	5.64
1915	6.15	—	—	—	—	—	—	—	—	—	—	—	—
1918	—	—	6.66	6.09	5.24	5.25	5.44	5.54	5.47	5.40	5.33	5.40	5.58
1919	—	—	5.36	5.45	—	5.32	5.33	5.38	5.48	5.35	5.27	5.15	5.64
1920	5.59	5.55	—	—	5.83	5.09	5.23	5.16	5.30	5.25	5.20	5.04	5.27
1921	5.47	5.72	5.81	5.04	4.32	4.98	4.72	4.87	4.98	4.94	4.94	4.88	5.06
1922	5.23	5.29	5.41	5.31	4.51	4.80	4.70	4.78	4.86	4.88	4.94	5.07	4.98
1923	5.86	5.49	5.94	5.60	5.05	5.20	5.33	5.35	5.34	5.40	5.17	4.95	5.39
1924	5.55	5.50	5.32	5.53	5.33	5.18	5.08	5.32	5.17	5.19	5.26	5.24	5.31
1925	5.76	6.38	6.01	5.20	4.93	5.12	5.09	5.05	5.14	5.22	5.25	5.30	5.39
1926	5.64	5.58	5.87	5.57	5.07	5.06	5.16	5.25	5.34	5.23	5.17	5.63	5.38
1927	5.67	5.64	5.63	4.96	4.96	5.09	5.24	5.14	5.04	4.95	5.14	5.26	5.23
1928	—	5.90	5.62	5.16	5.19	4.92	4.83	4.78	4.89	5.01	5.05	5.04	4.90
1929	—	5.38	5.38	5.81	5.49	4.88	4.84	4.07	5.04	4.99	4.88	4.79	4.81
1930	—	4.93	4.94	4.50	4.44	4.49	4.56	4.70	4.70	4.65	4.77	4.76	4.65
Mean.....	5.67	5.72	5.70	5.43	5.09	5.21	5.28	5.31	5.33	5.28	5.22	5.27	5.38

NOTE.—For reference to above table see p. 5.

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TABLE 88.—*Low-water lunitalid interval, Albany, N.Y.*

Year	January	Febr-	March	April	May	June	July	Aug-	Sept-	Octo-	Nov-	De-	Mean
	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours
1899					0.93	0.53	0.49	0.47	0.57	0.58	0.92	1.16	0.71
1900				1.43	1.12	0.52	0.37	0.39	0.36	0.43	1.03		0.71
1901				1.27	1.22	1.08	0.59	0.63	0.62	0.67	0.82		0.86
1902					1.07	0.55	0.58	0.57	0.83	0.75			0.72
1903					1.15	0.61	0.89	0.68	0.85	0.69	1.02	0.89	
1904						0.78	0.58	0.66	0.69	1.08			0.76
1910	0.88	1.93	1.72	0.82	1.07	0.98	0.30	0.33	0.31	0.17	0.45	0.80	0.81
1911	1.30	0.68	0.46	1.06	0.39	0.52	0.11	0.35	0.35	0.65	0.77	0.65	0.61
1914	0.77	1.10	1.10	0.52	0.84	0.28	0.21	0.24	0.27	0.21	0.36	0.86	0.56
1915	1.39												
1918				1.32	1.12	0.72	0.32	0.25	0.20	0.23	0.54	0.62	0.73
1919				0.44	0.85	0.92	0.33	0.19	0.18	0.27	0.15	0.59	0.22
1920	0.45	0.42			1.01	0.57	0.22	0.15	0.18	0.00	0.20	0.3	0.40
1921	0.81	0.94	0.96	0.67	-0.16	0.35	-0.33	-0.46	-0.45	-0.30	0.01	0.24	0.13
1922	-0.10	0.42	0.41	0.69	0.10	0.16	-0.22	-0.61	-0.42	-0.31	-0.18	-0.01	-0.01
1923	0.87	0.58	1.04	0.87	0.11	0.22	-0.02	-0.04	0.02	0.04	0.25	0.25	0.35
1924	0.86	0.59	0.41	0.88	0.69	0.11	-0.52	-0.04	-0.04	0.25	0.19	0.12	0.29
1925	1.01	1.23	1.00	0.84	0.42	0.17	0.11	0.10	0.11	0.44	0.12	0.66	0.52
1926	0.75	0.72	0.73	0.83	0.39	0.12	0.00	-0.02	-0.28	0.22	0.34	0.94	0.40
1927	0.68	0.95	1.01	0.52	0.44	0.09	-0.07	-0.15	-0.07	0.12	0.34	0.87	0.39
1928	1.06	0.91	0.51	0.54	0.41	0.26	-0.04	-0.14	-0.16	-0.19	-0.13	-0.06	0.25
1929	0.57	0.42	0.40	0.57	0.38	-0.18	-0.25	-0.35	-0.40	-0.36	-0.45	0.40	0.00
1930	0.11	-0.14	0.07	-0.36	-0.49	-0.62	-0.76	-0.81	-0.80	-0.75	-0.81	-0.57	-0.49
Mean	0.76	0.75	0.80	0.80	0.53	0.34	0.11	0.12	0.11	0.26	0.35	0.43	0.45

NOTE.—For reference to above table see p. 5.

TABLE 89.—*High water, Albany, N.Y.*

[Referred to a plane 2 feet below Sandy Hook sea-level datum]

Year	Janu-	Febr-	March	April	May	June	July	Aug-	Sept-	Octo-	Nov-	De-	Mean
	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet
1899				11.10	6.37	5.22	5.17	5.09	5.27	5.01	5.56	6.01	6.09
1900				9.27	6.06	5.52	5.17	5.22	5.06	5.02	5.58	6.26	5.91
1901				10.37	7.01	6.64	5.60	5.84	5.74	5.42	5.12		6.47
1902					5.76	5.97	7.03	6.04	5.71	6.49	6.07	5.47	6.07
1903					7.35	5.31	6.80	5.78	6.13	5.58	6.38	5.39	
1904						6.53	6.05	5.46	5.51	5.50	6.18	5.54	
1910	5.88	5.08	6.75	7.51	6.05	6.45	5.43	5.35	5.36	5.21	5.27	4.90	5.77
1911	5.29	4.80	5.37	7.93	6.23	5.74	5.07	5.08	5.50	6.17	5.80	5.76	5.73
1914	4.75	4.56	6.54	11.36	6.80	5.08	5.44	5.21	5.13	5.03	4.91	4.78	5.80
1915	6.45	7.22	5.55	6.30	5.51	5.18	6.47	6.26	5.51	5.61	5.43	5.89	5.95
1916	7.39	6.21	5.86	9.70	6.78	6.13	5.72	5.43	5.34	5.20	5.36	5.27	6.20
1917	4.98	4.26	7.03	7.93	6.30	7.19	5.85	5.48	5.33	5.93	5.79	4.47	5.88
1918	4.34	5.99	7.95	9.59	6.30	5.74	5.43	5.26	5.60	5.69	5.80	5.99	6.14
1919	5.48	5.07	6.63	7.54	7.09	5.89	5.67	5.67	5.77	5.94	6.53	5.72	6.08
1920	4.59	4.75	7.54	9.44	6.31	5.77	5.52	5.66	5.52	5.85	6.10	7.14	6.18
1921	5.30	5.36	8.63	6.73	6.29	5.31	5.83	5.42	5.48	5.27	5.86	5.79	5.94
1922	4.57	5.34	7.38	9.66	6.39	7.15	6.07	5.69	5.54	5.36	5.15	4.80	6.09
1923	5.08	4.70	6.43	8.61	6.66	5.57	5.34	5.29	5.28	5.38	5.72	6.59	5.89
1924	6.05	5.04	5.79	8.53	8.03	5.67	5.36	5.40	5.59	5.86	5.39	4.79	5.96
1925	4.56	7.25	7.69	7.04	6.07	5.67	5.64	5.62	5.80	5.67	6.73	5.76	6.12
1926	4.88	5.02	5.77	8.48	6.52	5.78	5.54	5.65	5.65	5.08	6.46	5.02	5.82
1927	4.73	5.67	7.50	6.10	6.41	5.72	5.57	5.68	5.70	6.07	7.32	7.30	6.15
1928	5.01	5.57	5.99	7.53	6.57	6.38	6.17	5.95	5.77	5.36	5.12	5.07	5.87
1929	4.69	4.94	7.57	8.65	6.86	5.87	5.55	5.39	5.51	5.38	5.56	5.14	5.93
1930	5.82	5.36	6.13	5.88	5.64	5.79	5.61	5.67	5.63	5.55	5.28	5.13	5.62
Mean	5.25	5.38	6.74	8.37	6.39	5.93	5.66	5.56	5.51	5.60	5.71	5.59	5.97

NOTE.—For reference to above table, see p. 5.

TABLE 90.—*Low water, Albany, N.Y.*

[Referred to a plane 2 feet below Sandy Hook sea-level datum]

Year	January	February	March	April	May	June	July	August	September	October	November	December	Mean
	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet
1899				10.74	4.41	4.20	2.28	2.28	2.63	2.30	3.20	4.06	3.81
1900				8.68	4.10	2.79	2.30	2.38	2.24	2.29	3.48	4.62	3.65
1901				9.71	5.45	4.67	2.67	3.05	2.94	2.86	2.62	-----	4.25
1902				3.78	3.75	5.31	3.59	2.92	4.27	3.97	3.63	3.90	3.82
1903				5.98	2.47	4.68	3.21	3.84	2.88	4.39	3.07	-----	3.82
1904				4.56	3.50	2.48	2.77	2.78	4.31	3.01	-----	3.34	3.34
1910	4.31	3.91	5.32	6.24	3.95	4.53	2.22	2.37	2.48	2.43	2.78	2.96	3.62
1911	4.13	3.34	3.54	6.92	4.00	3.06	1.97	2.15	2.74	3.90	3.79	3.90	3.62
1914	2.90	3.11	5.58	11.02	4.76	1.96	2.27	2.15	2.03	1.94	1.95	2.57	3.52
1915	5.46	6.71	3.49	4.41	2.51	1.93	3.84	3.57	2.31	2.78	2.67	4.56	3.69
1916	6.81	5.36	4.87	9.04	4.89	3.27	2.55	2.10	2.11	2.07	2.38	3.38	4.07
1917	3.37	2.64	6.26	6.76	4.23	5.19	2.69	1.11	1.97	3.21	3.11	2.39	3.66
1918	2.37	4.56	7.36	7.31	3.93	2.63	2.12	1.97	2.58	2.82	3.36	3.73	3.73
1919	2.93	2.37	4.98	6.07	5.20	2.54	2.46	2.33	2.65	3.01	4.32	3.83	3.56
1920	2.68	2.88	6.18	8.49	3.65	2.42	2.14	2.33	2.28	2.49	3.38	5.26	3.68
1921	3.32	3.69	7.81	4.57	3.34	1.91	2.56	1.94	2.03	1.96	3.13	3.65	3.33
1922	2.61	3.71	5.09	8.63	3.72	4.61	2.80	2.30	2.08	1.97	1.81	2.17	3.53
1923	3.51	2.73	4.89	7.30	4.22	2.13	1.84	1.82	1.93	1.98	2.53	4.31	3.27
1924	4.51	2.98	3.83	7.72	6.36	2.22	1.85	1.96	2.32	2.55	2.01	2.15	3.37
1925	2.32	5.80	6.56	5.26	3.32	2.41	2.92	2.25	2.54	2.86	4.81	3.51	3.71
Mean	3.56	3.72	5.26	7.00	4.03	2.96	2.47	2.33	2.30	2.65	2.98	3.35	3.55

NOTE.—For reference to above table see p. 5.

TABLE 91.—*Range of tide, Albany, N.Y.*

Year	January	February	March	April	May	June	July	August	September	October	November	December	Mean
	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet
1899				0.36	1.96	2.82	2.89	2.81	2.64	2.71	2.36	1.95	2.28
1900				0.59	1.96	2.73	2.87	2.84	2.82	2.73	2.10	1.64	2.25
1901				0.66	1.56	1.97	2.97	2.79	2.80	2.56	2.50	-----	2.22
1902				1.98	2.22	1.72	2.45	2.79	2.22	2.10	1.84	2.16	2.16
1903				1.37	2.84	2.12	2.57	2.29	2.70	1.99	2.32	-----	2.28
1904					1.97	2.55	2.98	2.74	2.72	1.87	2.53	-----	2.48
1910	1.57	1.17	1.43	1.27	2.10	1.92	3.21	2.98	2.88	2.78	2.49	1.94	2.14
1911	1.16	1.46	1.83	1.01	2.23	2.68	3.10	2.93	2.76	2.27	2.01	1.86	2.11
1914	1.85	1.45	0.96	0.34	2.04	3.12	3.17	3.06	3.10	3.09	2.96	2.21	2.28
1915	0.99	0.51	2.06	1.89	3.00	3.25	2.63	2.69	3.20	2.83	2.76	1.33	2.26
1916	0.58	0.85	0.99	0.66	1.89	2.86	3.17	3.33	3.23	3.13	2.98	1.89	2.13
1917	1.61	0.62	0.77	1.17	2.07	2.00	3.16	3.37	3.36	2.72	2.68	2.08	2.22
1918	1.97	1.43	0.59	2.28	2.37	3.11	3.31	3.29	3.02	2.87	2.44	2.26	2.41
1919	2.45	2.70	1.65	1.47	1.89	3.35	3.21	3.34	3.12	2.93	2.21	1.89	2.52
1920	1.91	1.87	1.36	0.95	2.66	3.35	3.38	3.33	3.24	3.36	2.72	1.88	2.50
1921	2.08	1.67	0.82	2.16	2.95	3.40	3.27	3.48	3.45	3.31	2.73	2.14	2.62
1922	1.96	1.63	1.39	1.03	2.67	2.54	3.27	3.39	3.46	3.39	3.34	2.63	2.56
1923	1.57	1.97	1.54	1.31	2.44	3.44	3.50	3.47	3.35	3.40	3.19	2.28	2.62
1924	1.54	2.06	1.96	0.81	1.67	3.45	3.51	3.44	3.27	3.31	3.38	2.64	2.59
1925	2.24	1.45	1.13	1.78	2.75	3.26	2.72	3.37	3.26	2.81	1.92	2.25	2.41
1926	1.81	1.77	1.35	1.19	2.36	3.32	3.54	3.50	3.35	2.22	2.20	1.86	2.37
1927	1.79	1.49	1.35	2.56	2.68	3.54	3.78	3.63	3.58	3.23	2.31	1.66	2.63
1928	0.51	1.36	2.03	1.67	2.56	3.13	3.36	3.48	3.65	3.60	3.52	3.46	2.69
1929	2.07	2.19	1.60	1.34	2.20	3.74	3.83	3.97	3.97	4.00	4.12	3.35	3.03
1930	2.50	2.85	3.30	3.03	4.25	4.38	4.54	4.66	4.64	4.55	4.51	4.30	4.01
Mean	1.60	1.66	1.48	1.37	2.36	2.97	3.18	3.23	3.21	2.96	2.74	2.24	2.42

NOTE.—For reference to above table, see p. 5.

TABLE 92.—*Half-tide level, Albany, N.Y.*

[Referred to a plane 2 feet below Sandy Hook sea-level datum!]

Year	January	Febr-	March	April	May	June	July	Au-	Sep-	Octo-	Nov-	De-	Mean
	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet
1899-----		10.92	5.39	3.81	3.72	3.68	3.95	3.66	4.38	5.04	4.95		
1900-----		8.98	5.08	4.15	3.74	3.80	3.65	3.66	4.53	5.44	4.78		
1901-----		10.04	6.23	5.66	4.13	4.44	4.34	4.14	3.87		5.36		
1902-----		4.77	4.86	6.17	4.81	4.31	5.38	5.02	4.55	4.98			
1903-----		6.67	3.89	5.74	4.49	4.99	4.23	5.39	4.23		4.95		
1904-----				5.54	4.78	3.97	4.14	4.14	5.24	4.28		4.58	
1910-----	5.09	4.49	6.03	6.87	5.00	5.49	3.82	3.86	3.92	3.52	4.02	3.93	4.70
1911-----	4.71	4.07	4.45	7.42	5.11	4.40	3.52	3.61	4.12	5.03	4.79	4.83	4.67
1914-----	3.82	3.83	6.06	11.19	5.78	3.52	3.86	3.68	3.58	3.48	3.43	3.68	4.66
1915-----	5.96	6.96	4.52	5.36	4.01	3.56	5.16	4.92	3.91	4.20	4.05	5.22	4.87
1916-----	7.10	5.78	5.36	9.37	5.84	4.70	4.14	3.76	3.72	3.64	3.87	4.32	5.13
1917-----	4.18	3.45	6.64	7.34	5.26	6.19	4.27	3.80	3.65	4.57	4.45	3.43	4.77
1918-----	3.36	5.28	7.66	8.45	5.12	4.18	3.78	3.62	4.09	4.26	4.58	4.86	4.94
1919-----	4.20	3.72	5.80	6.80	6.14	4.22	4.06	4.00	4.21	4.48	5.42	4.78	4.82
1920-----	3.64	3.82	6.86	8.96	4.98	4.10	3.83	4.00	3.90	4.17	4.74	6.20	4.93
1921-----	4.31	4.52	8.22	5.65	4.82	3.61	4.20	3.65	3.76	3.62	4.50	4.72	4.63
1922-----	3.59	4.52	6.68	9.14	5.06	5.88	4.44	4.00	3.81	3.66	3.48	3.48	4.81
1923-----	4.30	3.72	5.66	7.96	5.44	3.85	3.59	3.56	3.60	3.68	4.12	5.45	4.58
1924-----	5.28	4.01	4.81	8.12	7.20	3.94	3.60	3.68	3.96	4.20	3.70	3.47	4.66
1925-----	3.44	6.52	7.12	6.15	4.69	4.04	4.28	3.94	4.17	4.26	5.77	4.64	4.92
1926-----	3.98	4.14	5.10	7.88	5.34	4.12	3.77	3.90	3.98	3.97	5.36	4.09	4.64
1927-----	3.84	4.92	6.82	4.82	5.07	3.95	3.68	3.86	3.91	4.46	6.16	6.47	4.83
1928-----	4.76	4.89	4.98	6.70	5.29	4.82	4.49	4.21	3.94	3.56	3.36	3.34	4.53
1929-----	3.66	3.84	6.77	7.98	5.76	4.00	3.64	3.40	3.52	3.58	3.50	3.46	4.41
1930-----	4.57	3.94	4.48	4.06	3.52	3.60	3.34	3.34	3.31	3.28	3.02	2.98	3.62
Mean-----	4.41	4.55	6.00	7.69	5.21	4.45	4.07	3.95	3.91	4.13	4.35	4.47	4.77

NOTE.—For reference to above table, see p. 5.

TABLE 93.—*Tidal means, July to September, Albany, N.Y.*

Year	Intervals		Duration		Range		High water		Low water		Half-tide level
	High Water	Low Water	Rise	Fall	(A)	(B)	(A)	(B)	(A)	(B)	
1899-----	5.86	0.51	5.35	7.07	2.78	2.78	5.18	5.17	2.40	2.39	3.78
1900-----	5.73	0.37	5.36	7.06	2.84	2.81	5.15	5.13	2.31	2.32	3.73
1901-----	5.64	0.61	5.03	7.39	2.84	2.79	5.73	5.69	2.89	2.90	4.30
1902-----	5.51	0.57	4.94	7.48	2.32	2.26	6.26	6.23	3.94	3.97	5.10
1903-----	5.47	0.74	4.73	7.69	2.52	2.45	5.83	5.79	3.31	3.34	4.57
1904-----	5.61	0.64	4.97	7.45	2.81	2.73	5.49	5.45	2.68	2.72	4.08
1910-----	5.56	0.31	5.25	7.17	3.02	3.07	5.38	5.41	2.36	2.34	3.87
1911-----	5.52	0.27	5.25	7.17	2.93	3.00	5.22	5.25	2.29	2.25	3.75
1914-----	5.51	0.24	5.27	7.15	3.11	3.19	5.26	5.31	2.15	2.12	3.71
1915-----					2.84	2.90	6.08	6.11	3.24	3.21	4.66
1916-----					3.24	3.29	5.50	5.51	2.25	2.22	3.87
1917-----					3.30	3.32	5.55	5.57	2.26	2.25	3.91
1918-----	5.48	0.23	5.25	7.17	3.21	3.19	5.43	5.43	2.22	2.24	3.83
1919-----	5.40	0.21	5.19	7.23	3.22	3.17	5.70	5.67	2.48	2.50	4.09
1920-----	5.24	0.11	5.13	7.29	3.32	3.25	5.57	5.53	2.25	2.28	3.91
1921-----	4.86	-0.41	5.27	7.15	3.40	3.31	5.58	5.53	2.18	2.22	3.88
1922-----	4.78	-0.42	5.20	7.22	3.37	3.28	5.77	5.72	2.39	2.44	4.08
1923-----	5.34	-0.01	5.35	7.07	3.44	3.34	5.30	5.25	1.86	1.91	3.58
1924-----	5.19	-0.20	5.39	7.03	3.41	3.33	5.45	5.41	2.04	2.08	3.75
1925-----	5.09	0.11	4.98	7.44	3.12	3.06	5.69	5.66	2.57	2.60	4.13
1926-----	5.25	-0.10	5.35	7.07	3.46	3.43	5.61	5.59	2.15	2.16	3.88
1927-----	5.14	-0.10	5.24	7.18	3.66	3.66	5.65	5.65	1.99	1.99	3.82
1928-----	4.89	-0.09	4.98	7.44	3.50	3.54	5.96	5.98	2.47	2.44	4.21
1929-----	5.00	-0.33	5.33	7.09	3.92	3.99	5.48	5.52	1.56	1.53	3.52
1930-----	4.68	-0.79	5.47	6.95	4.62	4.74	5.64	5.70	1.02	0.96	3.33
Mean (C)-----	5.31	+0.11	5.20	7.22	3.21	3.19	5.58	5.57	2.37	2.38	3.97
Mean (D)-----	5.02	-0.23	5.25	7.17	3.59	3.57	5.61	5.60	2.02	2.03	3.82

Columns (A) contain direct means from observations.

