

QB  
275  
.U35  
no. 148  
1928

FILE COPY

DEPARTMENT OF COMMERCE  
U. S. COAST AND GEODETIC SURVEY  
E. LESTER JONES, Director

C. & G. SURVEY  
L. & A.  
NOV 20 1928  
Acc. No.

# TIDAL BENCH MARKS

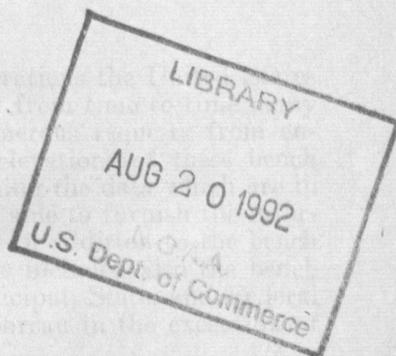
## STATE OF NEW JERSEY

By

L. A. COLE

Associate Mathematician, U. S. Coast and Geodetic Survey

Special Publication No. 148



PRICE 10 CENTS

Sold only by the Superintendent of Documents, U. S. Government Printing Office  
Washington, D. C.

UNITED STATES  
GOVERNMENT PRINTING OFFICE  
WASHINGTON

1928

# National Oceanic and Atmospheric Administration

## ERRATA NOTICE

One or more conditions of the original document may affect the quality of the image, such as:

Discolored pages

Faded or light ink

Binding intrudes into the text

This has been a co-operative project between the NOAA Central Library and the Climate Database Modernization Program, National Climate Data Center (NCDC). To view the original document, please contact the NOAA Central Library in Silver Spring, MD at (301) 713-2607 x124 or [www.reference@nodc.noaa.gov](mailto:www.reference@nodc.noaa.gov).

LASON

Imaging Contractor

12200 Kiln Court

Beltsville, MD 20704-1387

January 1, 2006

# TIDAL BENCH MARKS, STATE OF NEW JERSEY

By L. A. COLE, *Associate Mathematician, United States Coast and Geodetic Survey*

## CONTENTS

	Page
Introduction .....	1
Standard bench mark .....	2
Datum planes .....	2
Bases of elevations .....	4
Changes in elevation .....	4
Descriptions and elevations of bench marks .....	5
List of publications by the United States Coast and Geodetic Survey relating to bench marks and datum planes .....	16
Index .....	18

## ILLUSTRATIONS

Figure 1 .....	2
Figure 2 .....	3

## INTRODUCTION

In connection with its hydrographic operations the United States Coast and Geodetic Survey has established from time to time many tidal bench marks along our coasts. Numerous requests from engineers and others for descriptions and elevations of these bench marks have led the bureau to begin publishing the data which are in manuscript form in the files, in order to be able to furnish the information more promptly and economically. In addition to the bench marks established by this survey, there are included also the bench marks of other organizations, such as municipal, State, and Federal engineers, which have been used by this bureau in the execution of the hydrographic work along the coast.

This information is being made available by sections of the coast. Because of the many requests for the information for the vicinity of New York City, the first section to be published was for the State of New York, as given in Special Publication No. 83, issued in 1922; the second section, for the District of Columbia, is given in Special Publication No. 119; the third section, for the State of Rhode Island, in Special Publication No. 128; the fourth section, for the State of Connecticut, in Special Publication No. 136; and the fifth section, for the State of California, in Special Publication No. 141. The present volume is the sixth of the series and will be followed from time to time by similar volumes covering other sections of the coast.

### STANDARD BENCH MARK

Various kinds of bench marks have been used to indicate the point of which the elevation was determined. Among these are nails in piles or other structures; small crosses and squares cut in curbstones and doorsteps; bolts in ledges, boulders, and the foundations of buildings; and sometimes, just a well-defined point on a fixed object has been used. Since such marks may lack permanence and are often hard to identify, this bureau has adopted a standard brass disk identification mark. The standard brass disk is  $3\frac{5}{8}$  inches in diameter and has a shank or stem on the back 3 inches long for insertion in a building or other substantial support.

