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ed at vernn of fichit of the east or lakeward extremity of the North harbor pier, a permanent tide-gauge for the purpose of making daily observations of the relative heights and fluctuations of the surface of this lake. The position thus chosen for the observations projects into the lake, entirely beyond the mouth of the Chicago River, and altogether out of the reach of any influence from the river current, upon the fluctuations of the tide-gauge. It was the fluctuations of the lake surface alone, that could affect the readings of the tide-gauge.

"On the first day of September, 1854, a course of observations was commenced on this tide-gauge, and continued at least once a day, until the 31st day of December, inclusive, 1858. During each of the first three winters a portion of the daily observations was lost, owing to the tidegauge being frozen fast in its box, but they constituted only a small number in proportion to that embraced in the series. During the subsequent winters artificial means were resorted to, to prevent this freezing.

"These observations were instituted chiefly for the purpose of ascertaining with accuracy the amount of the annual and also of the secular variation in the elevation of the lake surface, with a view to regulating the heights of break-waters and piers to be erected for the protection of vessels, and for improving the lake harbors."

After a series of close observations from 1854 to 1858, Lieut.-Colonel Graham observes:—

"The difference of elevation of the lake surface, between the periods of lunar low and lunar high-water at the mean spring tides is here shown to be two hundred aud fifty-four thousandths (.254) of a foot, and the time of high-water at the full and

change of the moon is shown to be thirty (30) minutes after the time of the moon's meridian transit.

"We, therefore, in accordance with cus tom in like cases, indicate as the establishment for the port of Chicago,

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"Although this knowledge may be of but small practical advantage to navigators, yet it may serve as a memorandum of a physical phenomenon whose existence has generally heretofore been either denied or doubted.

"We think it probable that, if the effect of unfavorable winds and all other extraneous forces which produce irregular oscillations in the elevation of the lake surface could be fully eliminated, a semidiurnal lunar spring tide would be shown of as much as one-third of a foot for the periods of highest tides.

The time of low-water and the relative times of duration of the flood and ebb tides are given only approximately. The extreme rise of the tide being so little, the precise time of the change from ebb to flood, and hence the duration of the flow of each, can only be accurately determined by numerous observations at short intervals, say three to five minutes of time apart, from about an hour before to an hour after the actual time of lowwater.

"In conclusion, we offer the above observations as solving the problem in question, and as proving the existence of a semi-diurnal lunar tidal wave on Lake Michigan, and consequently on the other great freshwater lakes of North America, whose co-ordinate of altitude is, at its summit, as much as .15 to .25 (1^{10}_{100} to $\frac{24}{100}$ of a foot, United States' measure."