Columns (B) contain values which have been reduced for longitude of moon's node.

Mean (C) includes data from every year of the series.

Mean (D) includes values for last 10 years 1921-30.

NOTE.—Heights in last 5 columns are referred to a plane 2 feet below the Sandy Hook sea level datum.
For reference to above table see p. 6.

TABLE 94.—*Extreme high water, Albany, N.Y.*

[Referred to a plane 2 feet below Sandy Hook sea-level datum.]

Date	Height	Date	Height	Date	Height
<i>Feet</i>					
1839, Jan. 27	20.2	1901, Dec. 12	16.0	1922, Apr. 12-13	18.0
1846, Mar. 15	20.7	1902, Mar. 2	21.0	1923, Apr. 7	15.0
1857, Feb. 9	23.7	1903, Mar. 2	18.8	1924, Apr. 8	15.7
1869, Jan. 11	20.5	1903, Mar. 24	17.5	1925, Feb. 12-13	14.2
1869, Apr. 22	21.5	1903, Oct.	18.5	1926, Apr. 20	14.1
1869, Oct. 5	21.0	1910, Jan. 23	15.8	1927, Nov. 5	18.0
1876, Feb. 6	16.5	1913, Mar. 28	23.4	1927, Dec. 9	14.2
1886, Feb. 14	20.4	1914, Mar. 29	16.8	1928, Apr. 9	11.9
1887, Apr. 12	17.5	1914, Apr. 2	14.0	1929, Mar. 16	14.7
1893, Mar. 26	20.9	1914, Apr. 9	15.8	1929, Apr. 22	14.1
1893, May 5	18.6	1914, Apr. 21	17.5	1930, Jan. 15	9.3
1895, Apr. 10	18.4	1916, Apr. 2	17.0	1930, Mar. 9	9.3
1896, Mar. 1	20.2	1920, Mar. 17-18	14.5	1931, July 22	8.6
1900, Feb. 14	22.4	1920, Mar. 27	15.1	1932, Nov. 19	10.9
1901, Apr. 22	16.5	1921, Mar. 10	12.1		

NOTE.—Highest water recorded 23.7 feet on Feb. 9, 1857. For a reference to above table see p. 12.

TABLE 95.—*Extreme low water, Albany, N.Y.*

[Referred to a plane 2 feet below Sandy Hook sea-level datum.]

Date	Height	Date	Height	Date	Height
<i>Feet</i>					
1920, August 23	0.8	1923, Aug. 22	0.8	1928, Dec. 30	-0.3
1920, Sept. 19	0.8	1924, Nov. 17	-1.8	1929, Dec. 1	-1.2
1921, June 14	0.9	1925, Oct. 11	-0.2	1930, Nov. 7	-1.7
1921, Oct. 23	0.9	1926, Aug. 15	0.9	1931, Dec. 8	-2.2
1922, Dec. 7	0.8	1927, July 4	0.8	1932, Mar. 8	-1.7

NOTE.—Lowest tide recorded -2.2 feet on Dec. 8, 1931. For a reference to above table see p. 12.

TABLE 96.—Summary of tidal data from observations, Hudson River

Station no.	Locality	Latitude (north)	Longitude (west)	Observations		Lunitidal intervals				Duration of rise	Mean range	Half-tide level ¹	Reference station				
				Date	Length	Greenwich		Local									
						H WI	L WI	H WI	L WI								
T 1	Fort Hamilton	40 37	74 02	1893-1932	40 years	0.37	6.75	7.68	1.64	6.04	4.70	0.05	(*)				
T 2	Governors Island	40 42	74 01	1876-78	3 years	0.75	7.19	8.06	2.08	5.98	4.41	—	(*)				
T 3	The Battery, New York City	40 42	74 01	1921-32	12 years	0.95	7.30	8.26	2.19	6.07	4.43	0.07	(*)				
T 4	Jersey City (Communipaw)	40 42	74 02	Oct. 28-Nov. 13, 1871	2 days	0.71	7.24	8.02	2.13	5.89	4.45	—	Governors Island.				
T 5	Jersey City (Morris St.)	40 43	74 02	Oct. 25-Nov. 20, 1860	4 days	0.88	7.29	8.19	2.18	6.01	4.30	—	Do.				
T 6	Jersey City (Pennsylvania R.R.)	40 43	74 02	May 25-Aug. 17, 1885	12 days	0.81	7.39	8.12	2.28	5.84	4.31	—	Sandy Hook.				
T 7	Jersey City (First St.)	40 43	74 02	July 10-25, 1854	8 days	1.02	7.51	8.33	2.40	5.93	4.52	—	Governors Island.				
T 8	Jersey City (Pavonia Ave.)	40 44	74 02	Sept. 26-Oct. 10, 1873	7 days	0.67	7.21	7.98	2.10	5.88	4.29	—	Do.				
	Do.			Aug. 12-Sept. 2, 1874	9 days	0.97	7.44	8.28	2.33	5.95	4.26	—	Do.				
HA 1	New York City (Chambers St.)	40 43	74 01	May 3, 1932-Apr. 24, 1933	11½ months	0.79	7.26	8.10	2.15	5.95	4.43	0.25	The Battery.				
HA 2	New York City (Christopher St.)	40 44	74 01	May 13, 1932-Mar. 22, 1933	10 months	0.84	7.31	8.15	2.20	5.95	4.42	0.15	Do.				
T 9	New York City (20th St.)	40 45	74 01	Sept. 27, 1871	1 day	0.49	7.29	7.80	2.18	5.62	4.31	—	Governors Island.				
HA 3	New York City (22d St.)	40 45	74 01	May 13, 1932-Apr. 24, 1933	11 months	0.93	7.36	8.24	2.25	5.99	4.42	0.04	The Battery.				
T 10	New York City (25th St.)	40 45	74 01	Sept. 3-Oct. 4, 1855	8 days	0.61	7.21	7.92	2.10	5.82	4.55	—	Governors Island.				
T 11	New York City (41st to 43d Sts.)	40 46	74 00	Aug. 28-Sept. 14, 1875	1 day	0.92	7.28	8.23	2.17	6.06	4.31	—	Do.				
	Do.			Aug. 11-Sept. 18, 1885	9 days	0.94	7.61	8.25	2.50	5.75	4.09	—	Sandy Hook.				
	Do.			Sept. 28-Oct. 14, 1886	6 days	1.14	7.54	8.45	2.43	6.02	4.14	—	Do.				
	Do.			Sept. 1-Dec. 17, 1919	3½ months	0.97	7.41	8.28	2.30	5.98	4.16	—	Fort Hamilton.				
	Do.			May 3, 1932-Mar. 31, 1933	11 months	0.99	7.46	8.30	2.35	5.95	4.30	0.08	The Battery.				
T 12	Weehawken	40 47	74 00	Sept. 14-18, 1872	2 days	0.97	7.46	8.28	2.35	5.93	4.13	—	Governors Island.				
	Do.			June 20-July 27, 1885	11 days	1.46	7.96	8.77	2.85	5.92	3.99	—	Sandy Hook.				
HA 5	New York City (70th St.)	40 47	73 59	June 3, 1932-Apr. 24, 1933	10½ months	1.11	7.55	8.43	2.45	5.98	4.21	0.11	The Battery.				
T 13	New York City (96th St.)	40 48	73 59	Sept. 5-27, 1871	2 days	0.95	7.58	8.27	2.48	5.79	4.11	—	Governors Island.				
HB 1	New York City (98th St.)	40 48	73 59	May 3, 1932-Apr. 24, 1933	11½ months	1.22	7.67	8.54	2.57	5.97	4.07	0.18	The Battery.				
T 14	New York City (129th to 130th St.)	40 49	73 58	Nov. 2-17, 1885	5 days	1.43	7.97	8.75	2.87	5.88	4.46	—	(*)				
	Do.			1914-20	7 years						3.81	0.26	(*)				
	Do.			June 8, 1932-Apr. 24, 1933	10½ months	1.35	7.73	8.67	2.63	6.04	4.15	0.21	The Battery.				

See footnotes at end of table.

TABLE 96.—Summary of tidal data from observations, Hudson River—Continued

Station no.	Locality	Latitude (north)	Longitude (west)	Observations		Lunitidal intervals				Duration of rise	Mean range	Half-tide level ¹	Reference station				
				Date	Length	Greenwich		Local									
						H WI	L WI	H WI	L WI								
T 15	New York City (155th to 157th St.)	40° 50'	73° 57'	Aug. 8-31, 1855	6 days	Hours	Hours	Hours	Hours	Hours	Feet	Feet	Governors Island.				
	Do			May 6-Nov. 9, 1886	18 days	1.11	7.72	8.43	2.62	5.81	4.28	-----	(?).				
	Do			Aug. 30-Sept. 26, 1930	27 days	1.55	7.82	8.87	2.72	6.15	3.93	-----	The Battery.				
	Do			May 3, 1932-Jan. 27, 1933	8½ months	1.44	7.87	8.76	2.77	5.99	3.99	0.09	Do.				
T 16	Fort Lee	40° 51'	73° 58'	Oct. 18-22, 1837	2 days	1.20	8.47	8.52	3.37	5.15	3.83	-----	Governors Island.				
HB 4	New York City (George Washington Bridge)	40° 51'	73° 57'	June 28-Oct. 5, 1932	1 month	1.43	7.84	8.75	2.74	6.01	4.16	0.03	The Battery.				
T 17	New York City (Tubby Hook)	40° 52'	73° 56'	Sept. 17-Oct. 17, 1853	do	1.25	8.23	8.57	3.13	5.44	3.96	-----	Governors Island.				
	Do			Aug. 1-7, 1855	1 day	1.08	8.02	8.40	2.92	5.48	4.06	-----	Do.				
T 18	Spuyten Duyvil	40° 53'	73° 56'	June 21, 1932-Apr. 21, 1933	10 months	1.58	7.94	8.90	2.84	6.06	3.94	0.26	The Battery.				
	Do			June 3-18, 1886	14 days	1.78	8.20	9.10	3.10	6.00	4.12	-----	(?).				
T 19	Riverdale	40° 54'	73° 55'	1921-22; 1926-30	21 months	1.88	8.17	9.20	3.07	6.13	3.77	0.28	The Battery. ³				
	Do			Sept. 5, 1871	1 day	1.35	7.97	8.67	2.87	5.80	3.94	-----	Governors Island.				
	Do			Aug. 9-Sept. 22, 1898	5 days	1.78	8.33	9.10	3.23	5.87	3.86	-----	Fort Hamilton.				
T 20	Do			Aug. 22-31, 1932	10 days	2.04	8.19	9.36	3.09	6.27	3.73	0.25	The Battery.				
	Yonkers	40° 56'	73° 54'	Aug. 5-29, 1853	6 days	1.85	8.57	9.17	3.47	5.70	3.94	-----	Governors Island.				
	Do			July 16-26, 1855	2 days	1.71	8.33	9.03	3.23	5.80	4.08	-----	Do.				
	Do			Aug. 13-Nov. 14, 1898	3 days	1.48	8.35	8.80	3.25	5.55	3.77	-----	Fort Hamilton.				
	Do			1910-19, 1921-30	60 months ⁴	-----	-----	-----	-----	-----	3.44	0.51	(?).				
T 20-a	Alpine	40° 57'	73° 55'	Aug. 4-Oct. 30, 1930	73 days	2.13	8.47	9.45	3.37	6.08	3.65	0.10	The Battery.				
T 21	Hastings	41° 00'	73° 53'	July 1-Sept. 30, 1932	3 months	2.12	8.43	9.44	3.33	6.11	3.59	-----	Do. ⁵				
T 22	Dobbs Ferry	41° 01'	73° 53'	Aug. 20-Oct. 21, 1898	3 days	1.98	8.40	9.30	3.30	6.00	3.66	-----	Fort Hamilton.				
	Do			Oct. 6-11, 1853	2 days	1.56	8.48	8.88	3.38	5.50	3.86	-----	Governors Island.				
	Do			Aug. 23-Oct. 14, 1856	53 days	2.00	8.35	9.32	3.25	6.07	3.71	-----	(?).				
	Do			July 23-31, 1858	7 days	2.52	8.86	9.84	3.76	6.08	3.69	-----	Governors Island.				
	Do			Sept. 5-6, 1871	1 day	1.71	8.17	9.03	3.07	5.96	3.60	-----	Do.				
	Do			Aug. 10-Sept. 10, 1885	1 month	2.13	8.44	9.45	3.34	6.11	3.58	0.56	(?).				
	Do			Sept. 27-Oct. 30, 1886	do	2.13	8.52	9.45	3.42	6.03	3.60	0.41	Do.				
	Do			Aug. 13-Nov. 12, 1898	3 days	2.05	8.68	9.37	3.58	5.79	3.31	0.47	Fort Hamilton.				
	Do			Sept. 21-Nov. 2, 1900	6 days	2.06	8.48	9.38	3.38	6.00	3.66	0.28	Do.				
	Do			Aug. 31-Sept. 1, 1929	1 day	2.48	8.74	9.80	3.64	6.16	3.34	-----	The Battery.				
T 23	Sneden Landing	41° 01'	73° 54'	Aug. 31-Sept. 3, 1929	3 days	2.01	8.63	9.33	3.53	5.80	3.43	-----	Do.				
T 24	Irvington	41° 02'	73° 53'	Sept. 21-Oct. 26, 1900	6 days	2.21	8.67	9.53	3.57	5.96	3.42	-----	Fort Hamilton.				
	Do			Sept. 30-Oct. 13, 1930	14 days	2.34	8.78	9.66	3.68	5.98	3.38	-----	The Battery.				

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T 25	Tarrytown	41° 05'	73° 52'	Aug. 29-Oct. 17, 1853	1½ months	2.63	8.97	9.95	3.87	6.08	3.49	-----	(?).
	Do			Sept. 6-8, 1871	1 day	1.91	8.53	9.23	3.43	5.80	3.76	-----	Governors Island.
	Do			Oct. 29-Nov. 2, 1900	do	2.43	8.73	9.75	3.63	6.12	3.63	-----	Fort Hamilton.
	Do			Oct. 1-Nov. 30, 1918	2 months	2.72	9.20	10.04	4.10	5.94	3.10	-----	(?).
	Do			Oct. 1-Nov. 30, 1919	do	2.76	9.18	10.08	4.08	6.00	3.18	-----	(?).
	Do			1920, 1922	5 months ⁴	2.63	9.17	9.95	4.07	5.88	3.06	0.63	Fort Hamilton. ³
	Do			Sept. 3-5, 1929	2 days	2.55	9.11	9.87	4.01	5.86	2.86	-----	The Battery.
	Do			Aug. 1-31, 1932	1 month	2.78	9.20	10.10	4.10	6.00	3.25	0.60	Do. ⁴
T 26	Nyack	41° 05'	73° 55'	Aug. 30-Sept. 5, 1929	6 days	2.76	9.32	10.08	4.22	5.86	2.82	-----	Do.
T 27	Ossining	41° 10'	73° 52'	Aug. 15-Sept. 11, 1885	28 days	2.65	9.35	9.97	4.25	5.72	3.13	-----	Sandy Hook. ⁵
	Do			Aug. 15-Oct. 22, 1901	16 days	2.65	9.40	9.97	4.30	5.67	3.21	0.58	Fort Hamilton.
	Do			Sept. 1-30, 1932	1 month	3.07	9.75	10.39	4.65	5.74	3.07	0.81	The Battery. ⁴
T 28	Haverstraw	41° 12'	73° 58'	Sept. 3-6, 1929	3 days	2.72	9.82	10.04	4.72	5.32	2.51	-----	Do.
T 29	Crugers	41° 14'	73° 56'	Sept. 1-Oct. 31, 1932	2 months	3.20	10.06	10.52	4.96	5.56	2.89	-----	Governors Island.
T 30	Verplanck	41° 15'	73° 58'	Sept. 9-24, 1871	2 days	2.76	9.03	10.08	3.93	6.15	3.29	-----	(?).
	Do			1920; 1927-30	14 months ⁴	3.19	10.04	10.51	4.94	5.57	2.94	0.72	Governors Island.
T 31	Peekskill	41° 17'	73° 56'	Sept. 18-Oct. 7, 1854	3 days	3.40	10.05	10.72	4.95	5.77	3.07	-----	The Battery. ⁵
	Do			Sept. 25-Oct. 23, 1901	12 days	3.10	9.85	10.42	4.75	5.67	2.83	0.58	Governors Island.
	Do			Aug. 8-18, 1903	3 days	3.21	10.02	10.53	4.92	5.61	2.98	0.69	Do.
	Do			Aug. 1-Oct. 31, 1932	3 months	3.33	10.28	10.65	5.18	5.47	2.85	0.79	The Battery. ⁵
T 32	Iona Island	41° 18'	73° 58'	Sept. 11-24, 1871	2 days	3.15	9.37	10.47	4.27	6.20	2.78	-----	Governors Island.
	Do			Aug. 11-Sept. 6, 1885	19 days	3.20	10.32	10.52	5.22	5.30	2.79	-----	Sandy Hook.
T 32-a	Highland Station	41° 21'	73° 58'	Oct. 8-28, 1932	20 days	3.90	10.68	11.22	5.58	5.64	2.74	0.82	The Battery.
T 33	Dennings Landing	41° 21'	73° 57'	Sept. 12-22, 1871	2 days	3.43	9.90	10.75	4.80	5.95	2.87	-----	Governors Island.
T 34	West Point	41° 24'	73° 57'	Aug. 9-Oct. 22, 1856	2½ months	3.71	10.75	11.03	5.65	5.38	2.79	-----	(?).
	Do			July 25-27, 1905	2 days	4.08	10.72	11.40	5.62	5.78	2.86	-----	Cold Spring.
	Do			Sept. 6-9, 1929	3 days	3.22	10.67	10.54	5.57	4.97	2.60	-----	The Battery.
T 35	Cold Spring	41° 25'	73° 58'	Sept. 13-18, 1871	2 days	3.88	10.47	11.20	5.37	5.83	2.59	-----	Governors Island.
	Do			July 19-28, 1905	5 days	4.20	10.88	11.52	5.78	5.74	2.83	0.49	Fort Hamilton.
T 36	Storm King	41° 26'	73° 59'	1919, 1920	6 months ⁴	4.43	11.12	11.75	6.02	5.73	2.52	0.59	Do. ⁴
T 37	New Winsor (opposite)	41° 29'	73° 59'	Sept. 14-20, 1871	2 days	4.26	10.99	11.57	5.88	5.69	2.68	-----	Governors Island.
T 38	Newburgh	41° 30'	74° 00'	Aug. 1-Oct. 3, 1859	15 days	5.02	11.23	12.33	6.12	6.21	3.01	-----	Do.
	Do			Sept. 9-10, 1929	1 day	4.83	11.46	12.14	6.35	5.79	2.64	-----	The Battery.
T 39	Beacon	41° 30'	73° 59'	July 31-Aug. 19, 1905	7 days	4.45	11.17	11.77	6.07	5.70	2.59	0.74	Fort Hamilton.
T 40	Low Point	41° 33'	73° 58'	Sept. 19-20, 1871	1 day	4.41	11.20	11.73	6.10	5.63	2.91	-----	Governors Island.
T 41	New Hamburg	41° 35'	73° 57'	Aug. 15-Oct. 1, 1859	22 days	4.91	11.35	12.23	6.25	5.98	2.96	-----	Do.
	Do			Aug. 23-Sept. 1, 1905	4 days	4.91	11.53	12.23	6.43	5.80	2.78	0.37	Fort Hamilton.
	Do			July 1-Sept. 30, 1919	3 months	5.13	11.76	0.03	6.66	5.79	2.73	0.58	Do. ⁵

See footnotes at end of table.