At present there are two types of standard disk bench marks, as shown in Figures 1 and 2. The type shown in Figure 1 was formerly used in all leveling work of the bureau but is now used chiefly by hydrographic parties running short lines of levels, while the type shown in Figure 2, which provides a place for inserting the elevation above mean sea level, is used for lines of the first-order level net of the United States. The other forms of the standard brass disk shown in Figure 2, though not intended primarily for bench marks, may be used as such when their elevations have been determined.

### DATUM PLANES

In all engineering work where it is necessary to determine differences in elevation by spirit levels, and especially where it is desired to coordinate the work of various surveys, it is in the interest of efficiency and economy that a uniform datum be used. It has frequently happened that the various engineers operating in the same locality have used different arbitrary datums, which has led to much confusion. This condition can be obviated by the adoption of a single, reliable datum. Datums based on tidal definition are the best for both practical and scientific work, since they may be recovered even though all bench-mark connections be destroyed.

Of all the tidal datums, mean sea level is the most nearly fixed and therefore the best. By a network of first-order levels it has been carried to many parts of the interior of the country, and new level lines are being added to this level net each year.

Mean sea level, as determined at the primary tide stations on the open coast, may be considered for all practical engineering and surveying purposes to be in the same equipotential surface and may be defined as the level about which the tide oscillates. As determined by this bureau, it is derived from the hourly heights of the tide as referred to the zero of a fixed tide staff which has been connected with a primary bench mark by spirit levels. Because of the disturbing influences of wind and weather, an accurate determination of mean sea level must be based on observations extending over a considerable period of time. In general, a series of tidal observations three years in length will, when corrected by comparison with the results from a suitably located primary station, determine mean sea level within 0.02 foot; observations covering a period of a year will determine it to 0.05 foot, and a month of observations may be considered to determine it within 0.10 foot.

