

**PUGSLEY'S TIDES; STANDARD METHODS
OF COMPUTING THE TIMES OF HIGH
WATER AND LOW
WATER AS REQUIRED AT THE U. S.
LOCAL INSPECTORS EXAMINATIONS;
AN EXAMINATION SPECIALTY**

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Pugsley's Tides; Standard Methods of Computing the Times of High Water and Low Water as Required at the U. S. Local Inspectors Examinations; An Examination Specialty by R. M. Pugsley

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BY
CAPT. R. M. PUGSLEY

(LATE MASTER U. S. TRANSPORT SERVICE)

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PREFACE.

This volume is not intended to be a scientific treatise of the phenomena of tides; the object being to set forth in as clear and concise a manner as possible the standard methods used by practical navigators to compute the approximate time of high and low tides at a given port on any date, and particularly for those wishing to take the U. S. Local Inspectors examination for an ocean going license, as that is one of the problems given every applicant.

The lunitidal intervals used are taken from Bowditch and that of the high water differs a minute or so in some cases from that given in other works. The American Ephemeris and Nautical Almanac is used throughout as it is usually given applicants at examinations.

R. M. PUESLEY.

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TIDES.

In comparing the times of high water and low water found by the methods given here with those in the tide tables issued by the United States Coast & Geodetic Survey, a difference in most cases will be found and is due chiefly to the fact that the predictions given in the tables are the direct results of the proper scientific methods employed which takes into consideration every known element which may properly enter the calculation and are therefore to be accepted as the correct standard.

By the following methods only one element, the moon, is considered, the effect of the sun being entirely neglected, and while not exact the results are quite near enough for ordinary, practical use, and so much so that it is not necessary for the navigator to perform a long tedious calculation when a nearly correct result will meet the requirements.

When the sun's place differs from that of the moon ninety degrees the difference between these methods and the tide tables will be the maximum, and at the minimum when the sun's place and that of the moon are the same or one hundred and eighty degrees different.

In assuming a degree of dependence the nature of the port or place must be considered. Those into which streams of importance do not empty are subject to the influence of winds only, which do not affect the times of tidal occurrences to a marked extent. Large streams do, and together with the wind flood tide sometimes does not occur, the condition being low water without a change of height worth considering, except that perhaps which may be due to freshet.

Philadelphia is such a port. The flood tide under normal conditions runs about five hours and the ebb tide about seven hours, which is due to the emptying of the Delaware River. When the

country is quite dry and strong northwest winds blow for several days the tide may remain low. The other extreme would be abundant rains over the section drained by the stream and northeast winds when the tide would remain very high.

These facts are mentioned to illustrate the necessity of taking into consideration every local influence when the time of high water or low water is a factor of importance in the navigation of a ship.

COMPUTATION.

At the Local Inspectors examination the applicant for a License may receive the problem written in some peculiar manner; but that does not matter, as all that is wanted is the date and name of the port. In any case compute all the tides for the given civil date, and in cases where a tide occurs a few minutes before the beginning of the civil date and another a few minutes after the end, they must be included, and after all the tides have been correctly computed, they should be tabulated in the order of their occurrence.

Bowditch Navigator (Appendix IV) contains the high and low water "lunital intervals" or "corrected establishments of the ports." Other works of the same character contain the high water interval only.

The "lunital intervals" or "corrected establishments of the ports" are the intervals between the moon's meridian passage at a given place and the following high water and low water.

The first step in the computation of tides is the selection of the proper passage from the nautical almanac, and in doing so the astronomical date and time must be adhered to; but when the result is found, it must be converted into civil time and so expressed.

The hourly difference in the adjacent column may be given a standard value of two minutes which, when multiplied by the nearest hour of the longitude in time of the place, will give the correction to be added to the passage as taken from the almanac in west longitude and subtracted in east and gives the time of meridian passage at the port. The degree of precision required does not warrant a more exact operation for the simple reason that two or three minutes error is not a perceptible quantity.

As the Bowditch epitome is the only work containing both the

high water and low water intervals for various ports, the examiners prefer its use; but when it is not convenient to use that book, only the high water interval will be found in others and then half or quarter of a lunar day is applied to the time of high water found from the moon's meridian passage to find the times of the other tides for the given date.

A lunar day is the interval of time between two successive passages of the moon over the same meridian, which in solar time is given a value of 24h 52m, the half and quarter of which is 12h 26m and 6h 13m respectively; but as the interval of time between tides is in most cases different, it is necessary to use the low water interval from Bowditch that an accurate result may be obtained.

Beginning with the year 1916, the nautical almanac is different from those for preceding years by which nearly every examination is conducted. For that reason the almanacs for the years 1914 and 1917 are used.