TABLE 96.—Summary of tidal data from observations, Hudson River—Continued

Station no.	Locality	Latitude (north)	Longitude (west)	Observations		Lunitidal intervals				Duration of rise	Mean range	Half-tide level ¹	Reference station				
				Date	Length	Greenwich		Local									
						H.W.I.	L.W.I.	H.W.I.	L.W.I.								
T 42	Barnegat.	41 38	73 57	Sept. 18-19, 1871	1 day	4.73	11.27	12.05	6.17	5.88	3.01	-----	Governors Island.				
T 43	Poughkeepsie	41 42	73 56	Aug. 13-Oct. 20, 1856	2 months	5.25	12.03	0.15	6.93	5.64	3.30	-----	(?).				
	Do.			July 22-31, 1858	9 days	5.55	12.02	0.45	6.92	5.95	3.33	-----	Governors Island.				
	Do.			Sept. 2-28, 1859	24 days	5.38	11.50	0.28	6.40	6.30	3.12	-----	Do.				
	Do.			Sept. 9-Nov. 5, 1905	2 months	5.53	12.20	0.43	7.10	5.75	2.85	0.88	(?).				
	Do.			1918-20	4 months ⁴	5.57	12.15	0.47	7.05	5.84	2.91	0.70	Fort Hamilton. ⁵				
	Do.			Sept. 10-11, 1929	1 day	5.13	12.61	0.03	7.51	4.94	2.95	-----	The Battery.				
T 44	Hyde Park	41 42	73 56	Oct. 9-Nov. 2, 1905	10 days	5.72	12.37	0.62	7.27	5.77	3.11	0.93	Poughkeepsie.				
T 45	West Park	41 47	73 57	July 26-Aug. 24, 1860	1 month	5.63	12.26	0.53	7.16	5.79	3.46	-----	(?).				
T 46	Dinsmore	41 52	73 56	Aug. 24-Sept. 5, 1860	11 days	5.90	12.54	0.80	7.44	5.78	3.78	-----	Governors Island.				
T 47	Rhinecliff	41 55	73 57	Sept. 6-17, 1860	9 days	5.95	12.43	0.85	7.33	5.94	3.64	-----	Do.				
	Do.			Sept. 9-24, 1861	do.	5.95	12.51	0.85	7.41	5.86	3.70	-----	Do.				
T 48	Rondout Light	41 55	73 58	1920, 1927-30	15 months ⁴	6.17	12.83	1.07	7.73	5.76	3.62	0.73	The Battery. ⁶				
	Do.			Nov. 29-30, 1858	1 day	6.21	12.80	1.11	7.70	5.83	3.63	-----	Governors Island.				
T 49	Eddyville, Rondout Creek	41 54	74 01	Sept. 24-Nov. 17, 1868	134 months	6.33	12.78	1.23	7.68	5.97	3.65	-----	(?).				
T 50	Barrytown	42 00	73 56	Sept. 25-Nov. 17, 1868	134 months	6.14	12.98	1.03	7.87	5.58	3.75	-----	(?).				
T 51	Tivoli	42 04	73 56	Sept. 30-Oct. 15, 1861	8 days	6.17	12.83	1.07	7.73	5.76	4.09	-----	Governors Island.				
	Do.			Aug. 12-Oct. 20, 1856	2 months	6.50	13.30	1.40	8.20	5.62	4.09	-----	(?).				
	Do.			July 22-Aug. 1, 1858	10 days	6.76	13.35	1.66	8.25	5.83	4.27	-----	Governors Island.				
	Do.			Oct. 15-26, 1861	5 days	6.20	13.05	1.10	7.95	5.57	4.57	-----	Do.				
	Do.			1916, 1918, 1919	6 months ⁴	6.77	13.43	1.67	8.33	5.76	3.77	0.76	Fort Hamilton. ⁵				
	Do.			Sept. 11-13, 1929	2 days	7.43	12.98	2.33	7.88	6.87	3.87	-----	The Battery.				
T 52	Malden	42 06	73 56	Aug. 6-19, 1862	5 days	7.03	13.37	1.93	8.27	6.08	4.14	-----	Governors Island.				
T 53	Germantown	42 08	73 54	Aug. 20-29, 1862	2 days	6.78	13.56	1.68	8.46	5.64	4.13	-----	Do.				
T 54	Greendale	42 12	73 52	July 1-Sept. 30, 1919	3 months ⁴	7.33	14.06	2.23	8.96	5.69	4.07	0.90	Hudson. ⁴				
T 55	Catskill	42 13	73 52	Sept. 3-9, 1862	3 days	6.95	13.61	1.85	8.51	5.76	4.08	-----	Governors Island.				
T 56	Hudson	42 15	73 48	Sept. 11-30, 1862	7 days	7.51	13.76	2.42	8.67	6.17	4.21	-----	Do.				
	Do.			1920-21, 1927-30	18 months ⁴	7.68	14.37	2.59	9.28	5.73	4.04	1.00	(?).				
T 57	Four Mile Point	42 18	73 47	1919, 1921, 1927-30	16 months ⁴	8.13	14.75	3.04	9.66	5.80	3.82	1.13	(?).				
T 58	Coxackie	42 21	73 48	July 7-Sept. 24, 1863	3 days	8.44	15.12	3.35	10.03	5.74	3.73	-----	Governors Island.				
	Do.			1918-20	7 months ⁷	8.55	15.25	3.46	10.16	5.72	3.56	1.00	Hudson. ⁴				
T 59	Stayvesant	42 23	73 47	Aug. 14-Oct. 20, 1856	2 months	8.47	15.42	3.38	10.33	5.47	3.89	-----	(?).				
	Do.			July 22-31, 1858	8 days	8.75	15.36	3.66	10.47	5.61	3.90	-----	Governors Island.				
	Do.			Sept. 25-Oct. 15, 1863	3 days	8.22	15.17	3.13	10.08	5.47	3.55	-----	Do.				
T 60	Stonehouse Bar	42 26	73 47	1919, 1927-30	13 months ⁴	9.19	15.88	4.10	10.79	5.73	3.43	1.49	(?).				
T 61	New Baltimore	42 27	73 47	July 30-Sept. 21, 1856	10 days	8.67	15.61	3.58	10.52	5.48	3.24	-----	Governors Island.				
T 62	Barren Island	42 28	73 47	1919-21, 1927-30	18 months ⁴	9.42	16.20	4.33	11.11	5.64	3.29	1.64	(?).				
T 63	Castleton	42 32	73 46	Aug. 16-Oct. 20, 1856	2 months	9.60	17.01	4.51	11.92	5.01	2.68	-----	(?).				
	Do.			July 22-Aug. 2, 1859	10 days	10.14	17.29	5.05	12.20	5.27	2.41	-----	(?).				
	Do.			Nov. 5-6, 1863	1 day	9.85	16.99	4.76	11.90	5.28	2.16	-----	Governors Island.				
	Do.			1919, 1927-30	15 months ⁴	9.72	16.65	4.63	11.56	5.49	3.54	1.61	(?).				
	Do.			1918-20	7 months ⁴	9.85	16.82	4.76	11.73	5.45	3.45	1.64	Albany.				
T 64	Staat Point	42 34	73 45	Sept. 29-Oct. 21, 1856	15 days	9.84	17.47	4.75	12.38	4.79	1.98	-----	Governors Island.				
T 65	Van Wies Point	42 35	73 45	Aug. 11-Dec. 3, 1856	2½ months	10.49	18.52	5.40	1.01	4.39	2.26	-----	(?).				
T 66	Rensselaer (Greenbush)	42 38	73 45	Sept. 7-Dec. 22, 1857	1 month	10.46	18.62	5.37	1.11	4.26	1.96	-----	(?).				
	Do.			July 22-31, 1858	8 days	10.97	18.27	5.88	0.76	5.12	2.72	1.47	Governors Island.				
T 67	Albany	42 39	73 45	1921-30	30 months ⁴	10.11	17.28	5.02	12.19	5.25	3.57	1.82	(?).				
T 68	Bath	42 39	73 44	Oct. 21-Nov. 6, 1863	3 days	11.32	18.46	6.23	0.95	5.28	1.33	-----	Governors Island.				
T 69	Troy	42 44	73 42	Oct. 28-Nov. 4, 1863	1 day	11.21	18.83	6.13	1.33	4.80	1.42	-----	Do.				
	Do.			Sept. 12-14, 1929	2 days	10.49	17.80	5.41	0.30	5.12	3.42	-----	Albany.				

¹ Referred to Sandy Hook sea-level datum.² Results independently derived from high and low waters.³ Results derived from harmonic constants.⁴ Includes months of July, August, and September only.⁵ Used for range and half-tide level only.⁶ For intervals; only 2 months used for heights.⁷ Includes months of July, August, and September; 7 months used for intervals, 5 months for heights.

NOTE.—For reference to above table see p. 7.

TABLE 97.—Adjusted tidal data, Hudson River

Locality	Latitude (north)	Lunitidal intervals				Duration of rise	Mean range	Half- tide level ¹			
		Greenwich		Local							
		H.W.I.	L.W.I.	H.W.I.	L.W.I.						
The Battery, New York.....	40 42	Hours 0.95	Hours 7.30	Hours 8.26	Hours 2.19	Hours 6.07	Feet 4.4	Feet 0.07			
Jersey City (Pennsylvania R.R. ferry).....	40 43	1.05	7.40	8.36	2.29	6.07	4.4	0.08			
New York (Desbrosses St.).....	40 43	1.10	7.45	8.41	2.34	6.07	4.4	0.09			
Jersey City (D. L. & W. R.R. ferry).....	40 44	1.15	7.49	8.46	2.38	6.08	4.3	0.10			
Castle Point, Hoboken.....	40 45	1.22	7.55	8.53	2.44	6.09	4.3	0.10			
New York (23d St.).....	40 45	1.25	7.57	8.56	2.46	6.10	4.3	0.10			
New York (42d St.).....	40 46	1.31	7.63	8.62	2.52	6.10	4.2	0.10			
Days Point, Weehawken.....	40 46	1.34	7.66	8.65	2.55	6.10	4.2	0.10			
New York (Union Stock Yards).....	40 47	1.39	7.71	8.70	2.60	6.10	4.2	0.10			
New York (96th St.).....	40 48	1.47	7.78	8.78	2.67	6.11	4.1	0.10			
Grants Tomb (123d St.).....	40 49	1.54	7.85	8.86	2.75	6.11	4.0	0.15			
New York (130th St.).....	40 49	1.55	7.86	8.87	2.76	6.11	4.0	0.15			
George Washington Bridge.....	40 51	1.70	8.00	9.02	2.90	6.12	3.9	0.20			
Tubby Hook.....	40 52	1.79	8.09	9.11	2.99	6.12	3.8	0.20			
Spuyten Duyvil.....	40 53	1.88	8.17	9.20	3.07	6.13	3.8	0.25			
Riverdale.....	40 54	1.95	8.25	9.27	3.15	6.12	3.7	0.25			
Yonkers.....	40 56	2.08	8.38	9.40	3.28	6.12	3.5	0.35			
Dobbs Ferry.....	41 01	2.42	8.80	9.74	3.70	6.04	3.2	0.40			
Irvington.....	41 02	2.48	8.90	9.80	3.80	6.00	3.2	0.45			
Tarrytown.....	41 05	2.63	9.17	9.95	4.07	5.88	3.1	0.55			
Nyack.....	41 08	2.65	9.19	9.97	4.09	5.88	3.1	0.55			
Ossining.....	41 10	2.90	9.60	10.22	4.50	5.72	3.0	0.65			
Haverstraw.....	41 12	3.00	9.78	10.32	4.68	5.64	3.0	0.65			
Verplanck.....	41 15	3.19	10.04	10.51	4.94	5.57	2.9	0.65			
Peekskill.....	41 17	3.38	10.20	10.70	5.10	5.60	2.9	0.65			
Iona Island.....	41 18	3.49	10.31	10.81	5.21	5.60	2.9	0.65			
Bear Mountain Bridge.....	41 19	3.60	10.42	10.92	5.32	5.60	2.8	0.65			
Con Hook.....	41 21	3.80	10.62	11.12	5.52	5.60	2.7	0.65			
Highlands Falls.....	41 22	3.96	10.75	11.28	5.65	5.63	2.7	0.65			
West Point.....	41 24	4.22	10.95	11.54	5.85	5.69	2.6	0.70			
Cold Spring.....	41 25	4.32	11.03	11.64	5.93	5.71	2.6	0.70			
Storm King.....	41 26	4.43	11.12	11.75	6.02	5.73	2.5	0.70			
Newburgh.....	41 30	4.80	11.45	12.11	6.34	5.77	2.6	0.70			
Low Point.....	41 33	5.02	11.66	12.34	6.56	5.78	2.7	0.70			
New Hamburg.....	41 35	5.13	11.76	0.03	6.66	5.79	2.7	0.70			
Barnegat.....	41 38	5.32	11.94	0.22	6.84	5.80	2.8	0.70			
Poughkeepsie.....	41 42	5.57	12.15	0.47	7.05	5.84	2.9	0.70			
Hyde Park.....	41 47	5.80	12.43	0.70	7.33	5.79	3.2	0.70			
Dinsmore Point.....	41 52	6.03	12.68	0.93	7.58	5.77	3.5	0.70			
Rhinecliff.....	41 55	6.17	12.83	1.07	7.73	5.76	3.6	0.70			
Kingston Point.....	41 56	6.22	12.90	1.12	7.80	5.74	3.7	0.75			
Barrytown.....	42 00	6.45	13.12	1.35	8.02	5.75	3.7	0.75			
Tivoli.....	42 04	6.77	13.43	1.67	8.33	5.76	3.8	0.75			
Saugerties Light.....	42 04	6.81	13.47	1.71	8.37	5.76	3.8	0.75			
Maiden.....	42 06	6.90	13.57	1.80	8.47	5.75	3.8	0.80			
Silver Point.....	42 09	7.10	13.78	2.00	8.68	5.74	3.9	0.80			
Linhithgo.....	42 11	7.25	13.93	2.15	8.83	5.74	4.0	0.85			
Catskill.....	42 13	7.45	14.14	2.35	9.04	5.73	4.1	0.90			
Hudson.....	42 15	7.68	14.37	2.59	9.28	5.73	4.0	1.00			
Four Mile Point.....	42 18	8.13	14.75	3.04	9.66	5.80	3.8	1.10			
Coxackie.....	42 21	8.55	15.25	3.46	10.16	5.72	3.6	1.20			
Stuyvesant.....	42 23	8.80	15.50	3.71	10.41	5.72	3.4	1.30			
Matthew Point.....	42 26	9.19	15.88	4.10	10.79	5.73	3.4	1.45			
New Baltimore.....	42 27	9.32	16.05	4.23	10.96	5.69	3.5	1.50			
Barren Island.....	42 28	9.42	16.20	4.33	11.11	5.64	3.5	1.55			
Coeymans.....	42 28	9.45	16.25	4.36	11.16	5.62	3.5	1.55			
H. R. C. R. R. Bridge.....	42 31	9.65	16.55	4.56	11.46	5.52	3.5	1.60			
Castleton.....	42 32	9.72	16.65	4.63	11.56	5.49	3.5	1.60			
Staat Point.....	42 34	9.88	16.82	4.79	11.73	5.48	3.6	1.65			
Van Wies Point.....	42 35	9.92	16.90	4.83	11.81	5.44	3.6	1.65			
Albany.....	42 39	10.11	17.28	5.02	12.19	5.25	3.6	1.82			
Troy.....	42 44	10.49	17.80	5.41	0.30	5.11	3.4	2.00			

¹ Referred to Sandy Hook sea-level datum.

NOTE.—For reference to above table, see p. 8.

TABLE 98.—*Tidal harmonic constants, Fort Hamilton, N.Y.*

Series begins.....	Jan. 1, 1900		Jan. 1, 1904		Means	
	369 days		369 days		2 years	
Constituent	H	κ	H	κ	H	κ
	Feet	°	Feet	°	Feet (0.014)	° (107)
J ₁						
K ₁	0.320	103	0.324	104	0.322	104
K ₂	0.148	244	0.132	236	0.140	240
L ₂			0.103	232	0.103	232
M ₁	0.008	87	0.007	123	0.008	105
M ₂	2.212	221	2.208	221	2.210	221
M ₃	0.026	202	0.028	169	0.027	186
M ₄	0.028	333	0.030	345	0.029	339
M ₅	0.051	36	0.053	35	0.052	35
M ₈	0.009	89	0.013	80	0.011	84
N ₂	0.459	204	0.496	204	0.478 (0.064)	204 (187)
2N.....						
O ₁	0.178	98	0.167	99	0.172 (0.007)	98 (110)
O _O						
P ₁	0.102	103	0.095	109	0.098	106
Q ₁					0.031	87
2Q.....						(0.004)
R ₂						(92)
S ₁	0.044	68	0.036	59	0.040	64
S ₂	0.440	249	0.450	247	0.445	248
S ₄	0.035	76	0.042	64	0.038	70
S ₆	0.007	172	0.004	141	0.006	156
T ₂			0.110	157	0.110	157
λ_2			0.043	197	0.043	197
μ_2			0.061	235	0.061	235
ν_2			0.095	203	0.095	203
p_1						(0.007)
M _S			0.046	293	0.046	293
Sa. for 26 years (1893-1918).....					0.297	121
Ssa. for 26 years (1893-1918).....					0.091	50

NOTE.—Values in parentheses are inferred. For reference to above table see p. 9.

TABLE 99.—*Tidal harmonic constants, Governors Island, N.Y.*

Series begins.....	1876		1877		1878		Means	
	1 year		1 year		1 year		3 years	
Constituent	H	κ	H	κ	H	κ	H	κ
	Feet	°	Feet	°	Feet	°	Feet (0.018)	° (107)
J ₁								
K ₁	0.323	106	0.327	107	0.325	107	0.325	106
K ₂	0.126	269	0.116	255	0.113	241	0.118	255
L ₂	0.079	250	0.132	270	0.177	227	0.129	249
M ₁	0.019	144	0.014	86	0.016	82	0.016	104
M ₂	2.157	232	2.150	231	2.153	231	2.153	231
M ₄	0.091	335	0.081	331	0.090	332	0.087	332
M ₆	0.075	92	0.074	89	0.078	87	0.076	89
N ₂	0.479	211	0.499	208	0.511	213	0.496	211
2N.....								(0.066)
O ₁	0.169	110	0.154	101	0.160	102	0.161 (0.010)	104 (108)
O _O								
P ₁	0.107	103	0.115	106	0.093	104	0.105 (0.031)	104 (103)
Q ₁								(0.004)
2Q.....								(102)
R ₂								(257)
S ₂	0.403	255	0.412	256	0.423	260	0.413	257
T ₂			0.114	220	0.031	147	0.073	183
λ_2	0.004	103	0.029	209	0.042	247	0.025	186
μ_2	0.064	200	0.048	223	0.077	229	0.063	217
ν_2	0.009	260	0.109	251	0.161	212	0.093	241
p_1								(0.006)
Sa.....	0.281	149	0.287	144	0.166	88	0.245	127
Ssa.....	0.208	76	0.216	57	0.096	8	0.173	47

NOTE.—Values in parentheses are inferred. For reference to above table see p. 9.

TABLE 100.—*Tidal harmonic constants, the Battery, New York City*

Location.....	Barge office		Whitehall Street		Means	
	June 1, 1920		Jan. 1, 1929			
Length.....	369 days		369 days		2 years	
Constituent	H	K	H	K	H	K
J ₁	Feet (0.018)	Degrees (106)	Feet (0.013)	Degrees (106)	Feet (0.016)	Degrees (106)
K ₁	0.327	106	0.323	107	0.325	106
K ₂	0.107	255	0.130	263	0.118	259
L ₂	0.077	248	0.075	252	0.076	250
M ₁	0.011	205	0.026	196	0.018	201
M ₂	2.112	233	2.100	234	2.106	234
M ₃	0.033	198	0.029	207	0.031	203
M ₄	0.055	333	0.055	324	0.055	328
M ₅	0.071	81	0.094	86	0.082	83
M ₆	0.012	86	0.014	79	0.013	82
N ₂	0.487	213	0.466	212	0.476	213
2N.....	(0.065)	(193)	(0.062)	(190)	(0.064)	(192)
O ₁	0.176	106	0.168	109	0.172	107
O ₀	(0.010)	(106)	(0.007)	(106)	(0.008)	(106)
P ₁	0.102	106	0.110	112	0.106	109
Q ₁	0.046	138	0.046	131	0.046	134
2Q.....	(0.005)	(106)	(0.004)	(111)	(0.004)	(108)
R ₂	(0.003)	(259)	(0.003)	(260)	(0.003)	(259)
S ₁	0.049	67	0.047	55	0.048	61
S ₂	0.416	259	0.433	260	0.429	259
S ₄	0.043	79	0.037	83	0.040	81
S ₅	0.005	186	0.005	176	0.005	181
T ₂	(0.026)	(259)	(0.026)	(260)	(0.026)	(259)
X ₁.....	.....	.....	0.038	243	0.038	243
μ_1.....	.....	.....	0.057	229	0.057	229
ν_2.....	.....	.....	0.099	209	0.099	209
ρ_1	(0.007)	(106)	(0.006)	(110)	0.006	108
M _S.....	.....	.....	0.053	307	0.053	307
S _a	0.169	109	0.271	112	0.222	110
S _{sa}	0.136	92	0.181	32	0.158	62

NOTE.—Values in parentheses are inferred. For reference to above table see p. 9.

TABLE 101.—*Tidal harmonic constants, Albany, N.Y.*

[Series of observations 369 days beginning Jan. 1, 1914]

Constituent	H	K	Constituent	H	K	Constituent	H	K
	Feet (0.011)	Degrees (284)	N ₂	Feet 0.188	Degrees 154	S ₁	Feet 0.000	Degrees 286
J ₁	0.203	281	2N.....	(0.025)	(136)	S ₂	0.004	124
K ₁	0.053	210	O ₁	0.143	275	T ₂	0.033	255
K ₂	0.134	172	O ₀	(0.006)	(286)	X ₂	(0.007)	(186)
L ₂	0.016	333	P ₁	0.090	265	μ_2	0.075	305
M ₁	1.018	172	Q ₁	0.015	283	ν_2	0.034	177
M ₂	0.014	244	2Q.....	(0.004)	(270)	ρ_1	(0.005)	(273)
M ₃	0.130	254	R ₂	(0.001)	(203)	M _S	0.040	284
M ₄	0.034	171	S ₁	0.088	184	S _a ¹	1.073	9
M ₆	0.023	245	S ₂	0.124	203	S _{sa} ¹	0.688	44

¹ Constants for Sa and Ssa are from observations covering a period of 10 years from 1921 to 1930, inclusive.