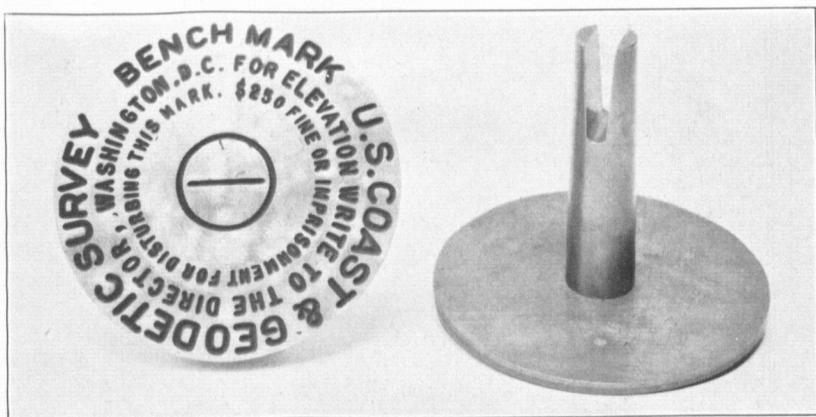


FIG. 1.—STANDARD BENCH MARK

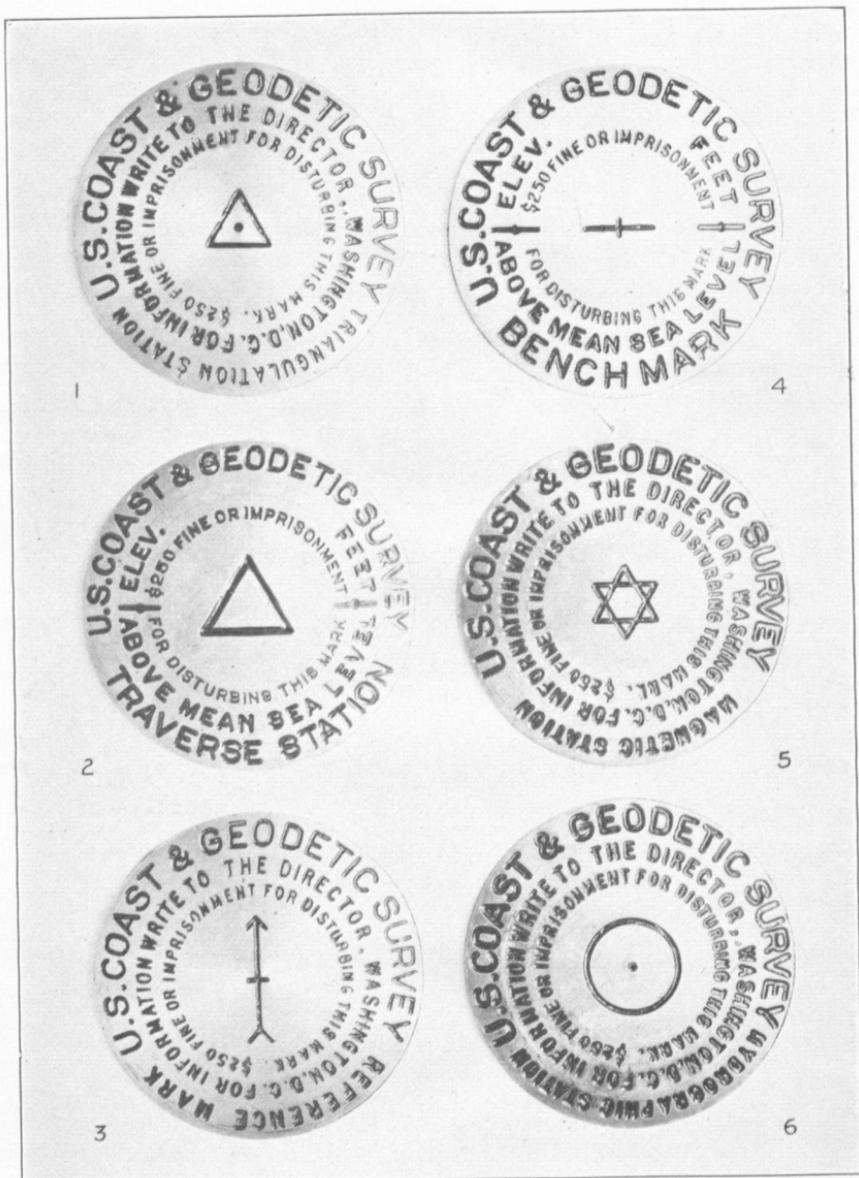


FIG. 2.—STANDARD MARKS OF THE U. S. COAST AND GEODETIC SURVEY

1. Triangulation station mark
2. Traverse station mark
3. Reference mark

4. Bench mark
5. Magnetic station mark
6. Hydrographic station mark

On inside bodies of water draining large areas which are subject to a considerable fresh-water run-off, mean sea level tends to stand somewhat higher than on the open coast. In tidal rivers where the seasonal variations in run-off cause relatively large fluctuations in level it is sometimes preferable to speak of mean river level rather than mean sea level, though mean river level is determined by averaging the hourly heights of the tide, which is precisely the same manner in which mean sea level is determined.

While mean sea level is the most nearly uniform, or fixed, datum over a wide area and is the primary datum through which different surveys may be coordinated, other datums are also useful for hydrographic work and harbor engineering. Therefore, the elevations of the bench marks in this publication are referred to mean low water as well as to either mean sea level or half tide level, as the case may be. Those bench marks which have been connected with the first-order level net and are near a primary tide station are referred to mean sea level; all other bench marks are referred to half tide level. The relations of other tide planes to mean low water are given in the table following the descriptions and elevations of the bench marks for each station.

Half tide level is determined from the high and low water readings and lies midway between the planes of mean high water and mean low water. It should be carefully distinguished from mean sea level, which is determined from the hourly heights of the tide. For most places on the open coast half tide level does not differ much from mean sea level, and for practical purposes the two planes may be used as if identical. On inside waters, especially on the upper reaches of tidal rivers, there may be a considerable difference in the elevations of the two planes. The relation between these two planes at any place is fairly constant, and for places where the relation has been accurately determined from a year or more of observations the one may readily be derived from the other.

At Atlantic City, based on 13 years of observations, mean sea level is determined to be approximately 0.03 foot above half tide level; at Cape May Harbor, Cold Spring Inlet, based on 20 months of observations, mean sea level is 0.04 foot above half tide level; while up the Delaware River in the vicinity of Camden and Philadelphia, based on 21 years of observations near the foot of Chestnut Street, Philadelphia, mean river level is found to be 0.16 foot above half tide level. This comparatively large difference between mean river level and half tide level is due to the fresh-water flow and the slope of the river bed. Mean river level at Camden and Philadelphia is also approximately three-quarters of a foot higher than mean sea level brought by first-order levels from Sandy Hook and Atlantic City.