NOTE.—Values in parentheses are inferred. For reference to above table see p. 9.

TABLE 102.—*Spring and neap tides*

Station	Phase age	Ratio to mean range				Accepted ranges		
		Spring range	Neap range	Phase inequality		Mean	Spring	Neap
				HW	LW			
The Battery.....	Hours	25	1.20	0.78	0.10	0.09	4.43	5.3
Spuyten Duyvil.....		27	1.19	0.81	0.11	0.08	3.8	4.5
Yonkers.....		29	1.18	0.82	0.11	0.07	3.5	4.1
Rhinecliff.....		36	1.13	0.87	0.09	0.04	3.6	4.1
Hudson.....		43	1.11	0.89	0.09	0.02	4.0	4.4
Castleton.....		35	1.10	0.90	0.09	0.01	3.5	3.9
Albany.....		43	1.09	0.91	0.08	0.01	3.6	3.9

NOTE.—For reference to above table, see p. 9.

TABLE 103.—*Perigean and apogean tides*

	The Battery	Albany			The Battery	Albany
Ratio of perigean range to mean range.....	1.21	1.10	Age of parallax inequality.hours.....	39	56	
Ratio of apogean range to mean range.....	0.83	0.95	Mean range of tide.....feet.....	4.43	3.6	
			Perigean range of tide.....do.....	5.4	4.0	
			Apogean range of tide.....do.....	3.7	3.4	

NOTE.—For reference to above table, see p. 11.

TABLE 104.—*Results from declinational reduction*

	The Battery	Albany			The Battery	Albany
Tropic higher high-water interval.....hours.....	8.20a	5.11b	Great diurnal range.....feet.....		4.9	4.0
Tropic lower high-water interval.....hours.....	8.31b	4.91a	Tropic high-water inequality.....feet.....		1.0	0.7
Tropic higher low-water interval.....hours.....	1.95a	12.54a	Tropic low-water inequality.....feet.....		0.3	0.1
Tropic lower low-water interval.....hours.....	2.42b	11.85b	Diurnal high-water inequality.....feet.....		0.3	0.3
Tropic range.....feet.....	4.9	3.8	Diurnal low-water inequality.....feet.....		0.2	0.1

NOTE.—For reference to the above table, see p. 11.

TABLE 105.—*Current data, Hudson River*

[Referred to times of high water and low water at the Battery, New York City]

OBSERVATIONS BY MAXWELL WOODHULL, 1854

Station no.	Location (off place named)	Observations				Slack	Flood strength			Flood duration	Slack	Ebb strength			Ebb duration	Mean current hour
		Date	Period	Method	Depth		Time	Direction (true)	Velocity			Time	Direction (true)	Velocity		
Wd 1	Fulton St., New York, 40°42'55", 74°01'17"	June 27-28, 1854	Days			Hours after LW	Hours after HW	°	Knots	Hours after HW	Hours after LW	°	Knots	Hours after LW	Hours after HW	
Wd 2	Charlton St., New York, 40°43'43", 74°01'07"	June 29-30, 1854	1	-----	8	3.45	-0.01	24	1.6	5.52	2.91	0.48	195	2.1	6.90	1.17
Wd 3	Castle Point, Hoboken, 40°44'48", 74°00'01"	July 1-2, 1854	1	-----	8	3.78	0.01	20	1.2	5.07	2.79	-0.27	202	2.2	7.35	1.04
Wd 4	32d St., New York, 40°45'29", 74°00'42"	July 5-6, 1854	1	-----	8	4.43	1.02	18	1.6	4.65	3.02	0.56	227	2.5	7.77	1.72

OBSERVATIONS BY RICHARD WAINWRIGHT, 1855

Wa 1 ¹ (R 42)	Spuiten Duyvil, 40°52'39", 73°55'47"	Aug. 3, 1855	1/2	-----	4.28	1.00	16	1.4	4.60	2.91	0.20	173	2.5	7.73	1.58
Wa 2 ¹ (R 38)	Fort Washington Point, 40°51'01", 73°57'02"	Aug. 5-6, 1855	1/2	-----	3.81	0.46	27	1.0	5.25	3.00	0.39	202	2.4	7.17	1.37
Wa 3	13th St., New York, 40°49'11", 73°57'48"	Aug. 17-18 1855	1	-----	5.03	2.00	38	0.6	4.04	3.01	1.14	198	2.2	8.38	2.25
Wa 4	27th St., Pier no. 66, New York, 40°45'12", 74°00'40"	Sept. 4, 1855	1/2	-----	3.36	-1.00	38	1.0	4.50	1.80	0.89	195	1.3	7.92	0.72
Wa 5	55th St., New York, 40°46'18", 73°59'59"	Sept. 6-7, 1855	1/2	-----	2.96	0.40	49	1.4	6.39	3.29	0.06	202	2.6	6.03	1.14
Wa 6	Castle Point, Hoboken, 40°44'39", 74°01'15"	Sept. 7-8, 1855	1/2	-----	3.57	0.16	353	1.8	5.49	3.00	0.29	179	2.0	6.93	1.21
Wa 7	14th St., Pier no. 56, New York, 40°44'36", 74°00'46"	Sept. 11, 1855	1/2	-----	3.03	0.38	23	1.0	5.36	2.33	-0.81	183	1.4	7.06	0.69
Wa 8	10th St., Pier no. 45, New York, 40°43'58", 74°00'52"	Sept. 15-16, 1855	1/2	-----	3.39	-0.67	18	0.8	4.67	2.00	-1.69	173	2.1	7.75	0.22
Wa 9	D.L. & W.R.R. ferry, Jersey City, 40°43'59", 74°01'28"	Sept. 20, 1855	1	-----	4.28	-0.27	15	0.8	3.24	1.46	-0.49	186	2.1	9.18	0.70
Wa 10	Day's Point, N.J., 40°46'17", 74°00'30"	Sept. 24, 1855	1/2	-----	2.63	0.33	29	1.5	6.19	2.76	-0.60	196	1.7	6.23	0.72
Wa 11	Cortlandt St., New York, 40°42'48", 74°01'08"	Sept. 26, 1855	1/2	-----	2.66	-0.64	29	1.3	5.50	2.10	-0.64	190	1.6	6.92	0.33
Wa 12	Grand St., Jersey City, 40°42'52", 74°01'49"	Sept. 28-29, 1855	1/2	-----	2.19	-0.92	19	1.4	5.83	1.96	-0.49	168	1.8	6.59	0.14

OBSERVATIONS BY HENRY MITCHELL, 1858 TO 1873

Mt 1-U	41st St., New York, 41°45'50", 74°00'24"	Sept. 4-5, 1858	1	Pole	8	3.13	-0.15	27	1.4	5.88	2.95	-0.01	212	2.2	6.54	0.94
Mt 1	95th St., New York, 40°47'50", 73°58'50"	Sept. 26-27, 1871	1	do	6	3.00	0.35	20	1.3	6.01	2.95	0.00	222	1.5	6.41	1.03
Mt 3	Dobbs Ferry, 41°00'56", 73°53'10"	Sept. 5-6, 1871	1	do	6	5.30	1.05	8	1.7	5.01	4.25	1.20	194	1.3	7.41	2.41
Mt 4	Tarrytown, 41°04'47", 73°52'47"	Sept. 6-8, 1871	1	do	6	3.90	1.35	341	1.7	7.03	4.87	1.40	178	1.3	5.39	2.34
Mt 5	Croton Point, 41°09'44", 73°54'29"	Sept. 8-9, 1871	1/2	do	6	4.40	-----	-----	-----	5.21	3.55	1.30	184	1.5	7.21	2.05
Mt 6	Verplanck, 41°14'42", 73°58'16"	Sept. 9-23, 1871	1	do	6	4.70	1.55	359	0.9	6.83	5.47	2.00	159	0.9	5.59	2.89
Mt 7	Iona Island, 41°18'07", 73°58'00"	Sept. 11-22, 1871	1	do	6	5.90	2.15	330	0.7	4.83	4.67	2.15	136	1.4	7.59	3.18
Mt 8	Cow Hook, 41°20'56", 73°57'37"	Sept. 12-22, 1871	1	do	6	5.60	2.25	27	0.9	5.43	4.97	1.90	190	1.5	6.99	3.14
Mt 9	Cold Spring, 41°24'56", 73°57'51"	Sept. 13-15, 1871	1	do	6	5.70	2.25	342	1.1	5.23	4.87	2.50	173	1.1	7.19	3.29
Mt 10	New Windsor, 41°28'22", 74°00'20"	Sept. 14-20, 1871	1	do	6	5.60	2.95	348	0.9	5.83	5.37	2.10	212	1.3	6.59	3.46
Mt 11	Low Point, 41°33'23", 73°58'32"	Sept. 19-20, 1871	1	do	6	5.50	2.75	40	0.9	6.03	5.47	2.10	232	0.9	6.39	3.41
Mt 12	Verplanck, 41°37'42", 73°57'04"	Sept. 18-19, 1871	1	do	6	5.70	2.45	352	1.0	5.73	5.37	3.30	183	0.6	6.69	3.66
Mt 13	Poughkeepsie, 41°42'15", 73°56'37"	Sept. 18, 1871	1/2	do	6	5.70	1.95	351	0.8	6.03	5.67	3.40	183	0.8	6.39	3.64
Mt 14	22d St., New York, 40°45'03", 74°00'58"	Sept. 27, 1871	1/2	do	6	2.71	-----	-----	-----	5.91	2.56	-0.39	175	1.6	6.51	0.59
Mt 15	42d St., New York, 40°45'50", 74°00'20"	Sept. 13-14, 1872	1	do	5	3.51	-0.14	20	0.9	4.61	2.06	-0.39	206	2.5	7.81	0.72
Mt 16	41st St., New York, 40°45'52", 74°00'32"	Sept. 19-20, 1872	1	do	5	3.51	0.16	42	1.5	5.41	2.86	-0.09	214	2.7	7.01	1.07
Mt 17	Weehawken, N.J., 40°45'58", 74°00'53"	Sept. 17, 1872	1	do	5	2.81	-0.14	30	1.2	6.41	3.16	-0.59	208	1.4	6.01	0.77
Mt 18	The Battery (near east shore) New York, 40°42'19", 74°01'16"	Sept. 17, 1872	1/2	do	5	-----	-0.24	0	1.4	2.26	-0.39	187	1.8	-----	0.49	
Mt 19	The Battery (midstream) New York, 40°42'22", 74°01'35"	Sept. 17, 1872	1/2	do	5	-----	-0.04	8	1.4	-----	2.56	-0.79	194	1.8	-----	0.53
Mt 20	Communipaw Ferry, Jersey City, 40°42'14", 74°01'59"	Sept. 21, 1872	1/2	do	5	3.31	-1.04	11	1.1	5.91	3.16	-0.49	200	1.1	6.51	0.69
Mt 21	Morris St., New York, 40°42'31", 74°01'13"	Sept. 2, 1873	1/2	do	6	2.71	-0.14	22	2.1	6.31	2.96	-0.09	188	2.1	6.11	0.82
Mt 22	Communipaw Ferry, Jersey City, 40°42'35", 74°01'53"	Aug. 22, 1873	1	do	6	3.11	-0.84	15	1.1	5.41	2.46	-0.09	199	1.9	7.01	0.62
Mt 23	Duane St., New York, 40°43'07", 74°01'04"	Sept. 1-2, 1873	1	do	6	2.61	-0.24	12	2.0	6.41	2.96	-0.29	188	1.6	6.01	0.72
Mt 24	Bay St., Jersey City, 40°43'11", 74°01'44"	Aug. 22-23, 1873	1	do	6	2.81	-0.54	12	1.1	5.21	1.96	-0.19	191	1.5	7.21	0.47
Mt 25	Charlton St., New York, 40°43'43", 74°01'04"	Aug. 29-Sept. 1, 1873	1	do	6	3.61	0.26	18	2.2	5.71	3.26	0.51	192	1.8	6.71	1.37
Mt 26	Erie R.R. piers, Jersey City, 40°43'44", 74°01'38"	Aug. 23-25, 1873	1	do	6	3.21	-0.34	4	1.1	4.61	1.76	-0.19	186	2.1	7.81	0.57
Mt 27	Bank St., New York, 40°44'11", 74°00'54"	Aug. 29, 1873	1/2	do	6	4.11	0.46	9	1.6	5.11	3.16	0.31	176	1.6	7.31	1.47
Mt 28	2d St., Hoboken, 40°44'16", 74°01'26"	Aug. 25-27, 1873	1	do	6	3.31	-0.14	20	1.1	4.41	1.66	0.11	198	1.9	8.01	0.69
Mt 29	Castle Point, Hoboken, 40°44'40", 74°01'08"	Aug. 28, 1873	1/2	do	6	3.91	0.16	8	1.1	5.11	2.96	0.51	188	1.7	7.31	1.34

See footnotes at end of table.

TABLE 105.—*Current data, Hudson River—Continued*

OBSERVATIONS BY H. L. MARINDIN, 1885

Station no.	Location (off place named)	Observations				Slack	Flood strength			Flood duration	Ebb strength			Ebb duration	Mean current hour	
		Date	Period	Method	Depth		Time	Direction (true)	Velocity		Time	Direction (true)	Velocity			
M 1	39th St., New York (midstream), 40°45'45", 74°00'34".	Aug. 11-12, 1885.	Days 3	Meter...	Feet 7	Hours after LW 3.71	Hours after HW 0.06	° 30	Knots 1.7	Hours 5.41	Hours after HW 3.06	Hours after LW 0.01	° 216	Knots 2.9	Hours 7.01	Hours 1.17
M 2	39th St., New York (west side of river), 40°45'53", 74°00'51".	Aug. 11, 1885.	½ do.		5	2.91	-----	-----	-----	5.61	2.46	-1.09	-----	1.9	6.81	0.39
M 3	39th St., New York (east side of river), 40°45'39", 74°00'22".	do.	½ do.		5	-----	-----	-----	-----	-----	1.86	-0.09	-----	1.8	-----	0.34
M 4	Dobbs Ferry (midstream), 41°00'46", 73°53'24".	Aug. 19-21, 1885.	1 do.		5	4.70	1.25	-----	2.8	5.21	3.85	1.10	-----	2.2	7.21	2.18
M 5	Dobbs Ferry (450 yards from east shore), 41°00'43", 73°53'08".	Aug. 20-21, 1885.	1 do.		5	4.30	1.15	-----	2.6	5.51	3.75	0.60	-----	1.8	6.91	1.91
M 6	Dobbs Ferry (800 yards from west shore), 41°00'48", 73°53'41".	Aug. 20, 1885.	½ do.		5	4.80	1.55	-----	2.2	6.03	4.77	-----	-----	-----	6.39	2.62
M 7	Dobbs Ferry (500 yards from west shore), 41°00'50", 73°53'51".	do.	½ do.		5	4.50	1.65	-----	2.0	6.43	4.87	-----	-----	-----	5.99	2.59
M 8	Dobbs Ferry (200 yards from west shore), 41°00'52", 73°54'01".	Aug. 19-21, 1885.	1 do.		5	3.81	0.56	-----	1.7	5.71	3.46	0.81	-----	1.7	6.71	1.62

OBSERVATIONS BY J. B. BOUTELLE, 1901

B 1	Ossining, 41°09'06", 73°53'56"	Sept 9-16, 1901	1	Pole...	5	4.30	1.45	3.46	1.0	6.63	4.87	1.30	166	1.4	5.79	2.44
B 2	Peekskill, 41° 17'27", 73°57'04"	Oct. 21, 1901	½ do.		5	6.00	-----	-----	5.53	5.47	2.70	166	1.7	6.89	3.69	

OBSERVATIONS BY ISAAC WINSTON, 1919

W 1	Spuyten Duyvil, 40°52'55", 73°55'47"-----	Aug. 25-27, 1919-----	2	Pole----- Meter----- do----- do-----	7 8 20 32	4.08 3.92 0.45 0.17	0.59 0.45 0.17 0.17	32	1.64 1.63 5.52 1.48	5.39 5.52 3.38 5.70	3.41 3.48 0.91 3.28	0.61 0.44 0.42 0.67	201	2.17 2.07 1.38 0.83	7.03 6.90 6.72 6.02	1.63 1.62 1.39 1.12
W 2	Tubby Hook 40°52'29", 73°56'17"-----	Aug. 28-30, 1919-----	2	Pole----- Meter----- do----- do-----	7 7 17 27	3.14 3.32 0.08 2.94	-0.01 -0.08 -0.26 -0.53	30	1.75 1.67 6.22 1.53	6.40 3.48 3.48 6.61	3.48 0.42 0.42 3.51	0.44 -0.06 -0.06 -0.44	206	2.04 1.97 1.50 1.07	6.02 6.20 5.82 5.81	1.22 1.24 0.98 0.83
W 3 ¹ (R 37)	Fort Washington Point, 40°51'03", 73°57' 08".	Sept. 2-4, 1919-----	2	Pole----- Meter----- do----- do-----	7 8 21 33	4.19 3.72 0.17 3.59	0.19 0.17 0.50 0.39	17	2.07 1.84 1.52 0.89	5.28 5.52 5.68 5.87	3.41 3.18 3.21 3.13	0.54 0.57 0.97 0.12	206	3.11 2.74 2.40 1.61	7.14 6.90 6.74 6.55	1.54 1.37 1.52 1.20
W 4	135th St., New York, 40°49'28", 73°57'48"-----	Sept. 8-10, 1919-----	2	Pole----- Meter----- do----- do-----	7 10 24 39	3.74 3.42 0.40 3.00	0.22 0.40 0.02 0.12	16	2.03 2.09 1.90 1.50	5.38 5.78 6.28 6.38	3.06 3.14 3.22 3.16	0.17 0.19 0.14 -0.19	193	2.04 2.07 1.53 0.95	7.04 6.64 6.14 6.04	1.26 1.24 1.05 0.94
W 5	12th St., New York, 40° 44'29", 74°00'09"-----	Sept. 10-11, 1919-----	2½	Pole----- Meter----- do----- do-----	7 12 30 48	3.32 3.52 0.08 3.42	-0.53 -0.08 -0.06 -0.06	14	1.16 1.16 1.54 1.38	5.20 5.20 5.56 5.75	2.46 2.66 2.92 2.91	----- ----- ----- -----	-----	7.22 7.22 6.86 6.87	0.66 0.95 1.01 0.94	
W 5A	28th St., New York, 40°45'20", 70°00'51"-----	Sept. 15-17, 1919-----	2	Pole----- Meter----- do----- do-----	7 10 24 38	3.47 3.82 0.39 3.47	0.39 0.39 0.37 0.27	16	1.60 1.96 2.14 1.60	5.65 5.42 5.60 5.57	3.06 3.18 3.03 2.98	-0.19 -0.06 -0.03 0.11	204	2.26 2.30 1.92 1.42	6.77 7.00 6.82 6.85	1.14 1.29 1.17 1.16
W 7	Fulton St., New York, 40°42'53", 74°01' 27".	Sept. 22-23, and Oct. 6-7, 1919.	2	Pole----- Meter----- do----- do-----	7 9 22 35	3.40 3.44 0.06 3.12	-0.06 -0.03 -0.03 -0.06	11	1.73 1.73 5.76 1.37	5.50 5.50 2.94 5.90	2.91 2.88 -0.33 2.96	-0.21 -0.33 -0.41 -0.26	183	2.26 2.36 1.69 1.10	6.85 6.92 6.66 6.52	1.00 0.94 0.89 0.90
W 9	The Battery, New York, 40°42'09", 74°01' 44".	Sept. 30, Oct. 20-21, and Nov. 3-4, 1919.	2	Pole----- Meter----- do----- do-----	7 8 20 32	3.41 3.39 0.03 2.73	-0.30 -0.03 -0.03 -0.35	21	1.59 1.56 1.92 1.58	5.39 5.61 6.43 6.44	2.74 2.94 3.10 2.97	0.04 -0.06 -0.16 -0.15	199	2.37 2.11 1.46 1.04	7.03 6.81 5.99 5.98	0.93 1.02 0.87 0.72

See footnotes at end of table.