Mean high water is the mean height of all high waters and mean low water the mean height of all low waters for the period of the observations. The difference in height between mean high water and mean low water corresponds to the mean range of tide. The relation of mean high water and mean low water to half tide level at any point is equal to one-half the mean range of tide above and below that datum. The mean range of tide varies considerably from place to place, depending in a large measure on the location, depth

of water, and configuration of the coast line. Therefore, mean high water and mean low water are not uniform datums over a large area, like mean sea level and half tide level, but vary in proportion to the difference in the mean range of tide over that area. Mean low water on the Atlantic coast of the United States is of importance as the hydrographic datum to which all soundings on charts and the predicted heights in tide tables are referred.

The highest and lowest tides represent the probable extreme heights for each locality and, in places where long series of observations are not available, have been estimated to the nearest half foot, based on the highest and lowest values observed in that region.

#### BASES OF ELEVATIONS

The elevations of the bench marks at the various tide stations are in most cases based on local tidal observations which have been reduced to mean values by comparison with simultaneous observations at other stations where longer series of tides have been observed. As explained on page 2, regarding the determination of mean sea level, the accuracy of the elevations of the bench marks at the different tide stations will, in general, vary in accordance with the lengths of the tidal series upon which they depend. Those bench marks, which have been connected with the first-order level net and are located near a primary tide station, where several years of tides have been observed, are referred to the standard datum of mean sea level. A well-determined plane of reference is thus afforded for all such bench marks. At stations where shorter series of tides have been observed the bench marks are referred to half tide level. A statement in regard to the lengths of the tidal series at each station precedes the descriptions of the bench marks at that station.

The elevations of the planes of mean high water and mean low water given in the tables following the descriptions of bench marks at each station were obtained from mean sea level or half tide level through the local mean range of tide, while the elevations of the planes of highest and lowest tides are based on the highest and lowest tides observed in that region, especially at the nearest primary tide stations, where long series of tides have been observed. At Atlantic City the dates and heights of the actual highest and lowest tides observed during the period of the observations are given, but for the other stations the heights have been estimated to the nearest half foot above and below the plane of mean low water. The purpose of furnishing these highest and lowest elevations is to give the engineer an approximation of the extreme stages of the water that may occur in the different localities.

#### CHANGES IN ELEVATION

Although a bench mark may appear to be quite permanent in character and correspond with its description, the elevation may have changed materially since its determination because of settling of the immediate locality from construction work or from other causes. Engineers are therefore cautioned to make use of at least two bench marks where possible. They will confer a favor on the profession and on this bureau by reporting to the Director, United States Coast

and Geodetic Survey, any changes in elevation or destruction of bench marks noted, in order that information in regard to these marks may be kept up to date and this publication revised when necessary.

### DESCRIPTIONS AND ELEVATIONS OF TIDAL BENCH MARKS, STATE OF NEW JERSEY

[The year of establishment is given in parentheses following the number of the bench mark]

#### BERGEN POINT, KILL VAN KULL

The elevations of the following bench marks are based on 17 high waters and 16 low waters observed during the period November 17 to December 12, 1919, reduced to mean values by comparison with simultaneous observations at Fort Hamilton, N. Y., where the datum is based on 30 years of observations.

**Bench mark 1 (1919), Bergen Point,** is a Coast and Geodetic Survey standard disk set in cement in a drill hole made in the concrete foundation of a small steel water tank supplying pump house (on water front) of the Safety Insulated Wire & Cable Co., Bayonne, N. J. The water tank is located at the southwest corner of storeroom No. 9. Elevation: 10.09 feet above mean low water; 7.79 feet above half tide level.

**Bench mark 2 (1919), Bergen Point,** is a Coast and Geodetic Survey standard disk set in cement in drill hole made in the southeast of the four concrete foundations supporting large steel water tank, about 75 feet south of and between building No. 1 and building No. 2. Elevation: 10.72 feet above mean low water; 8.42 feet above half tide level.