TABLE 105.—*Current data, Hudson River—Continued*
OBSERVATIONS BY H. C. DENSON, 1922

Station no.	Location (off place named)	Observations				Slack	Flood strength			Flood duration	Slack	Ebb strength			Ebb duration	Mean current hour		
		Date	Period	Method	Depth		Time	Direction	Velocity			Time	Direction	Velocity				
D 1	Riverdale (west side of river), 40°54'28", 73°55'35".	July 16-19, and Aug. 27-28, 1922.	3½ Days	Pole.....	7	Hours after HW	4.18	0.47	°	6	1.09	4.70	2.82	0.64	206	1.85	7.72	1.48
				Meter.....	4	4.25	0.60	1.45	4.99	3.18	0.71	2.22	7.43	1.64
				do.....	11	3.82	0.40	1.49	5.27	3.03	0.51	1.96	7.15	1.40
				do.....	18	3.32	-0.30	1.18	5.53	2.79	0.18	1.24	6.89	0.96
				do.....														
D 2	Riverdale (midstream), 40°54'25", 73°55'18".	July 15-21, and Aug. 27-28, 1922.	6	Pole.....	7	4.67	1.45	15	1.32	5.21	3.82	1.20	193	1.89	7.21	2.24		
				Meter.....	8	4.75	1.43	.....	1.56	5.18	3.87	1.27	.....	.....	2.07	7.24	2.29
				do.....	20	3.77	0.45	.....	1.52	6.18	3.89	0.77	.....	.....	1.57	6.24	1.68
				do.....	32	2.81	-0.31	.....	1.12	6.69	3.44	-0.07	.....	.....	1.05	5.73	0.92
D 3	Riverdale (east side of river), 40°54'17", 73°55'03".	July 16-19, and Aug. 27-28, 1922.	3½	Pole.....	7	4.17	1.35	11	1.59	5.51	3.62	0.89	210	2.06	6.91	1.96		
				Meter.....	10	4.08	1.27	.....	1.63	5.56	3.58	0.75	.....	.....	1.89	6.86	1.88
				do.....	26	3.47	0.91	.....	1.78	6.57	3.98	0.63	.....	.....	1.50	5.85	1.70
				do.....	42	3.11	-0.23	.....	1.31	6.69	3.74	0.13	.....	.....	1.05	5.73	1.14
D 4	Spuyten Duyvil (west side of river), 40°52'56", 73°56'16".	July 19-20, 1922.....	1½	Pole.....	7	4.43	0.90	18	1.17	5.35	3.72	1.25	213	1.79	7.07	2.03		
				Meter.....	4	4.53	0.96	.....	1.49	4.96	3.45	0.85	.....	.....	2.30	7.44	1.90
				do.....	11	3.83	0.20	.....	1.42	5.58	3.35	0.55	.....	.....	1.52	6.84	1.44
				do.....	18	2.73	-0.24	.....	1.09	6.52	3.19	0.10	.....	.....	0.94	5.90	0.90
D 5 ¹ (R 43)	Spuyten Duyvil (east side of river), 40°52'47", 73°55'44".	July 20-21, 1922.....	½	Pole.....	7	5.18	1.28	31	1.74	4.80	3.92	1.75	194	2.09	7.62	2.49		
				Meter.....	10	4.58	.....	.....	.....	.....	.....	1.25	.....	.....	2.24	.....	2.45
				do.....	24	3.98	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.96	
D 7	Linwood, 40°51'28", 73°56'58"	July 21-23, 1922.....	2	Pole.....	7	3.76	0.38	30	1.70	5.77	3.47	0.53	214	2.02	6.65	1.49		
				Meter.....	9	3.66	0.31	.....	1.81	6.07	3.67	0.53	.....	.....	2.05	6.35	1.50
				do.....	22	3.16	-0.07	.....	1.62	6.34	3.44	0.30	.....	.....	1.52	6.08	1.17
				do.....	35	2.78	-0.19	.....	1.34	6.38	3.10	-0.17	.....	.....	1.11	6.04	0.84
D 8	Fort Washington Point, 40°51'05", 73°57'07".	July 21-23, 1922.....	2	Pole.....	7	4.06	0.35	5	1.16	5.22	3.22	0.65	219	1.94	7.20	1.53		
				Meter.....	7	3.86	0.01	.....	1.36	5.42	3.22	0.42	.....	.....	2.07	7.00	1.34
				do.....	18	3.48	-0.27	.....	1.37	5.52	2.94	0.12	.....	.....	1.83	6.90	1.02
				do.....	29	3.23	-0.45	.....	0.88	5.47	2.64	-0.08	.....	.....	0.93	6.95	0.71
D 9 ^a	75th St., New York (midstream), 40°47'08", 73°59'35".	July 16-19 and Aug. 26-27, 1922.	3½	Pole.....	7	4.13	0.53	27	1.75	5.06	3.13	0.72	211	2.53	7.36	1.58		
				Meter.....	11	4.09	0.64	.....	1.81	5.15	3.18	0.65	.....	.....	2.58	7.27	1.60
				do.....	27	3.38	0.24	.....	2.11	6.00	3.32	0.27	.....	.....	2.17	6.42	1.26
				do.....	43	2.41	-0.46	.....	1.62	6.57	2.92	0.06	.....	.....	1.63	5.85	0.69
D 9c	74th St., New York (west side of river), 40°47'09", 73°50'44".	Aug. 26-27, 1922.....	½	Pole.....	7	3.98	0.33	37	1.49	4.60	2.52	-0.70	215	2.21	7.82	0.90		
				Meter.....	10	3.58	0.33	38	1.76	5.40	2.92	-0.85	216	2.24	7.02	0.95		
				do.....	24	3.08	0.23	29	1.95	6.00	3.02	-1.10	218	1.72	6.42	0.76		
				do.....	38	2.68	0.13	36	1.24	6.40	3.02	-1.10	213	1.12	6.02	0.64		
D 9e	74th St., New York (east side of river), 40°47'01", 73°59'22".	do.....	½	Pole.....	7	3.58	.....	41	1.00	4.90	2.42	-0.45	207	1.80	.....	1.10	
				Meter.....	7	3.58	-0.17	36	1.10	5.70	2.42	-0.55	207	2.13	7.52	0.78		
				do.....	17	2.78	-0.67	36	1.39	5.11	3.15	0.05	213	1.68	6.72	0.42		
				do.....	27	2.48	-0.97	27	1.12	6.20	2.62	-1.00	216	0.99	6.22	0.24		
D 10	35th St., New York, 40°45'42", 74°00'49".	July 21-23, 1922.....	1½	Pole.....	7	3.76	0.36	11	1.26	5.32	3.02	0.32	207	2.51	7.10	1.32		
				Meter.....	9	3.40	0.53	.....	1.25	5.65	2.99	0.15	.....	.....	2.10	6.77	1.22
				do.....	23	3.10	0.53	.....	1.55	6.11	3.15	0.05	.....	.....	1.98	6.31	1.16
				do.....	37	2.95	-0.52	.....	1.19	6.03	2.92	0.15	.....	.....	1.72	6.39	0.83
D 11	34th St., New York, 40°45'33", 74°00'39".	do.....	1	Pole.....	7	4.05	0.56	16	1.46	4.96	2.95	0.28	205	2.36	7.46	1.42		
				Meter.....	10	4.68	0.78	.....	1.44	4.60	3.22	-0.05	.....	.....	2.36	7.82	1.62
				do.....	25	3.88	0.78	.....	1.39	5.30	3.12	-0.05	.....	.....	1.52	7.12	1.39
				do.....	40	3.38	0.68	.....	1.30	5.65	2.97	-0.45	.....	.....	0.98	6.77	1.10
D 12	Castle Point, 40°44'41", 74°01'00".	July 19-21, 1922.....	1	Pole.....	7	5.08	0.88	358	0.67	3.63	2.65	0.85	178	2.64	8.79	1.82		
				Meter.....	14	4.78	1.18	.....	0.92	4.07	2.79	0.55	.....	.....	2.42	8.35	1.78
				do.....	36	3.53	0.98	.....	1.38	5.78	3.25	-0.15	.....	.....	1.43	6.64	1.38
				do.....	50	2.48	0.53	.....	0.87	6.40	2.82	-0.45	.....	.....	1.22	6.02	0.80
D 13	Communipaw Ferry, Jersey City, 40°32'30", 74°01'50".	July 23-27 and Aug. 25-26, 1922.	3½	Pole.....	7	2.72	-0.90	14	0.66	5.18	1.84	-0.79	192	1.76	7.24	0.18		
				Meter.....	6	2.75	-1.35	.....	0.72	4.91	1.60	-1.13	.....	.....	1.82	7.51	12.34
				do.....	15	2.66	-1.22	.....	0.72	5.32	1.92	-0.82	.....	.....	1.47	7.10	0.09
				do.....	24	2.56	-0.09	.....	0.72	5.72	2.22	-0.77	.....	.....	1.11	6.70	0.44
D 14	The Battery, New York, 40°42'27", 74°01'35".	July 15-Aug. 6, Aug. 11-18, and Aug. 25-31, 1922.	31	Pole.....	7	3.69	0.03	17	1.19	5.06	2.69	0.19	194	2.22	7.36	1.11		
				Meter.....	9	3.66	0.01	.....	1.20	5.18	2.78	0.15	.....	.....	2.13	7.24	1.11
				do.....	24	2.87	-0.05	.....	1.56	6.23	3.04	-0.22	.....	.....	1.52	6.19	0.87
				do.....	38	2.15	-0.42	.....	1.30	6.90	2.99	-0.63	.....	.....	1.05	5.52	0.48
D 15	Morris St., New York, 40°42'29", 74°01'19".	July 23-25 and Aug. 25-26, 1922.	3	Pole.....	7	3.06	0.07	359	1.42	5.52	2.52	-0.28	183	2.20	6.90	0.80		
				Meter.....	11	3.01	-0.27	.....	1.56	5.62	2.57	-0.28	.....	.....	1.93	6.80	0.72
				do.....	27	2.58	-0.27	.....	1.57	6.19	2.71	-0.28	.....	.....	1.50	6.23	0.64
				do.....	43	2.11	-0.65	.....	1.35	6.74	2.79	-0.42	.....	.....	1.11	5.68	0.42
D 73	34th St. (Pier No. 74), New York, 40°45'30", 74°00'29".	Aug. 28-29, 1922.....	½	Pole.....	7	4.08	-0.17	13	0.27	4.10	2.12	-0.25	217	1.22	8.32	0.90		
				Meter.....	9	3.88	-0.87	321	0.47	4.30	2.12	-0.65	214	1.17	8.12	0.58		
				do.....	23	3.18	-0.97	27	0.62	.....	.....	-0.85	213	0.72	.....	0.45	
				do.....	37	3.08	-0.47	36	0.72	.....	.....	-0.75	212	0.62	.....	0.62	

See footnotes at end of table.

TABLE 105.—*Current data, Hudson River—Continued*

OBSERVATIONS BY H. C. DENSON, 1922—Continued

Station no.	Location (off place named)	Observations				Slack	Flood strength			Flood duration	Slack	Ebb strength			Ebb duration	Mean current hour	
		Date	Period	Method	Depth		Time	Direction (true)	Velocity			Time	Direction (true)	Velocity			
D 74	25th St. (Pier No. 65), New York, 40°45' 08", 74°00'39".	Aug. 28-29, 1922.....	Days	Pole.....	7	Hours after LW	4.08	0.67	17	Knots	Hours after HW	4.00	2.02	0.35	197	0.87	8.42 0.90
				Meter.....	7	4.18	0.03	29	0.57	3.90	2.02	0.45	204	0.67	8.52 1.13		
				do.....	18	3.68	-0.77	18	0.87	4.40	2.02	-0.05	204	0.37	8.02 0.68		
				do.....	29	3.58	-1.07	4	0.92	4.50	2.02	-0.45	234	0.47	7.92 0.48		
D 75	Weehawken Cove (Scan.-Amer. Line Pier), 40°45'18", 74°01'13".	do.....	Days	Meter.....	7	3.78	-0.07	1	0.50	4.10	1.82	-0.15	206	1.75	8.32 0.80		
				do.....	18	3.38	-0.07	11	1.05	5.00	2.32	-0.05	202	1.30	7.42 0.85		
				do.....	28	2.88	-0.87	10	0.90	5.40	2.22	-0.05	227	1.35	7.02 0.50		
D 76	13th St. (Pier No. 54), New York, 40°44' 30", 74°01'48".	Aug. 29, 1922.....	Days	Pole.....	7	2.68	-0.97	15	0.41	4.50	1.12	-0.80	187	1.21	7.92 12.38		
				Meter.....	9	3.08	-0.47	4	1.01	5.40	2.42	-0.75	207	1.29	7.02 0.53		
				do.....	22	2.68	-0.97	351	1.01	5.80	2.42	-0.65	204	0.98	6.62 0.33		
				do.....	35	2.28	-1.67	330	0.96	6.30	2.52	-0.85	203	0.76	6.12 0.08		
D 77	Bethune St. (Pier No. 50), New York, 40°44'14", 74°00'49".	Aug. 29-30, 1922.....	Days	Pole.....	7	4.18	.....	.....	.....	3.00	1.12	-0.85	204	1.62	9.42 0.45
				Meter.....	7	3.78	-0.07	16	0.85	4.30	2.02	0.65	202	1.75	8.12 1.05		
				do.....	18	2.98	-0.07	20	1.03	5.40	2.32	0.35	214	1.13	7.02 0.85		
				do.....	28	1.78	-0.47	13	1.07	6.60	2.32	0.05	192	0.82	5.82 0.38		
D 78	1st St. (Army Transport Pier), Hoboken, 40°44'11", 74°01'28".	Aug. 29, 1922.....	Days	Pole.....	7	3.68	.....	.....	.....	4.80	2.42	0.25	191	1.19	7.62 1.08
				Meter.....	9	3.68	-0.47	6	0.58	4.50	2.12	-0.25	173	1.58	7.92 0.73		
				do.....	22	2.88	-0.47	34	0.76	5.40	2.22	-1.15	150	0.86	7.02 0.33		
				do.....	35	2.58	-0.17	13	1.06	5.80	2.32	-1.65	170	0.66	6.62 0.23		
D 79	Beach St. (Pier No. 26), New York, 40°43'18", 74°01'00".	Aug. 30, 1922.....	Days	Pole.....	7	3.28	-0.77	337	0.83	5.75	2.97	0.85	189	1.03	6.67 1.06		
				Meter.....	9	3.38	0.43	0	0.84	5.50	2.82	0.05	206	1.29	6.92 1.13		
				do.....	18	3.08	0.23	9	1.18	6.00	3.02	0.05	224	0.73	6.42 1.05		
				do.....	28	2.78	-0.97	7	0.96	6.30	3.02	-0.05	191	0.51	6.12 0.65		
D 80	Cortlandt St. (Pier No. 13), New York, 40°42'48", 74°01'08".	do.....	Days	Pole.....	7	3.28	-0.17	14	0.44	4.80	2.02	.....	.....	.....	7.62 0.62
				Meter.....	9	3.18	-0.17	29	1.15	5.60	2.72	-1.05	227	1.20	6.82 0.63		
				do.....	22	2.78	-0.77	20	1.38	6.00	2.72	-0.85	237	0.63	6.42 0.43		
				do.....	35	1.78	-1.77	24	1.28	7.00	2.72	-1.05	217	0.58	5.42 12.30		
D 81	Grand St. (Isthmian Pier B), Jersey City, 40°42'51", 74°01'52".	do.....	Days	Pole.....	7	3.08	-0.37	70	0.11	5.80	2.82	-0.45	165	1.11	6.62 0.76		
				Meter.....	8	2.98	-0.37	28	0.41	5.00	1.92	-0.45	165	1.01	6.92 0.30		
				do.....	20	2.08	-0.97	5	0.93	5.50	2.12	-0.45	135	0.93	6.62 0.20		

OBSERVATIONS BY H. E. FINNEGAN, 1929

F 1 (R 41)	Riverdale (east side of river) 40°53'44", 73°55'16".	Aug. 29-30, 1929.....	1	Pole.....	5	4.60	1.15	15	1.32	5.04	3.58	1.36	210	2.12	7.38 2.13
				Meter.....	11	4.35	1.00	.....	1.62	5.29	3.58	1.01	.....	2.17	7.13 1.94
				do.....	27	3.55	0.70	.....	1.88	6.44	3.93	0.81	.....	2.03	5.98 1.71
				do.....	43	3.15	0.50	.....	1.77	6.84	3.93	0.71	.....	1.97	5.58 1.53
F 2 (R 40)	Riverdale (midstream), 40°53'47", 73°55'28".	Aug. 29-30 and Sept. 19-20, 1929.	2	Pole.....	7	4.00	0.70	30	1.48	5.22	3.16	0.66	197	2.06	7.20 1.50
				Meter.....	7	4.03	0.62	.....	1.56	5.41	3.38	0.81	.....	2.24	7.01 1.67
				do.....	15	3.53	0.32	.....	1.47	6.01	3.48	0.59	.....	1.67	6.41 1.44
				do.....	15	3.80	0.60	22	1.23	5.54	3.28	0.61	202	1.53	6.88 1.53
F 3 (R 39)	Riverdale (west side of river) 40°53'52", 73°55'52".	Aug. 29-30, 1929.....	1	Pole.....	7	4.05	0.70	26	1.14	4.39	2.38	0.16	197	1.94	8.03 1.28
				Meter.....	7	3.95	0.45	.....	1.19	4.44	2.33	0.16	.....	1.84	7.98 1.18
				do.....	16	2.85	-0.20	.....	1.05	5.04	2.43	0.06	.....	1.05	6.78 0.74
F 4	Dobbs Ferry (east side of river) 41°00'56", 73°52'57".	Aug. 30-31, 1929.....	1	Pole.....	5	4.30	0.55	16	1.32	4.84	3.08	1.61	194	1.92	7.58 1.84
				Meter.....	9	4.10	0.45	.....	1.51	5.29	3.33	1.61	.....	2.01	7.13 1.83
				do.....	22	4.00	-0.05	.....	1.22	5.19	3.13	0.66	.....	1.52	7.23 1.39
				do.....	34	3.75	-0.05	.....	0.93	5.34	3.03	0.11	.....	1.33	7.06 1.17
F 5	Dobbs Ferry (midstream) 41°01'00", 73°53'17".	do.....	1	Pole.....	7	4.30	1.20	15	1.86	5.44	3.68	0.46	188	1.86	6.98 1.87
				Meter.....	8	4.35	1.10	.....	1.86	5.49	3.78	0.56	.....	1.86	6.93 1.91
				do.....	20	3.65	0.60	.....	1.52	6.24	3.83	0.51	.....	1.42	6.18 1.61
				do.....	20	3.65	0.50	22	1.42	6.09	3.68	0.61	199	1.27	6.33 1.57
				do.....	32	3.60	0.45	.....	1.13	6.19	3.73	0.51	.....	1.08	6.23 1.53
F 6	Dobbs Ferry (west side of river) 41°01'04", 73°53'41".	do.....	1	Pole.....	4	3.30	-0.40	12	1.13	5.59	2.83	0.36	184	1.28	6.83 0.98
				Meter.....	7	3.35	-0.75	.....	1.27	5.54	2.83	0.11	.....	1.42	6.88 0.84
				do.....	11	3.30	-0.65	.....	1.17	5.64	2.88	-0.44	.....	1.27	6.78 0.73
F 7	Tarrytown (east side of river), 41°04'40", 73°52'45".	Sept. 3-4, 1929.....	1	Pole.....	7	4.10	0.60	358	0.74	5.79	3.83	1.41	172	1.34	6.63 1.94
				Meter.....	7	4.05	0.60	.....	0.75	5.94	3.93	1.16	.....	1.30	6.48 1.89
				do.....	15	3.95	0.45	.....	0.81	5.84	3.73	0.96	.....	1.06	6.58 1.73
				do.....	24	3.65	0.35	.....	0.79	5.99	3.58	0.46	.....	0.84	6.43 1.47
F 8	Tarrytown (midstream), 41°04'42", 73°53'01".	Sept. 3-4, 19-20, 1929.	2	Pole.....	7	4.23	0.68	4	0.89	5.71	3.88	1.43	180	1.47	6.71 2.01
				Meter.....	9	4.25	0.68	.....	0.94	5.74	3.93	1.49	.....	1.41	6.68 2.05
				do.....	23	3.83	0.65	.....	0.92	6.36	4.13	1.33	.....	1.04	6.06 1.94
				do.....	23	3.90	0.80	355	0.86	6.14	3.98	1.36	184	0.86	6.28 1.97
				do.....	36	3.50	0.80	.....	0.90	6.79	4.23	1.20	.....	0.78	5.63 1.91

See footnotes at end of table.

TABLE 105.—*Current data, Hudson River—Continued*
OBSERVATIONS BY H. E. FINNEGAN, 1929—Continued

Station no.	Location (off place named)	Observations				Slack	Flood strength			Flood duration	Ebb strength			Ebb duration	Mean current hour			
		Date	Period	Method	Depth		Time	Direction (true)	Velocity		Slack	Time	Direction (true)	Velocity				
F 9	Tarrytown (west side of river), 41°04'46", 73°54'06".	Sept. 3-4, 1929	Days	Pole	7	4.00	1.30	332	0.80	6.59	4.53	1.21	148	0.75	5.83	2.22		
				Meter	7	4.05	1.50	332	0.88	6.59	4.58	1.21	148	0.83	5.83	2.20		
				do	15	3.85	1.35	332	0.86	6.99	4.78	1.26	148	0.61	5.43	2.27		
				do	24	3.60	1.50	332	0.81	7.29	4.83	1.26	148	0.41	5.13	2.26		
F 10	Ossining, 41°09'04", 73°53'13".	Sept. 4-5, 1929	1	Pole	5	3.25	-0.50	355	0.45	5.74	2.93	0.06	161	0.35	6.68	0.89		
				Meter	6	3.30	-0.35	355	0.55	5.79	3.03	-0.04	161	0.45	6.63	0.94		
				do	9	3.20	-0.45	355	0.53	5.94	3.08	-0.09	161	0.38	6.48	0.90		
				do	15	3.85	1.35	355	0.86	6.99	4.78	1.26	161	0.41	5.13	2.26		
F 11	Croton Point (west side of river), 41°09'36", 73°55'00".	do	1	Pole	5	4.45	0.70	312	0.40	6.64	4.03	1.96	144	1.20	6.78	2.24		
				Meter	6	4.25	0.60	312	0.69	5.99	4.18	2.01	144	1.29	6.43	2.22		
				do	15	4.20	0.55	312	0.57	6.14	4.28	1.86	144	1.17	6.28	2.18		
				do	24	4.00	0.80	312	0.53	6.74	4.68	1.91	144	0.83	5.68	2.31		
F 12	Croton Point (midstream), 41°09'50", 73°54'34".	do	1	Pole	7	4.30	1.20	303	0.91	5.99	4.23	1.46	157	0.96	6.43	2.26		
				Meter	8	4.50	1.30	303	1.09	6.14	4.58	1.31	157	0.89	6.28	2.38		
				do	20	4.10	1.15	303	0.98	6.69	4.73	1.71	157	1.03	5.73	2.38		
				do	32	4.05	1.15	303	0.85	6.79	4.78	1.86	157	0.70	5.63	2.42		
F 13	Croton Point (east side of river), 41°10'04", 73°54'10".	do	1	Pole	4	3.10	-0.80	322	0.61	5.29	2.33	-0.64	161	0.56	7.13	0.46		
				Meter	7	3.10	-0.85	322	0.68	5.34	2.38	-0.49	161	0.73	7.08	0.49		
				do	10	2.95	-0.90	322	0.61	5.44	2.33	-0.29	161	0.58	6.98	0.48		
				do	34	3.2	-0.90	322	0.70	6.59	5.26	1.89	161	0.58	5.83	2.50		
F 14	Haverstraw, 41°11'55", 73°56'32".	Sept. 5-6, 18-19, 1929	2	Pole	7	5.67	2.50	354	0.69	5.62	5.23	2.26	162	1.09	6.80	3.37		
				Meter	7	5.57	2.65	354	0.78	5.82	5.33	2.23	162	1.06	6.60	3.40		
				do	15	5.17	2.52	354	0.83	6.15	5.26	2.19	162	0.83	6.27	3.24		
				do	24	4.73	2.25	354	0.70	6.59	5.26	1.89	162	0.58	5.83	2.99		
F 15	Verplanck, 41°15'16", 73°58'22".	do	2	Pole	6	5.13	2.10	343	0.72	5.73	4.80	2.06	197	1.37	6.69	2.98		
				Meter	13	5.10	2.12	343	0.92	5.86	4.90	2.09	197	1.32	6.56	3.01		
				do	34	4.90	1.85	343	1.00	6.12	4.96	2.06	197	1.04	6.30	2.90		
				do	53	4.85	1.50	343	0.94	6.07	4.86	2.06	197	0.94	6.35	2.78		

See footnote at end of table.

TABLE 105.—*Current data, Hudson River*—Continued
OBSERVATIONS BY H. E. FINNEGAN, 1929—Continued

Station no.	Location (off place named)	Observations				Slack	Flood strength			Flood duration	Ebb strength			Ebb duration	Mean current hour			
		Date	Period	Method	Depth		Time	Direction (true)	Velocity		Slack	Time	Direction (true)	Velocity				
F 26	Saugerties, 42°03'54", 73°55'42"	Sept. 10-13, 1929	Days 2½	Pole	Feet	Hours after LW	Hours after HW	°	Knots	Hours	Hours after LW	Hours after HW	°	Knots	Hours	Hours		
				Meter	5	7.90	4.12	19	1.39	4.88	6.72	3.75	189	1.75	7.64	5.08		
				Meter	10	7.87	4.20	-	1.57	4.93	6.74	3.87	-	2.01	7.49	5.13		
				do	25	7.73	4.38	-	1.40	5.07	6.74	3.63	-	1.70	7.35	5.08		
				do	40	7.90	4.32	-	1.17	4.94	6.78	3.59	-	1.26	7.48	5.10		
F 27	Catskill Creek Entrance, 42°18'10", 73°51'06"	do	2	Pole	7	8.33	5.52	25	1.48	4.93	7.20	3.89	184	1.88	7.49	5.69		
				Meter	10	8.47	5.42	-	1.51	4.85	7.26	4.03	-	1.83	7.57	5.75		
				do	26	8.43	5.42	-	1.49	5.05	7.42	3.86	-	1.76	7.37	5.74		
				do	41	8.37	5.42	-	1.47	5.11	7.42	4.01	-	1.67	7.31	5.76		
				Pole	5	8.60	5.70	2	1.59	5.54	8.08	5.11	190	1.79	6.88	6.33		
F 28	Four Mile Point, 42°18'14", 73°46'54"	Sept. 13-14, 1929	1	Meter	7	8.50	5.75	-	1.79	5.69	8.13	5.01	-	2.14	6.73	6.30		
				do	18	8.45	5.70	-	1.70	5.74	8.13	5.06	-	2.00	6.68	6.29		
				do	28	8.36	5.65	-	1.50	5.84	8.13	5.01	-	1.65	6.58	6.24		
				Pole	7	9.65	5.60	28	0.91	5.04	8.63	5.56	216	1.16	7.38	6.82		
				Meter	7	9.50	5.55	-	1.04	5.29	8.73	5.91	-	1.19	7.13	6.88		
F 29	H. R. C. R. R. Bridge, 42°30'32", 73°46'28"	do	1	do	12	9.60	5.60	-	0.98	5.14	8.58	5.71	-	1.18	7.28	6.80		
				do	20	9.55	5.35	-	0.98	5.14	8.63	5.86	-	1.16	7.28	6.80		
				Pole	7	10.47	6.05	22	0.30	3.62	8.03	5.81	202	0.86	8.80	7.05		
				Meter	7	10.55	6.18	-	0.30	3.71	8.20	6.21	-	0.86	8.71	7.24		
				do	14	10.50	6.28	-	0.24	3.94	8.38	6.44	-	0.73	8.48	7.36		
F 31	Troy (½ mile south of drawbridge), 42°43'22", 73°41'56"	do	2	Pole	4	-	-	-	-	-	-	-	-	0.68	(?)	-		
				Meter	7	-	-	-	-	-	-	-	-	0.80	-	-		
				do	11	-	-	-	-	-	-	-	-	0.65	-	-		

OBSERVATIONS BY U.S. ENGINEERS. 1832

E 1	Carlisle St. (midstream), New York, 40°42.7', 74°01.5'.	July 22-Aug. 18, 1932.	27	Meter..	10	3.72	0.13	-	1.76	5.15	2.81	0.09	-	2.52	7.27	1.15
				-do-	25	2.92	0.01	-	1.04	6.16	3.02	-0.25	-	1.63	6.26	0.89
E 2	Carlisle St. (west side of river), New York, 40°42.7', 74°01.8'.	July 22-July 29, 1932.	7	-do-	7	3.97	0.09	-	0.74	4.29	2.20	-0.29	-	1.65	8.13	0.96
				-do-	17	3.06	-0.25	-	1.12	5.32	2.32	-0.93	-	1.68	7.10	0.51
E 3	Carlisle St. (east side of river), New York, 40°42.6', 74°01.2'.	July 29-Aug. 4, 1932.	6	-do-	12	2.92	-0.21	-	1.32	5.53	2.39	-0.35	-	1.79	6.89	0.65
				-do-	30	2.44	-0.46	-	1.78	6.44	2.82	-0.61	-	1.30	5.98	0.54
E 4	Carlisle St. (1/4 mile from western shore), New York, 40°42.7', 74°01.7'.	Aug. 4-11, 1932.	7	-do-	48	1.59	-0.55	-	2.09	7.32	2.85	-1.08	-	0.95	5.10	0.16
				-do-	8	3.71	-0.07	-	1.12	4.65	2.30	-0.30	-	2.34	7.77	0.87
E 5	Carlisle St. (1/4 mile from eastern shore), New York, 40°42.7', 74°01.3'.	Aug. 11-18, 1932.	7	-do-	20	3.05	0.16	-	1.43	5.65	2.64	-0.32	-	1.77	6.77	0.84
				-do-	33	2.48	-0.35	-	1.56	6.23	2.65	-0.47	-	1.41	6.19	0.64

OBSERVATIONS BY I. E. RITTENBURG, 1932

R 30	Gansevoort St. (west side of river), New York, $40^{\circ}44.4'$, $74^{\circ}01.3'$.	July 18-20, 1932.....	2	Pole..... Meter..... do..... do.....	7 9 23 36	3.77 3.67 -0.27 3.17 -0.27 2.67 -0.67	-0.37 -0.27 1.60 1.60	25	1.00 0.90 5.52 6.12	4.42 4.92 2.53 2.63	2.13 2.53 -0.03 0.07	-0.03 -0.03 0.17	187	2.70 2.40 7.50 6.90	8.00 0.94 0.86 0.69	0.84
R 31	Gansevoort St. (midstream), New York, $40^{\circ}44.4'$, $74^{\circ}01.1'$.	Aug. 1-3, 1932.....	2	Pole..... Meter..... do..... do.....	7 10 26 42	3.27 3.17 0.13 1.77	0.23 0.13 0.13 0.13	9	1.70 1.70 1.80 1.80	5.52 5.52 6.32 7.32	2.73 2.63 3.03 3.03	-0.03 -0.03 -0.13 -0.43	180	2.40 2.20 6.90 1.40	6.90 2.20 6.10 5.10	1.01 0.94 0.91 0.59
R 32	Gansevoort St. (east side of river), New York $40^{\circ}44.4'$, $74^{\circ}00.9'$.	July 18-20, 1932.....	2	Pole..... Meter..... do..... do.....	6 10 25 40	3.87 3.67 3.17 2.17	0.13 0.13 0.33 -0.17	11	0.90 1.10 1.70 1.90	4.42 4.92 5.92 6.92	2.23 2.53 3.03 3.03	-0.03 -0.03 -0.63 -0.83	178	2.00 1.70 1.20 1.00	8.00 7.50 6.50 5.50	1.01 0.89 0.94 0.51
R 33	57th St. (west side of river), New York, $40^{\circ}46.6'$, $74^{\circ}00.3'$.	July 20-22, 1932.....	2	Pole..... Meter..... do..... do.....	7 7 18 29	3.27 3.27 0.23 2.17	0.13 0.23 0.23 -0.17	36	1.90 1.80 2.00 1.80	5.62 5.52 6.42 7.02	2.83 2.73 3.13 3.13	-0.33 -0.53 -0.53 -1.13	216	2.50 2.30 1.70 1.20	6.80 6.90 6.00 5.40	0.94 0.89 0.86 0.46
R 34	57th St.(midstream), New York, $40^{\circ}46.5'$, $74^{\circ}00.1'$.	July 20-22 and Aug. 29-31, 1932.	4	Pole..... Meter..... do..... do.....	7 10 24 38	3.47 3.67 3.17 2.47	0.43 0.43 0.23 -0.07	31	2.10 2.10 2.20 1.50	5.72 5.52 6.20 6.72	3.13 3.13 3.13 3.13	0.07 0.07 -0.03 -0.43	210	2.60 2.60 2.00 1.40	6.70 6.90 6.40 5.70	1.24 1.29 1.09 0.74

See footnotes at end of table.

TABLE 105.—*Current data, Hudson River—Continued*
OBSERVATIONS BY I. E. RITTENBURG, 1932—Continued

Station no.	Location (off place named)	Observations				Slack	Flood strength			Slack	Ebb strength			Ebb duration	Mean current hour	
		Date	Period	Method	Depth		Time	Direction (true)	Velocity		Time	Direction (true)	Velocity			
R 35	57th St. (east side of river), New York, $40^{\circ}46.4'$, $73^{\circ}59.8'$.	July 20-22, 1932.....	2 Days	Pole.....	7	Hours after LW	Hours after HW	°	Knots	Hours after LW	Hours after HW	°	Knots	Hours	Hours	
				Meter.....	9	3.47	-0.07	34	1.40	5.42	2.83	0.27	209	2.80	7.00	1.09
				do.....	23	3.27	-0.07	.....	1.50	5.82	3.03	0.27	.....	2.40	6.60	1.09
				do.....	36	2.17	-0.17	.....	1.90	6.42	3.03	-0.03	.....	1.80	6.00	0.84
R 36	George Washington Bridge (west side of river), $40^{\circ}51.2'$, $73^{\circ}57.3'$.	June 29-July 1, 1932..	2	Pole.....	7	3.77	0.43	6	1.50	5.82	3.53	0.27	204	2.40	6.60	1.46
R 37 (W 3) ⁴	George Washington Bridge (midstream), $40^{\circ}51.1$, $73^{\circ}57.1'$.	June 29-July 1, and Aug. 20-31, 1932.	4	Pole.....	7	3.57	0.53	9	1.50	5.82	3.33	0.17	212	2.40	6.60	1.36
				Meter.....	8	3.47	0.23	.....	1.60	6.12	3.53	0.27	.....	2.30	6.30	1.34
				do.....	19	3.27	0.33	.....	1.50	5.92	3.13	0.17	.....	1.90	6.50	1.19
				do.....	30	3.37	0.33	.....	1.10	5.72	3.03	0.17	.....	1.50	6.70	1.19
R 38 (Wa 2) ⁴	George Washington Bridge (east side of river), $40^{\circ}51.1'$, $73^{\circ}56.9'$.	June 29-July 1, 1932..	2	Pole.....	7	3.37	0.73	20	2.40	5.82	3.13	0.27	210	2.70	6.60	1.34
				Meter.....	24	3.27	0.53	.....	2.20	6.42	3.63	0.27	.....	2.20	6.00	1.39
				do.....	60	2.67	0.13	.....	1.60	6.52	3.13	0.07	.....	1.10	5.90	0.96
				do.....	96	3.17	0.03	.....	1.40	6.72	3.83	0.07	.....	0.80	5.70	1.49
R 39 (F 3) ⁴	Riverdale (west side of river), $40^{\circ}53.8'$, $73^{\circ}55.9'$.	June 27-29, 1932.....	2	Pole.....	7	4.37	0.03	25	1.20	4.32	2.63	1.07	194	2.10	8.10	1.49
				Meter.....	4	4.27	-0.47	.....	1.40	4.32	2.53	0.97	.....	2.20	8.10	1.29
				do.....	16	3.27	-0.47	.....	1.20	5.82	3.03	-0.03	.....	1.20	6.60	0.91
				do.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
R 40 (F 2) ⁴	Riverdale (midstream), $40^{\circ}53.8'$, $73^{\circ}55.5'$.	June 27-29 and Aug. 29-31, 1932.	4	Pole.....	7	4.17	0.63	17	1.40	5.32	3.43	1.17	202	2.00	7.10	1.81
				Meter.....	6	4.17	1.03	.....	1.30	5.42	3.53	0.97	.....	1.90	7.00	1.89
				do.....	15	3.77	0.13	.....	1.40	5.82	3.53	0.67	.....	1.30	6.60	1.49
				do.....	24	2.27	-0.47	.....	1.00	7.32	3.53	-0.03	.....	0.80	5.10	0.79
R 41 (F 1) ⁴	Riverdale (east side of river), $40^{\circ}53.7'$, $73^{\circ}55.2'$.	June 27-29, 1932.....	2	Pole.....	7	4.07	0.83	24	1.90	5.52	3.53	0.97	199	2.20	6.90	1.81
				Meter.....	11	4.27	1.23	.....	1.60	5.92	4.13	1.37	.....	1.90	6.50	2.21
				do.....	27	3.67	0.63	.....	2.00	6.52	4.13	0.57	.....	1.40	5.90	1.71
				do.....	44	2.27	-0.47	.....	1.70	7.52	3.73	-0.03	.....	1.00	4.90	0.84
R 42 (Wa 1) ⁴	Spuyten Duyvil Creek (south of entrance), $40^{\circ}52.7'$, $73^{\circ}55.7'$.	Aug. 3-5, 1932.....	2	Pole.....	7	3.67	-0.47	50	1.50	4.72	2.33	0.97	214	2.10	7.70	1.09
				Meter.....	8	3.77	-0.27	.....	1.30	4.72	2.43	1.07	.....	2.10	7.70	1.21
				do.....	20	3.57	-0.57	.....	1.50	5.22	2.73	0.87	.....	1.50	7.20	1.11
				do.....	32	3.67	-0.57	.....	1.30	5.92	3.53	-0.03	.....	1.40	6.50	1.11
R 43 (D 5) ⁴	Spuyten Duyvil Creek (north of entrance), $40^{\circ}52.8'$, $73^{\circ}55.6'$.	Aug. 1-3, 1932.....	2	Pole.....	7	3.57	0.23	39	1.60	5.62	3.13	0.57	212	2.10	6.80	1.34
				Meter.....	7	3.27	0.23	.....	1.60	5.92	3.13	0.67	.....	1.90	6.50	1.29
				do.....	10	3.27	-0.17	.....	1.20	5.82	3.03	0.47	.....	1.60	6.60	1.11
				do.....	29	3.17	-0.37	.....	1.00	6.02	3.13	-0.23	.....	1.40	6.40	0.89

¹ Station reoccupied in 1932 with designation as given in parentheses.² Observations by Pettersson meter.³ Observations at station F 31 indicated a continuous ebb current with velocities fluctuating irregularly. Velocities given are averages of largest velocities for each day. The average ebb velocities for the entire period of observations for the 3 depths were 0.37 knot, 0.50 knot, and 0.44 knot, respectively.⁴ Original designation of station during previous observations used on index chart.

NOTE.—For a reference to above table see p. 18.

TABLE 106.—*Adjusted current data, Hudson River*

Locality (midchannel off place named)	Latitude (north)	Greenwich lunisolar intervals						Referred to tides at the Battery				Velocity	
		Slack before flood	Flood strength	Slack before ebb	Ebb strength	Mean current hour		Slack before flood	Flood strength	Slack before ebb	Ebb strength	Flood strength	Ebb strength
The Battery, New York.	40° 42'	Hours 11.00	Hours 1.01	Hours 3.71	Hours 7.43	Hours 1.13		Hours after LW 3.70	Hours after HW 0.07	Hours after LW 2.77	Knots 0.13	1.5	2.3
Jersey City (Pennsylvania railroad ferry)....	40 43	11.02	1.04	3.74	7.50	1.17		3.72	0.10	2.80	0.20	1.5	2.3
New York (Desbrosses St.)....	40 43	11.04	1.08	3.76	7.54	1.20		3.74	0.14	2.82	0.24	1.5	2.3
Jersey City (D. L. & W. R.R. Ferry)....	40 44	11.07	1.12	3.79	7.56	1.23		3.77	0.18	2.85	0.26	1.6	2.3
Castle Point, Hoboken....	40 45	11.10	1.17	3.83	7.59	1.26		3.80	0.23	2.89	0.29	1.6	2.3
New York (23d St.)....	40 45	11.12	1.20	3.85	7.61	1.29		3.82	0.26	2.91	0.31	1.6	2.3
New York (42d St.)....	40 46	11.16	1.26	3.94	7.66	1.35		3.86	0.32	3.00	0.36	1.7	2.3
Days Point, Weehawken....	40 46	11.18	1.28	3.96	7.68	1.37		3.88	0.34	3.02	0.38	1.7	2.3
New York (Union Stock Yards)....	40 47	11.20	1.31	3.98	7.70	1.39		3.90	0.37	3.04	0.40	1.7	2.3
New York (96th St.)....	40 48	11.26	1.39	4.06	7.78	1.46		3.96	0.45	3.12	0.48	1.7	2.3
Grants Tomb (123d St.)....	40 49	11.30	1.46	4.12	7.83	1.52		4.00	0.52	3.18	0.53	1.6	2.3
New York (130th St.)....	40 49	11.31	1.48	4.13	7.85	1.54		4.01	0.54	3.19	0.55	1.6	2.3
Geo. Washington Bridge....	40 51	11.40	1.58	4.21	7.95	1.63		4.10	0.64	3.27	0.65	1.6	2.2
Tubby Hook....	40 52	11.45	1.65	4.26	8.01	1.68		4.15	0.71	3.32	0.71	1.6	2.1
Spuyten Duyvil....	40 53	11.50	1.71	4.32	8.06	1.74		4.20	0.77	3.38	0.76	1.6	2.1
Riverdale....	40 54	11.55	1.78	4.37	8.12	1.80		4.25	0.84	3.43	0.82	1.6	2.0
Yonkers....	40 56	11.64	1.89	4.48	8.22	1.90		4.34	0.95	3.54	0.92	1.5	1.9
Dobbs Ferry....	41 01	11.81	2.14	4.76	8.49	2.14		4.51	1.20	3.82	1.19	1.3	1.7
Irvington....	41 2	11.85	2.20	4.82	8.54	2.20		4.55	1.26	3.88	1.24	1.2	1.7
Tarrytown....	41 5	11.94	2.35	5.04	8.70	2.35		4.64	1.41	4.10	1.40	1.1	1.5
Nyack....	41 5	11.96	2.38	5.07	8.72	2.38		4.66	1.44	4.13	1.42	1.1	1.5
Ossining....	41 10	12.15	2.62	5.45	8.99	2.64		4.85	1.68	4.51	1.69	0.9	1.3
Haverstraw....	41 12	12.24	2.72	5.59	9.10	2.76		4.94	1.78	4.65	1.80	0.8	1.3
Verplanck....	41 15	12.38	2.88	5.80	9.26	2.92		5.08	1.94	4.86	1.96	0.8	1.2
Peekskill....	41 17	0.06	2.99	5.91	9.36	3.03		5.18	2.05	4.97	2.06	0.8	1.2
Iona Island....	41 18	0.12	3.05	5.96	9.42	3.08		5.24	2.11	5.02	2.12	0.8	1.1
Bear Mountain Bridge....	41 19	0.17	3.10	6.01	9.47	3.14		5.29	2.16	5.07	2.17	0.8	1.1
Cow Hook....	41 21	0.27	3.21	6.09	9.57	3.23		5.39	2.27	5.15	2.27	0.8	1.1
Highlands Falls....	41 22	0.32	3.26	6.13	9.62	3.28		5.44	2.32	5.19	2.32	0.8	1.1
West Point....	41 24	0.43	3.37	6.21	9.73	3.38		5.55	2.43	5.27	2.43	0.9	1.1
Cold Spring....	41 25	0.48	3.42	6.25	9.78	3.43		5.60	2.48	5.31	2.48	0.9	1.1
Storm King....	41 26	0.53	3.48	6.29	9.83	3.48		5.65	2.54	5.35	2.53	0.9	1.1
Newburgh....	41 30	0.73	3.69	6.41	10.02	3.66		5.85	2.75	5.47	2.72	0.9	1.1
Low Point....	41 33	0.88	3.83	6.50	10.13	3.78		6.00	2.89	5.56	2.83	1.0	1.1
New Hamburg....	41 35	0.98	3.92	6.55	10.21	3.88		6.10	2.98	5.61	2.91	1.0	1.1
Barnegat....	41 38	1.13	4.05	6.62	10.33	3.98		6.25	3.11	5.68	3.03	1.0	1.1
Poughkeepsie....	41 42	1.33	4.20	6.72	10.49	4.13		6.45	3.26	5.78	3.19	1.1	1.2
Hyde Park....	41 47	1.60	4.38	6.86	10.67	4.32		6.72	3.44	5.92	3.37	1.2	1.3
Dinsmore Point....	41 52	1.86	4.57	7.08	10.84	4.64		6.98	3.63	6.14	3.55	1.3	1.5
Rhinecliff....	41 55	2.02	4.70	7.24	10.96	4.68		7.14	3.76	6.30	3.66	1.3	1.5
Kingston Point....	41 56	2.05	4.73	7.27	10.98	4.70		7.17	3.79	6.33	3.68	1.3	1.6
Barrytown....	42 00	2.33	4.93	7.53	11.10	4.92		7.45	3.99	6.59	3.80	1.4	1.7
Tivoli....	42 4	2.56	5.19	7.79	11.24	5.14		7.68	4.25	6.85	3.94	1.5	1.8
Saugerties Light....	42 4	2.62	5.28	7.85	11.27	5.20		7.74	4.34	6.91	3.97	1.5	1.9
Malden....	42 6	2.70	5.43	7.95	11.33	5.30		7.82	4.49	7.01	4.03	1.5	1.9
Silver Point....	42 9	2.92	5.82	8.18	11.50	5.55		8.04	4.88	7.24	4.20	1.5	2.0
Linhithgo....	42 11	3.04	6.02	8.33	11.61	5.70		8.16	5.08	7.39	4.31	1.6	2.0
Catskill....	42 13	3.16	6.20	8.52	11.76	5.86		8.28	5.26	7.58	4.46	1.6	2.0
Hudson....	42 15	3.28	6.34	8.70	11.92	6.01		8.40	5.40	7.76	4.62	1.6	2.0
Four Mile Point....	42 18	3.46	6.46	9.01	12.16	6.22		8.58	5.52	8.07	4.86	1.6	1.9
Coxackie....	42 21	3.65	6.54	9.29	12.40	6.42		8.77	5.60	8.35	5.10	1.6	1.8
Stuyvesant....	42 23	3.80	6.58	9.42	12.43	6.54		8.92	5.64	8.48	5.25	1.6	1.7
Matthew Point....	42 26	4.03	6.63	9.55	12.46	6.69		9.15	5.69	8.61	5.48	1.4	1.6
New Baltimore....	42 27	4.10	6.65	9.58	12.49	6.74		9.22	5.71	8.64	5.52	1.3	1.5
Barren Island....	42 28	4.18	6.66	9.60	12.50	6.78		9.30	5.72	8.66	5.58	1.3	1.5