**Bench mark 3 (1919), Bergen Point,** is a Coast and Geodetic Survey standard disk set in cement in drill hole made in the concrete foundation of steel ladder leading to roof on the west side of building No. 1, near south end. Elevation: 10.51 feet above mean low water; 8.21 feet above half tide level.

The elevations of other tide planes at Bergen Point referred to mean low water are as follows:

	Feet
Highest tide.....	8. 00
Mean high water.....	4. 60
Half tide level.....	2. 30
Mean low water.....	0. 00
Lowest tide.....	-4. 00

#### SECAUCUS, HACKENSACK RIVER

The elevations of the following bench marks are referred to the mean low-water datum of the United States Army Engineers at Little Ferry, carried to Secaucus by levels in 1915.

**Bench mark 1 (1915), Secaucus,** is a cross with the letters "U. S. C. & G. S." cut in the east end of the abutment at the south end of the Paterson plank-road bridge over the river. Elevation: 13.20 feet above mean low water; 10.63 feet above half tide level.

**Bench mark 3 (1915), Secaucus,** is a Coast and Geodetic Survey triangulation station mark at triangulation station "Hud" and is embedded in a block of concrete and placed between the cobblestones of the road at the eastern end of the plank-road bridge. It is 22.3 feet southwesterly from bench mark No. 1. Elevation: 12.45 feet above mean low water; 9.88 feet above half tide level.

The elevation of other tide planes at Secaucus referred to mean low water are as follows:

	Feet
Highest tide.....	8. 00
Mean high water.....	5. 14
Half tide level.....	2. 57
Mean low water.....	0. 00
Lowest tide.....	-3. 00

#### LINCOLN HIGHWAY BRIDGE, PASSAIC RIVER

The elevations of the following bench marks are based on four high waters and four low waters observed during the period August 28 to 30, 1920, reduced to mean values by comparison with simultaneous observations at the Submarine

Boat Corporation dock at Port Newark, which in turn had been reduced to mean values by comparison with simultaneous observations at Fort Hamilton, N. Y., where the datum is based on 30 years of observations.

**Bench mark 1 (1920), Lincoln Highway Bridge,** is the upper surface of the third course of masonry from the top forming the pier on which the east end of the draw span rests. It is on the east side of the north end of the pier. The mark has the letters "U. S." on either side of the crowfoot which points down to the bench. Elevation: 6.93 feet above mean low water; 4.58 feet above half tide level.

**Bench mark 2 (1920), Lincoln Highway Bridge,** is a cross, surrounded by the letters "U. S.," on the north side of the head house of Henry Ford & Co.'s plant on the east side of Passaic River, adjoining the bridge and highway. The head house fronts on the river and is about 400 feet distant from the Lincoln Highway. The mark is on the north side of the northwest corner about 1 foot from the edge and  $1\frac{1}{2}$  feet from the paving or ground. The mark is chiseled about  $\frac{1}{2}$  inch into the concrete, and the elevation is to the horizontal cut. Elevation: 10.98 feet above mean low water; 8.63 feet above half tide level.

**Bench mark 3 (1920), Lincoln Highway Bridge,** is a square, surrounded by the letters "U. S. C. S.," cut in the step or bench on the east abutment of the Lincoln Highway Bridge over the Passaic River. The mark is on the south side of the bridge, about 10 feet below the floor of the bridge. It is located about 6 inches from the southwest corner of the bench and chiseled into the stone masonry. Elevation: 9.95 feet above mean low water; 7.60 feet above half tide level.

The elevations of other tide plans at Lincoln Highway Bridge referred to mean low water are as follows:

	Feet
Highest tide.....	8.00
Mean high water.....	4.70
Half tide level.....	2.35
Mean low water.....	0.00
Lowest tide.....	-3.00

#### PORT NEWARK, NEWARK BAY

The elevations of the following bench marks are based on five months of automatic gauge records for the period March 1 to July 29, 1919, reduced to mean values by comparison with simultaneous observations at Fort Hamilton, N. Y., where the datum is based on 30 years of observations.

**Bench mark N. B. 22-A** (city of Newark engineers), *Port Newark,* is a  $\frac{1}{2}$ -inch brass plug set in the concrete dock wall at station O+47.412 of the rear of dock base line of the Submarine Boat Corporation. It is 71.5 feet west of the southeast corner of the west light-fittings warehouse, and 16.5 feet north of the most westerly of a group of three columns supporting an elevated railway. Elevation: 10.78 feet above mean low water; 8.43 feet above half tide level.

**Bench mark 2 (1922), Port Newark,** is a Coast and Geodetic Survey standard disk set in concrete dock wall of the Submarine Boat Corporation. It is about 800 feet west of bench mark N. B. 22-A and about 10 feet east of division fence line between United States Army Quartermaster Base and city of Newark dock. Elevation: 10.83 feet above mean low water; 8.48 feet above half tide level.

**Bench mark 3 (1922), Port Newark,** is a Coast and Geodetic Survey standard disk set in concrete in the center of a 12-inch riveted steel pipe, which used to be a flag pole of the Submarine Boat Corporation at Port Newark. A five-pointed concrete star surrounds the mark and is about 12 feet in diameter. The pipe, filled with concrete, extends about 15 feet below the surface. Elevation: 10.92 feet above mean low water; 8.57 feet above half tide level.

The elevations of other tide planes at Port Newark referred to mean low water are as follows:

	Feet
Highest tide.....	8.00
Mean high water.....	4.70
Half tide level.....	2.35
Mean low water.....	0.00
Lowest tide.....	-4.00

#### ELIZABETHPORT, NEWARK BAY

The elevations of the following bench marks are based on 6 high waters and 7 low waters observed October 11 to 14, 1886, and 3 high waters and 4 low

waters observed November 5 to 7, 1920. The first series was reduced to mean values by comparison with simultaneous observations at Governors Island, N. Y., the datum of which was based on 65 high waters and 64 low waters. The second series was reduced to mean values by comparison with simultaneous observations at Port Newark, which in turn had been reduced to mean values by comparison with simultaneous observations at Fort Hamilton, N. Y., where the datum is based on 30 years of observations. A mean of the two series was taken.

**Bench mark 1 (1886), Elizabethport,** is the center of a cross cut in a brick at the southeast corner of S. L. Moore & Son's Foundry. It is in the seventh course from the bottom and about 2 feet from where the frame part of the building joins to the bricks. The foundry is on the corner of Front and Franklin Streets. Bench mark is marked "U. S." Elevation: 14.76 feet above mean low water; 12.41 feet above half tide level.

**Bench mark 4 (1920), Elizabethport,** is the top edge of a square brass plate set in the brickwork of the corner of Front and Franklin Streets, on the office of the Bethlehem Shipbuilding Corporation (1920). It adjoins the foundry on which bench mark 1 is located. This mark was established by Mr. Welch, chief engineer of the shipyard, and is marked 13 feet above mean low water. Elevation: 13.13 feet above mean low water; 10.78 feet above half tide level.

**Bench mark 6 (1923), Elizabethport,** is a Coast and Geodetic Survey standard disk, stamped "6/1923," set in cement in a hole drilled into the concrete sill of the northern door to the machine shop of the Moore plant of the Bethlehem Shipbuilding Corporation at Elizabeth. It is on the side of the building facing Front Street and is 77 feet south of the northeastern corner of the building. Elevation: 15.59 feet above mean low water; 13.24 feet above half tide level.

**Bench mark 7 (1923), Elizabethport,** is a Coast and Geodetic Survey standard disk, stamped "7/1923," set in cement in a hole drilled into the top of the concrete post at the northeastern corner of the Bethlehem Shipbuilding Corporation wharf leading from Franklin Street. The concrete post is a foundation for a "niggerhead." Elevation: 11.18 feet above mean low water; 8.83 feet above half tide level.

**Bench mark 8 (1923), Elizabethport,** is a Coast and Geodetic Survey standard disk, stamped "8/1923," set in cement in a hole drilled into the concrete sill of a cellar window at the rear of the new office building of the Moore plant of the Bethlehem Shipbuilding Corporation. It is between the concrete incline and the fire escape. Elevation: 19.97 feet above mean low water; 17.62 feet above half tide level.