TABLE 106.—*Adjusted current data, Hudson River—Continued*

Locality (midchannel off place named)	Latitude (north)	Greenwich lunurrent intervals						Referred to tides at the Battery				Velocity	
		Slack before flood	Flood strength	Slack before ebb	Ebb strength	Mean current hour	Slack before flood	Flood strength	Slack before ebb	Ebb strength	Flood strength	Ebb strength	
Coeymans.....	42° 28'	4.21	6.67	9.61	0.49	6.80	9.33	5.73	8.67	5.61	1.2	1.4	
H.R.C. R.R. Bridge.....	42° 31'	4.38	6.72	9.59	0.61	6.88	9.50	5.78	8.65	5.73	1.0	1.3	
Castleton.....	42° 32'	4.49	6.76	9.56	0.74	6.94	9.61	5.82	8.62	5.86	0.9	1.2	
Staat Point.....	42° 34'	4.78	6.88	9.45	0.83	7.04	9.90	5.94	8.51	5.95	0.7	1.0	
Van Wies Point.....	42° 35'	4.85	6.91	9.41	0.86	7.06	9.97	5.97	8.47	5.98	0.6	1.0	
Albany.....	42° 39'	5.39	7.11	9.14	1.03	7.22	10.51	6.17	8.20	6.15	0.3	0.8	
Troy.....	42° 44'	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.7	

NOTE.—For a reference to above table, see p. 19.

TABLE 107.—*Current harmonic constants, Hudson River*

Constituent	Station D 14, off the Battery, New York City			Station E 1, off Carlisle Street, New York City		
	H	κ	Greenwich epoch	H	κ	Greenwich epoch
K ₁	Knots 0.312	Degrees 89	Degrees 163	Knots 0.395	Degrees 94	Degrees 168
M ₂	1.539	239	27	1.827	244	32
M ₄	0.070	349	285	0.035	45	341
M ₆	0.081	338	62	0.065	19	103
M ₈	0.030	4	236	0.006	38	270
N ₂	(0.298)	(242)	(30)	0.398	213	1
O ₁	0.145	133	207	0.163	111	185
S ₂	0.304	235	23	0.295	256	44
S ₄	0.011	174	110	0.013	48	344
S ₆	0.018	253	337	0.005	347	71
Observations.....	July 17-Aug. 6, 1922.			July 22-Aug. 18, 1932.		
Length of series.....	21 days.			27 days.		
Method.....	Pole.			Meter.		
Average depth.....	7 feet.			10 feet.		

NOTE.—Epochs refer to flood strength of the several constituents. Inferred constants are in parentheses.
For a reference to above table, see p. 22.

TABLE 108.—*Temperature and density of water, the Battery, New York, N.Y.*
 [Observations at Barge Office Pier until June 1927, and at Whitehall Street Pier beginning August 1927]

Month	Temperature, ° C.			Density at 15° C.		
	Mean	Warmest	Coldest	Mean	Heaviest	Lightest
1927						
January.....	1.1	3.0	-1.0	1.0160	1.0183	1.0135
February.....	2.1	3.0	1.5	1.0143	1.0166	1.0125
March.....	3.6	5.0	1.5	1.0106	1.0166	1.0064
April.....	7.6	10.2	5.5	1.0137	1.0159	1.0107
May.....	11.9	14.2	9.5	1.0132	1.0164	1.0090
June.....	15.4	17.0	14.5	1.0125	1.0142	1.0101
July.....						
August.....	20.5	21.5	19.5	1.0171	1.0195	1.0158
September.....	20.1	21.0	19.0	1.0168	1.0188	1.0138
October.....	17.5	20.2	14.5	1.0153	1.0178	1.0095
November.....	10.9	15.0	9.0	1.0113	1.0155	1.0084
December.....	6.0	9.0	4.0	1.0113	1.0149	1.0056
Means and extremes.....	10.6	21.5	-1.0	1.0137	1.0195	1.0056
1928						
January.....	3.0	5.0	0.5	1.0139	1.0172	1.0108
February.....	2.2	3.0	1.0	1.0142	1.0168	1.0124
March.....	3.6	5.0	2.5	1.0140	1.0168	1.0104
April.....	7.1	8.2	5.0	1.0128	1.0168	1.0104
May.....	11.4	14.0	8.0	1.0143	1.0175	1.0109
June.....	17.0	20.0	15.0	1.0145	1.0161	1.0122
July.....	21.1	22.3	20.0	1.0133	1.0153	1.0116
August.....	23.1	24.0	22.0	1.0144	1.0161	1.0103
September.....	20.5	22.0	17.5	1.0154	1.0183	1.0124
October.....	16.1	17.5	12.5	1.0179	1.0189	1.0167
November.....	10.6	12.5	8.0	1.0181	1.0196	1.0168
December.....	6.3	8.0	4.5	1.0175	1.0190	1.0161
Means and extremes.....	11.8	24.0	0.5	1.0150	1.0196	1.0103
1929						
January.....	2.8	4.5	0.5	1.0163	1.0180	1.0130
February.....	1.5	2.0	0.5	1.0167	1.0179	1.0154
March.....	3.8	6.0	1.8	1.0127	1.0168	1.0092
April.....	7.3	8.5	6.0	1.0108	1.0150	1.0076
May.....	11.6	15.0	8.5	1.0124	1.0150	1.0076
June.....	18.1	21.5	14.8	1.0161	1.0181	1.0154
July.....	21.1	23.0	19.9	1.0170	1.0186	1.0152
August.....	21.5	22.5	20.5	1.0182	1.0193	1.0175
September.....	20.8	22.5	18.5	1.0186	1.0196	1.0173
October.....	15.1	18.5	13.0	1.0178	1.0194	1.0152
November.....	11.2	13.5	7.0	1.0172	1.0187	1.0145
December.....	4.4	5.8	3.0	1.0166	1.0187	1.0144
Means and extremes.....	11.6	23.0	0.5	1.0159	1.0196	1.0076
1930						
January.....	3.3	5.0	2.0	1.0148	1.0175	1.0120
February.....	2.5	4.0	1.0	1.0159	1.0177	1.0132
March.....	4.3	5.5	3.0	1.0128	1.0146	1.0103
April.....	7.5	10.0	5.5	1.0142	1.0162	1.0124
May.....	13.6	15.2	10.0	1.0165	1.0182	1.0153
June.....	18.5	20.5	15.0	1.0162	1.0177	1.0150
July.....	21.8	23.8	20.5	1.0180	1.0191	1.0168
August.....	23.0	25.0	20.0	1.0185	1.0194	1.0174
September.....	22.5	23.2	21.0	1.0186	1.0196	1.0176
October.....	16.9	19.5	13.5	1.0187	1.0198	1.0170
November.....	11.0	13.0	8.8	1.0181	1.0191	1.0160
December.....	5.8	8.2	4.0	1.0182	1.0192	1.0165
Means and extremes.....	12.6	25.0	1.0	1.0167	1.0198	1.0103
1931						
January.....	2.9	4.0	2.0	1.0179	1.0195	1.0168
February.....	2.5	3.5	1.8	1.0181	1.0191	1.0143
March.....	4.2	5.5	3.0	1.0167	1.0195	1.0126
April.....	8.0	10.0	5.5	1.0131	1.0150	1.0102
May.....	12.7	15.8	9.0	1.0140	1.0149	1.0124
June.....	18.0	21.2	15.2	1.0151	1.0164	1.0139
July.....	23.5	25.0	21.2	1.0158	1.0176	1.0134
August.....	23.3	24.0	22.5	1.0171	1.0182	1.0162
September.....	22.6	23.5	20.5	1.0177	1.0190	1.0167
October.....	17.6	20.5	14.0	1.0175	1.0186	1.0161
November.....	12.5	14.0	11.5	1.0168	1.0178	1.0153
December.....	8.1	11.0	6.5	1.0156	1.0182	1.0123
Means and extremes.....	13.0	25.0	1.8	1.0163	1.0195	1.0102

TABLE 108.—Temperature and density of water, the Battery, New York, N.Y.—Con.

Month	Temperature, ° C.			Density at 15° C.		
	Mean	Warmest	Coldest	Mean	Heaviest	Lightest
1932						
January.....	6.0	6.5	5.5	1.0139	1.0176	1.0109
February.....	4.8	6.0	4.0	1.0144	1.0176	1.0091
March.....	4.1	5.5	3.0	1.0168	1.0179	1.0130
April.....	7.2	9.5	5.5	1.0122	1.0179	1.0056
May.....	12.9	16.5	10.0	1.0145	1.0166	1.0136
June.....	17.8	20.5	15.5	1.0172	1.0187	1.0180
July.....	21.1	22.8	19.8	1.0177	1.0186	1.0169
August.....	22.5	23.0	21.0	1.0179	1.0184	1.0173
September.....	21.2	23.5	18.2	1.0184	1.0192	1.0171
October.....	16.5	20.0	13.8	1.0162	1.0201	1.0117
November.....	10.8	13.8	7.0	1.0133	1.0174	1.0104
December.....	5.7	7.5	3.5	1.0153	1.0171	1.0130
Means and extremes.....	12.6	23.5	3.0	1.0156	1.0201	1.0091

NOTE.—For reference to above table see p. 36.

TABLE 109.—Temperature and density of water, Hudson River, N.Y., 1929

Station no.	Locality	Date (1929)	Time	Temperature, ° C.			Density at 15° C.		
				Air	Water		(10 ft.)	(27 ft.)	(44 ft.)
F 1	Riverdale (east-side of river).	Aug. 29	h.m. h.m.	18.3	(10 ft.)	(27 ft.)	(44 ft.)	(10 ft.)	(27 ft.)
		Aug. 30	14:10-14:20	18.5	18.0	18.5	18.5	1.0117	1.0118
		Do....	6:06-6:20	16.7	21.3	21.6	21.6	1.0105	1.0120
			12:13-12:27	21.2	19.6	19.6	19.2	1.0118	1.0123
		Means.....						1.0113	1.0120
F 2	Riverdale (mid-stream).	Aug. 29	15:07-15:19	21.8	(7 ft.)	(15 ft.)	(24 ft.)	(7 ft.)	(15 ft.)
		Do....	22:10-22:24	20.8	21.0	21.0	21.8	1.0129	1.0114
		Aug. 30	6:18-6:28	17.3	21.0	20.9	21.8	1.0096	1.0111
		Sept. 19	22:08-22:16	12.8	19.5	19.0	19.0	1.0103	1.0113
		Sept. 20	6:15-6:25	8.1	19.7	20.2	20.2	1.0083	1.0084
		Do....	14:15-14:25	14.5	20.7	19.3	20.5	1.0114	1.0113
		Means.....						1.0107	1.0109
F 3	Riverdale (westside of river).	Aug. 29	14:10-14:15	21.7	(7 ft.)	(16 ft.)		(7 ft.)	(16 ft.)
		Do....	22:10-22:14	22.2	21.4	21.0	-----	1.0084	1.0091
		Aug. 30	6:15-6:20	16.9	21.4	21.0	-----	1.0106	1.0107
		Means.....		15.9	21.4	21.7	-----	1.0101	1.0101
F 4	Dobbs Ferry (east side of river).	Aug. 30	14:05-14:20	18.2	(9 ft.)	(22 ft.)	(34 ft.)	(9 ft.)	(22 ft.)
		Do....	23:20-23:45	21.4	21.7	21.7	21.8	1.0065	1.0070
		Aug. 31	6:12-6:22	17.7	20.3	20.0	19.3	1.0081	1.0084
		Means.....		15.5	15.8	21.1	17.0	1.0068	1.0081
F 5	Dobbs Ferry (mid-stream).	Aug. 30	15:10-15:17	20.2	(8 ft.)	(20 ft.)	(32 ft.)	(8 ft.)	(20 ft.)
		Do....	22:10-22:22	26.5	20.6	21.5	21.9	1.0157	1.0163
		Aug. 31	5:20-5:40	16.3	16.9	17.0	17.2	1.0080	1.0084
		Means.....			21.0	20.7	21.3	1.0059	1.0066
F 6	Dobbs Ferry (west side of river).	Aug. 30	14:10-14:15	18.2	(7 ft.)	(11 ft.)		(7 ft.)	(11 ft.)
		Do....	22:10-22:15	16.6	20.2	20.0	-----	1.0060	1.0062
		Aug. 31	5:50-6:00	13.5	20.2	20.3	-----	1.0060	1.0060
		Means.....						1.0073	1.0073
F 7	Tarrytown (east side of river).	Sept. 3	14:40-14:50	23.5	(6 ft.)	(15 ft.)	(24 ft.)	(6 ft.)	(15 ft.)
		Do....	22:10-22:25	22.9	22.5	23.0	23.0	1.0054	1.0059
		Sept. 4	6:10-6:20	18.5	22.5	23.1	23.2	1.0081	1.0076
		Means.....						1.0055	1.0058

TABLE 109.—Temperature and density of water, Hudson River, N.Y., 1929—Con.

Station no.	Locality	Date (1929)	Time	Temperature, ° C.			Density at 15° C.			
				Air	Water		(9 ft.)	(23 ft.)	(36 ft.)	
F 8	Tarrytown (mid-stream).	Sept. 3	11:10-11:21	32.0	(9 ft.)	(23 ft.)	(36 ft.)	(9 ft.)	(23 ft.)	(36 ft.)
		Do.	22:20-22:43	27.0	25.6	24.3	23.7	1.0059	1.0080	1.0078
		Sept. 4	6:10- 6:22	21.0	22.6	23.0	23.0	1.0068	1.0068	1.0070
		Sept. 19	14:10-14:20	23.0	18.4	18.8	18.8	1.0056	1.0053	1.0048
		Do.	22:10-22:20	10.0	18.2	18.5	18.4	1.0052	1.0053	1.0057
		Sept. 20	6:40- 6:50	5.0	16.0	16.4	16.4	1.0051	1.0053	1.0052
		Means.						1.0054	1.0056	1.0057
F 9	Tarrytown (west side of river).	Sept. 3	14:15	33.5	(7 ft.)			(7 ft.)		
		do.	22:11	24.2	24.2			1.0060		
		Sept. 4	5:50	23.1	23.7			1.0070		
		Means.						1.0065		
F 10	Ossining (east side of river).	Sept. 4	14:50-15:00	30.0	(7 ft.)	(15 ft.)	(24 ft.)	(7 ft.)	(15 ft.)	(24 ft.)
		do.	21:45-21:55	24.0	23.2	23.0	22.7	1.0052	1.0056	1.0054
		Sept. 5	6:05- 6:15	20.0	22.6	22.7	22.6	1.0048	1.0048	1.0048
		Means.						1.0047	1.0047	1.0048
F 11	Croton Point (west side of river).	Sept. 4	22:15-22:42	24.0	(6 ft.)	(15 ft.)	(24 ft.)	(6 ft.)	(15 ft.)	(24 ft.)
		Sept. 5	5:31- 5:49	13.5	23.3	23.2	22.9	1.0051	1.0048	1.0049
		do.	12:50-12:59	23.9	22.6	22.7	22.7	1.0056	1.0057	1.0054
		Means.						1.0053	1.0051	1.0051
F 12	Croton Point (mid-stream).	Sept. 4	14:12-14:21	28.8	(8 ft.)	(20 ft.)	(32 ft.)	(8 ft.)	(20 ft.)	(32 ft.)
		do.	22:10-22:20	24.1	23.2	23.5	23.3	1.0049	1.0047	1.0055
		Sept. 5	6:12- 6:24	21.0	22.7	23.0	22.2	1.0042	1.0048	1.0044
		Means.						1.0043	1.0046	1.0049
F 13	Croton Point (east side of river).	Sept. 4	3:00	28.0	(9 ft.)			(9 ft.)		
		do.	11:00	21.7	27.2			1.0056		
		Sept. 5	6:05	19.2	22.7			1.0045		
		Means.						1.0043		
F 14	Haverstraw (mid-stream).	Sept. 5	6:10- 6:20	30.3	(7 ft.)	(15 ft.)	(24 ft.)	(7 ft.)	(15 ft.)	(24 ft.)
		do.	22:10-22:20	17.1	23.8	22.6	22.4	1.0048	1.0043	1.0040
		Sept. 6	14:10-14:20	20.3	22.4	22.8	22.7	1.0036	1.0038	1.0039
		Sept. 18	14:10-14:20	18.5	19.0	19.5	19.0	1.0043	1.0047	1.0045
		do.	22:10-22:20	9.7	14.7	14.7	14.7	1.0032	1.0034	1.0034
		Sept. 19	6:10- 6:20	5.0	17.5	17.5	17.0	1.0031	1.0033	1.0032
		Means.						1.0037	1.0039	1.0038
F 15	Verplanck (mid-stream).	Sept. 5	21:38-21:52	22.0	(13 ft.)	(33 ft.)	(52 ft.)	(13 ft.)	(33 ft.)	(52 ft.)
		Sept. 6	6:12- 6:24	20.5	23.0	22.6	22.6	1.0024	1.0034	1.0023
		do.	14:09-14:17	27.0	23.3	23.0	22.7	1.0022	1.0029	1.0025
		Sept. 18	14:10-14:20	19.0	21.7	21.5	21.4	1.0028	1.0032	1.0033
		do.	22:10-22:18	11.4	21.4	20.5	20.8	1.0012	1.0014	1.0011
		Sept. 19	6:35- 6:50	8.2	19.8	21.5	21.3	1.0026	1.0026	1.0026
F 16	Iona Island (mid-stream).	Means.						1.0016	1.0017	1.0023
		Sept. 5	22:17-22:49	21.0	(27 ft.)	(67 ft.)	(100 ft.)	(27 ft.)	(67 ft.)	(100 ft.)
		Sept. 6	5:37- 5:51	18.5	22.6	22.6	22.0	1.0012	1.0012	1.0016
		do.	14:13-14:30	25.0	23.0	23.0	22.5	1.0021	1.0024	1.0019
F 17	West Point (west side of river).	Means.						1.0017	1.0019	1.0020
		Sept. 6	22:30-22:50	20.0	(16 ft.)	(37 ft.)	(53 ft.)	(16 ft.)	(37 ft.)	(53 ft.)
		Sept. 7	6:05- 6:15	19.4	22.7	23.0	22.9	1.0006	1.0006	1.0007
		do.	14:05-14:15	28.5	23.8	23.2	23.2	1.0010	1.0009	1.0009
F 18	Poughkeepsie (mid-stream).	Means.						1.0007	1.0007	1.0007

TABLE 109.—Temperature and density of water, Hudson River, N.Y., 1929—Con.

Station no.	Locality	Date (1929)	Time	Temperature, ° C.			Density at 15° C.		
				Air	Water		(80 ft.)	(64 ft.)	(80 ft.)
					(30 ft.)	(64 ft.)	(80 ft.)		
F 18	West Point (east side of river).	Sept. 6	22:10-22:30	18.1	(30 ft.)	(64 ft.)	(80 ft.)	(80 ft.)	(64 ft.)
		Sept. 7	6:10- 6:20	18.9	22.7	22.8	22.8	1.0011	1.0010
		do	14:15-14:30	28.0	23.0	22.7	22.9	1.0012	1.0009
					27.9	28.0	28.0	1.0017	1.0017
								1.0013	1.0010
									1.0012
F 19	Storm King Mountain, (west side of river).	Sept. 6	22:12-22:44	20.0	(16 ft.)	(40 ft.)	(64 ft.)	(16 ft.)	(40 ft.)
		Sept. 7	5:37- 5:54	20.8	22.6	22.7	22.6	1.0009	1.0008
		do	14:10-14:25	25.2	22.1	22.1	21.6	1.0007	1.0006
					23.0	23.8	23.5	1.0016	1.0015
								1.0011	1.0008
F 20	Storm King Mountain, (east side of river).	Sept. 6	21:40-21:47	22.9	(8 ft.)	(20 ft.)	(32 ft.)	(8 ft.)	(20 ft.)
		Sept. 7	6:10- 6:22	21.0	22.6	22.0	22.7	1.0007	1.0004
		do	14:09-14:19	29.0	23.1	23.2	23.3	1.0012	1.0012
					23.8	23.8	23.0	1.0008	1.0008
								1.0009	1.0008
									1.0008
F 21	Danskammer Point, (midstream).	Sept. 10	22:05-22:15	23.1	(14 ft.)	(34 ft.)	(54 ft.)	(14 ft.)	(54 ft.)
		Sept. 11	5:55- 6:05	17.8	23.2	23.1	22.9	0.9997	0.9998
		Sept. 18	13:40-13:50	17.1	21.0	22.0	21.8	0.9992	0.9991
		do	22:10-22:20	10.0	21.5	21.0	21.0	0.9990	0.9996
		Sept. 19	6:09- 6:21	6.0	17.7	17.9	18.0	0.9994	0.9992
								0.9996	0.9994
F 22	Poughkeepsie (east side of river).	Sept. 10	22:09-22:21	23.7	(12 ft.)	(30 ft.)	(48 ft.)	(12 ft.)	(30 ft.)
		Sept. 11	5:42- 5:52	17.2	23.2	23.0	23.7	0.9995	0.9996
		do	14:15-14:23	21.0	22.0	22.4	22.0	0.9995	0.9996
					22.0	22.5	22.5	0.9997	0.9995
								0.9996	0.9997
									0.9996
F 23	Cave Point (main east channel).	Sept. 9	22:09-22:21	23.7	(18 ft.)	(45 ft.)	(72 ft.)	(18 ft.)	(45 ft.)
		Sept. 10	5:37- 5:52	23.2	22.6	22.3	23.1	0.9992	0.9993
					22.9	22.2	22.4	0.9994	0.9993
								0.9993	0.9992
F 24	Cave Point (west channel).	Sept. 9	14:40-14:50	21.5	(7 ft.)	(10 ft.)	(16 ft.)	(7 ft.)	(10 ft.)
		Do	22:10-22:20	22.0	22.9	22.4	22.6	0.9994	0.9992
		Sept. 10	6:10- 6:20	22.7	23.3	23.0	22.7	0.9993	0.9991
					22.3	22.5	22.7	0.9999	0.9992
								0.9993	0.9992
F 25	Rondout Creek entrance.	Sept. 9	22:10-22:17	21.2	(9 ft.)	(15 ft.)	-----	(9 ft.)	(15 ft.)
		Sept. 10	6:10- 6:15	22.0	22.8	22.7	-----	1.0012	1.0022
		Do	14:10-14:17	23.1	22.3	22.3	-----	0.9995	0.9994
					23.1	23.4	-----	0.9991	0.9991
								0.9999	1.0002
F 26	Sangerties Light, (midstream).	Sept. 10	22:08-22:23	21.8	(10 ft.)	(25 ft.)	(40 ft.)	(10 ft.)	(25 ft.)
		Sept. 11	6:10- 6:20	14.8	23.8	22.5	23.5	0.9995	0.9993
		Do	14:08-14:19	22.3	22.2	22.0	22.3	0.9992	0.9992
		Do	22:41-22:53	14.0	21.0	21.0	20.7	0.9995	0.9993
		Sept. 12	6:10- 6:17	9.2	21.8	21.6	21.8	0.9994	0.9991
		Do	14:20-14:45	22.3	21.5	21.9	21.4	0.9995	0.9993
F 27	Below Catskill (midstream).	Sept. 11	14:40-14:50	18.0	(10 ft.)	(26 ft.)	(41 ft.)	(10 ft.)	(26 ft.)
		Sept. 12	2:10- 2:20	20.5	22.2	21.9	21.7	0.9995	0.9992
		Do	18:40-18:50	18.7	20.0	20.1	20.1	0.9994	0.9994
		Sept. 13	6:10- 6:20	14.0	14.5	14.7	14.7	0.9995	0.9991
								0.9995	0.9993

TABLE 109.—Temperature and density of water, Hudson River, N.Y., 1929—Con.

Station no.	Locality	Date (1929)	Time	Temperature, ° C.			Density as 15° C.			
				Air	Water		(7 ft.)	(18 ft.)	(28 ft.)	(7 ft.)
F 28	Four Mile Point (midchannel).	Sept. 13	14:15-14:23	25.0	(7 ft.)	(18 ft.)	(28 ft.)	0.9996	0.9993	0.9992
		Do.	22:15-22:25	21.0	21.3	21.3	21.0	1.0000	1.0000	0.9998
		Sept. 14	6:10- 6:20	19.0	21.0	21.0	21.2	1.0001	0.9995	0.9993
		Means.						0.9999	0.9996	0.9994
F 29	H.R.C.R.R. Bridge (midstream).	Sept. 13	14:10-14:20	18.2	(7 ft.)	(18 ft.)	(28 ft.)	(7 ft.)	(18 ft.)	(28 ft.)
		Sept. 14	6:10- 6:20	18.0	19.6	19.5	19.5	0.9993	0.9994	0.9994
		Do.		19.7	19.5	19.2				
		Means.						0.9993	0.9994	0.9994
F 30	Albany Bridge (midstream).	Sept. 12	22:10-22:15	13.2	(7 ft.)	(14 ft.)		(7 ft.)	(14 ft.)	
		Sept. 13	5:40- 6:45	14.5	18.8	18.8	18.9	0.9997	0.9996	
		Do.	12:10-12:15	22.0	19.3	19.3	19.6	0.9995	0.9998	
		Do.	23:10-23:15	20.0	20.8	20.8	20.8	0.9996	0.9996	
		Sept. 14	6:40- 6:45	22.6	20.0	20.0	20.0	0.9991	0.9993	
		Do.	14:10-14:15	26.5	21.5	21.3		1.0000	1.0001	
		Means.						0.9996	0.9997	
		Sept. 12	22:05-22:15	14.3	(7 ft.)	(11 ft.)		(7 ft.)	(11 ft.)	
		Sept. 13	6:10- 6:15	14.3	20.1	20.2		1.0000	1.0002	
		Do.	15:05-15:10	23.0	19.4	19.6		1.0003	0.9998	
F 31	Troy (midstream)...	Do.	23:00-23:15	21.9	21.9	20.5		1.0000	0.9998	
		Sept. 14	6:10- 6:15	18.3	20.7	20.6		0.9999	1.0000	
		Means.						1.0000	1.0000	

NOTE.—For reference to above table, see p. 36.

TABLE 110.—Temperature and density of water, Hudson River, N.Y., 1932

Station no.	Locality	Date, 1932	Time	Temperature, ° C.			Density at 15° C.			
				Air	Water		(9 ft.)	(28 ft.)	(36 ft.)	(9 ft.)
R 30	New York, Gansevoort St. (west side of river).	July 18	h. m. h. m.	26.5	(9 ft.)	(28 ft.)	(36 ft.)	1.0154	1.0156	1.0148
		Do.	14:40-14:44	21.7	21.6	21.5				
		22:15-22:23	22.0	20.7	20.4	19.9	1.0177	1.0177	1.0180	
		July 19	5:45- 5:53	19.5	21.4	21.2	21.0	1.0137	1.0139	1.0142
		Do.	14:10-14:17	31.0	22.5	21.4	21.3	1.0167	1.0166	1.0166
		21:45-21:53	26.3	22.5	20.8	20.6	1.0152	1.0170	1.0170	
		July 20	5:39- 5:47	22.7	22.0	21.7	21.2	1.0142	1.0142	1.0143
Means.								1.0155	1.0158	1.0158
R 31	New York, Gansevoort St. (mid-stream).	Aug. 1	14:10-14:20	25.6	(10 ft.)	(26 ft.)	(42 ft.)	(10 ft.)	(26 ft.)	(42 ft.)
		Do.	22:10-22:20	22.8	21.8	21.2	20.8	1.0179	1.0182	1.0182
		Aug. 2	6:07- 6:17	22.4	22.5	22.3	22.1	1.0139	1.0141	1.0147
		Do.	14:10-14:20	27.4	23.3	23.1	22.7	1.0151	1.0150	1.0148
		Do.	21:55-21:44	24.4	23.3	22.0	21.7	1.0185	1.0185	1.0184
		Aug. 3	6:10- 6:20	19.5	22.2	21.7	21.4	1.0149	1.0149	1.0149
		Means.						1.0156	1.0161	1.0163
R 32	New York, Gansevoort St. (east side of river).	July 18	14:40-14:50	27.0	(10 ft.)	(25 ft.)	(40 ft.)	(10 ft.)	(25 ft.)	(40 ft.)
		Do.	22:10-22:20	22.1	20.7	20.5	20.2	1.0175	1.0178	1.0176
		July 19	6:06- 6:16	20.0	21.0	21.3	21.3	1.0133	1.0136	1.0140
		Do.	14:15-14:40	31.4	21.5	20.8	20.5	1.0163	1.0163	1.0164
		Do.	22:07-22:17	26.2	21.7	21.3	21.1	1.0164	1.0167	1.0167
		July 20	6:10- 6:20	22.6	21.6	21.5	21.5	1.0141	1.0148	1.0150
		Means.						1.0156	1.0160	1.0161

TIDES AND CURRENTS IN HUDSON RIVER

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TABLE 110.—Temperature and density of water, Hudson River, N.Y., 1932—Con.

Station no.	Locality	Date, 1932	Time	Temperature, ° C.			Density at 15° C.			
				Air	Water		(7 ft.)	(18 ft.)	(29 ft.)	
R 33	New York, 57th St. (west side of river).	July 20	22:10-22:19	24.2	(7 ft.)	(18 ft.)	(29 ft.)	1.0145	1.0144	1.0143
		July 21	6:15- 6:23	22.4	22.7	21.9	21.7	1.0129	1.0132	1.0136
		Do-	14:10-14:18	27.4	22.1	22.0	22.0	1.0159	1.0162	1.0171
		Do-	23:40-23:50	22.5	22.8	21.6	21.4	1.0157	1.0167	1.0156
		July 22	5:44- 6:10	22.2	22.2	22.0	21.9	1.0146	1.0150	1.0148
		Means-----						1.0147	1.0151	1.0151
					(10 ft.)	(24 ft.)	(38 ft.)	(10 ft.)	(24 ft.)	(38 ft.)
								1.0144	1.0160	1.0162
								1.0141	1.0142	1.0158
								1.0139	1.0144	1.0156
R 34	New York, 57th St. (midstream)	July 20	14:35-14:45	35.0				1.0158	1.0164	1.0173
		Do-	22:10-22:20	23.0				1.0159	1.0161	1.0173
		July 21	5:10- 5:20	21.0				1.0158	1.0164	1.0173
		Do-	14:10-14:20	30.5				1.0137	1.0135	1.0135
		Do-	22:10-22:20	23.0				1.0137	1.0135	1.0135
		July 22	8:20- 8:30	25.0				1.0137	1.0135	1.0135
		Aug. 29	14:15-14:21	27.5	24.0	23.7	23.4	1.0104	1.0116	1.0129
		Do-	21:43-21:52	23.3	23.0	22.7	22.2	1.0169	1.0161	1.0173
		Aug. 30	5:40- 5:48	20.2	22.3	22.7	22.7	1.0128	1.0134	1.0153
		Do-	15:13-15:22	27.6	24.3	23.6	23.3	1.0111	1.0122	1.0132
		Do-	22:10-22:16	23.2	22.5	22.3	22.3	1.0171	1.0176	1.0186
		Aug. 31	5:44- 5:52	22.5	23.6	23.5	23.5	1.0135	1.0140	1.0137
		Means-----						1.0139	1.0144	1.0153
R 35	New York, 57th St. (east side of river).	July 20	14:06-14:17	29.7	(9 ft.)	(23 ft.)	(36 ft.)	(9 ft.)	(23 ft.)	(36 ft.)
		Do-	22:10-22:20	24.0				1.0148	1.0154	1.0155
		July 21	6:10- 6:20	22.3	22.7	22.0	21.5	1.0138	1.0150	1.0154
		Do-	14:10-14:20	31.0	23.2	22.0	21.4	1.0134	1.0138	1.0137
		Do-	22:10-22:20	23.8	22.5	22.2	21.7	1.0157	1.0166	1.0175
		July 22	6:06- 6:17	22.1	22.3	22.0	21.9	1.0124	1.0146	1.0155
		Means-----						1.0140	1.0150	1.0155
R 36	George Washington Bridge (west side of river).	June 29	14:10-14:18	29.6	(4½ ft.)	(11 ft.)	(18 ft.)	(4½ ft.)	(11 ft.)	(18 ft.)
		Do-	22:09-22:17	23.0	22.1	21.3	20.9	1.0068	1.0076	1.0101
		June 30	5:40- 5:50	23.5	21.7	20.6	21.1	1.0069	1.0079	1.0095
		Do-	14:07-14:15	26.0	23.5	22.6	20.9	1.0053	1.0052	1.0104
		Do-	22:09-22:20	22.9	21.3	20.8	20.3	1.0124	1.0124	1.0128
		July 1	5:48- 6:13	20.8	21.8	21.2	20.8	1.0084	1.0077	1.0081
		Do-	14:20-14:23	29.4	25.0	23.4	-----	1.0056	1.0062	-----
		Means-----						1.0072	1.0076	1.0096
R 37	George Washington Bridge (midstream).	June 29	14:10-14:20	34.1	(8 ft.)	(19 ft.)	(30 ft.)	(8 ft.)	(19 ft.)	(30 ft.)
		Do-	22:40-22:50	22.0	22.1	21.5	20.6	1.0083	1.0108	1.0143
		June 30	5:40- 5:50	24.0	21.0	21.2	21.2	1.0082	1.0084	1.0101
		Do-	13:55-14:05	32.2	22.0	22.5	20.0	1.0048	1.0054	1.0041
		Do-	22:10-22:20	21.8	21.5	21.5	21.0	1.0123	1.0106	1.0160
		July 1	6:10- 6:23	26.3	21.8	21.6	20.8	1.0061	1.0084	1.0123
		Do-	14:10-14:20	30.8	22.5	23.0	22.0	1.0060	1.0059	1.0048
		Do-	22:10-22:20	23.0	23.4	23.3	23.1	1.0144	1.0149	1.0145
		Aug. 29	6:06- 6:16	21.2	23.5	23.5	23.4	1.0115	1.0108	1.0106
		Do-	14:10-14:20	27.8	24.2	23.5	23.7	1.0198	1.0212	1.0207
		Do-	22:07-22:15	23.0	23.2	23.1	23.0	1.0156	1.0157	1.0156
		Aug. 31	6:10- 6:20	22.2	23.4	23.3	23.3	1.0114	1.0112	1.0114
		Means-----						1.0108	1.0113	1.0114
R 38	George Washington Bridge (east side of river).	June 29	14:10-14:20	26.0	(24 ft.)	(60 ft.)	(96 ft.)	(24 ft.)	(60 ft.)	(96 ft.)
		Do-	22:10-22:20	22.5	20.4	19.6	19.9	1.0106	1.0093	1.0127
		June 30	6:10- 6:20	25.0	20.5	19.8	19.7	1.0131	1.0171	1.0155
		Do-	14:10-14:20	28.5	20.9	20.4	20.2	1.0122	1.0147	1.0151
		Do-	22:25-22:40	23.8	20.2	19.6	19.7	1.0141	1.0148	1.0141
		July 1	5:45- 6:10	20.8	21.2	21.0	20.2	1.0122	1.0117	1.0122
		Do-	14:10-14:20	29.0	23.0	23.7	21.4	1.0123	1.0117	1.0125
		Means-----						1.0125	1.0132	1.0136

TABLE 110.—Temperature and density of water, Hudson River, N.Y., 1932—Con.

Station no.	Locality	Date, 1932	Time	Temperature, ° C.			Density at 15° C.		
				Air	Water		(4 ft.)	(16 ft.)	(4 ft.)
R 39	Riverdale (west side of river).	June 27	14:15-14:20	31.3	(4 ft.)	(16 ft.)	(4 ft.)	(16 ft.)	(4 ft.)
		Do	21:48-21:52	21.3	22.5	21.0	1.0053	1.0066	1.0053
		June 28	5:45-5:50	22.2	21.3	21.1	1.0082	1.0090	1.0082
		Do	13:45-13:50	32.0	21.8	20.8	1.0051	1.0059	1.0051
		Do	21:45-21:52	23.4	23.4	21.5	1.0043	1.0045	1.0043
		June 29	5:41-5:45	21.5	21.7	20.5	1.0069	1.0095	1.0069
		Means.....					1.0043	1.0059	
							1.0057	1.0069	
R 40	Riverdale (mid-stream).	June 27	14:40-14:47	30.6	(6 ft.)	(15 ft.)	(6 ft.)	(15 ft.)	(24 ft.)
		Do	22:10-22:20	23.0	22.3	21.6	1.0059	1.0066	1.0083
		June 28	6:10-6:20	23.0	21.2	21.5	1.0103	1.0095	
		Do	14:10-14:20	32.0	21.2	20.8	1.0049	1.0045	1.0044
		Do	22:10-22:20	23.0	23.0	23.5	1.0035	1.0044	1.0062
		June 29	6:10-6:20	20.6	21.8	20.8	1.0063	1.0066	1.0101
		Aug. 29	14:40-14:50	29.9	24.7	23.5	1.0064	1.0092	1.0100
		Do	22:10-22:20	23.2	23.5	23.0	1.0120	1.0126	1.0126
		Aug. 30	6:10-6:20	30.2	23.5	23.0	1.0078	1.0081	1.0089
		Do	15:10-15:20	27.8	24.0	23.8	1.0073	1.0088	1.0088
		Do	22:10-22:20	21.2	23.8	23.4	1.0113	1.0125	1.0136
		Means.....					1.0074	1.0081	1.0091
R 41	Riverdale (east side of river).	June 27	13:45-13:53	30.5	(11 ft.)	(27 ft.)	(44 ft.)	(11 ft.)	(27 ft.)
		Do	22:10-22:20	21.5	23.2	20.2	1.0048	1.0082	1.0101
		June 28	6:05-6:15	22.9	21.5	20.9	1.0098	1.0099	1.0106
		Do	14:10-14:20	31.4	22.7	23.0	1.0054	1.0103	
		Do	22:06-22:16	23.1	22.7	20.6	1.0071	1.0087	1.0074
		June 29	6:10-6:20	21.0	21.5	20.8	1.0085	1.0106	1.0112
		Means.....					1.0066	1.0092	1.0124
R 42	Spuyten Duyvil Creek (south of entrance).	Aug. 3	14:12-14:20	20.2	(8 ft.)	(20 ft.)	(32 ft.)	(8 ft.)	(20 ft.)
		Do	22:10-22:20	23.2	22.7	22.8	1.0114	1.0113	1.0112
		Aug. 4	6:20-6:45	23.5	23.2	23.2	1.0138	1.0129	1.0145
		Do	14:10-14:20	29.5	24.2	23.7	1.0097	1.0098	1.0099
		Do	22:10-22:20	22.4	23.2	23.1	1.0107	1.0107	1.0109
		Aug. 5	6:05-6:15	20.8	22.8	23.1	1.0122	1.0126	1.0122
		Means.....					1.0090	1.0099	1.0100
R 43	Spuyten Duyvil Creek (north of entrance).	Aug. 1	14:40-14:48	26.9	(7 ft.)	(18 ft.)	(29 ft.)	(7 ft.)	(18 ft.)
		Do	21:45-22:15	21.6	22.5	22.3	1.0127	1.0154	1.0143
		Aug. 2	5:39-5:50	19.9	23.0	22.9	1.0079	1.0086	1.0091
		Do	13:48-14:20	27.6	23.6	23.2	1.0112	1.0105	1.0117
		Do	21:40-21:48	24.0	22.9	22.9	1.0132	1.0138	1.0138
		Aug. 3	6:20-6:26	19.1	23.5	22.4	1.0086	1.0094	1.0097
		Means.....					1.0103	1.0107	1.0113

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