The elevations of the other tide planes at Elizabethport referred to mean low water are as follows:

	Feet
Highest tide.....	8. 00
Mean high water.....	4. 70
Half tide level.....	2. 35
Mean low water.....	0. 00
Lowest tide.....	-4. 00

#### BELVEDERE BEACH, BARTON BAY

The elevations of the following bench marks are based upon two low waters observed on September 10 and 13, 1926, reduced to mean values by comparison with simultaneous observations at Sandy Hook, and on the mean sea-level elevation of bench mark F-1 obtained from a line of first-order levels run in 1914 by the Coast and Geodetic Survey from Sandy Hook to Perth Amboy. (See Sandy Hook, p. 8.)

**Bench mark F-1 (1914), Belvedere Beach,** is a Coast and Geodetic Survey standard disk in the top of the northwest pier of the small masonry bridge about 200 meters east of the railroad station at Lorillard. Elevation: 15.13 feet above mean low water; 13.58 feet above mean sea level.

**Bench mark 1 (1926), Belvedere Beach,** is a Coast and Geodetic Survey standard disk, stamped "1/1926," set flush in the top on the northwest corner of the concrete pier which supports the north end of the highway bridge which spans Waackaack Creek at the junction of Laurel and Maplewood Avenues at Belvedere Beach. Elevation: 8.36 feet above mean low water; 5.81 feet above mean sea level.

**Bench mark 2 (1926), Belvedere Beach,** is a Coast and Geodetic Survey standard disk, stamped "2/1926," set flush in the southeast corner on top of the concrete railing of the veranda of Mahler's Hotel at Belvedere Beach. The

hotel is a white stucco three-story building at the corner of Laurel and Highland Avenues. Elevation: 13.59 feet above mean low water; 11.04 feet above mean sea level.

**Bench mark 3 (1926), *Belvedere Beach***, is a Coast and Geodetic Survey standard disk, stamped "3/1926," set flush in the top of northwest corner of the concrete base of the Keansburg standpipe at Highland Avenue and Oakwood Place, Keansburg. Elevation: 31.81 feet above mean low water; 29.26 feet above mean sea level.

The elevations of other tide planes at Belvedere Beach referred to mean low water are as follows:

	Feet
Highest tide.....	8.50
Mean high water.....	5.19
Mean sea level.....	2.53
Mean low water.....	0.00
Lowest tide.....	-4.00

#### HIGHLANDS BRIDGE, SHREWSBURY RIVER

The elevation of the following bench marks are based on 56 high waters and 57 low waters observed during the period August 17 to September 23, 1926, reduced to mean values by comparison with simultaneous observations at Sandy Hook and on the mean sea level elevation of bench mark J-1 obtained from a line of first-order levels run in 1914 by the Coast and Geodetic Survey from Sandy Hook to Perth Amboy. (See Sandy Hook, p. 8.)

**Bench mark 4 (1926), *Highlands Bridge***, is a Coast and Geodetic Survey standard disk, stamped "4/1926," set in the top of the concrete base of the monument to veterans of the World War, which stands at the foot of Highland Avenue and is about 100 meters west of the railroad station at Highlands. Elevation: 45.40 feet above mean low water; 43.65 feet above mean sea level.

**Bench mark 3 (1926), *Highlands Bridge***, is a Coast and Geodetic Survey standard disk, stamped "3/1926," set in the top of the northeast corner of the stone pier which supports the west end of the railroad drawbridge. Elevation: 12.30 feet above mean low water; 10.55 feet above mean sea level.

**Bench mark J-1 (1914), *Highlands Bridge***, is a Coast and Geodetic Survey standard disk set in the top of the northwest end of the concrete retaining wall at the south side of the railroad fill on the east side of the Shrewsbury River. Elevation: 15.35 feet above mean low water; 13.60 feet above mean sea level.

**Bench mark 2 (1926), *Highlands Bridge***, is a Coast and Geodetic Survey standard disk, stamped "2/1926," set in the concrete base of the west gatepost at entrance to Fort Hancock reservation at Highlands Beach. Elevation: 10.79 feet above mean low water; 9.04 feet above mean sea level.

The elevations of other tide planes at Highlands Bridge referred to mean low water are as follows:

	Feet
Highest tide.....	7.56
Mean high water.....	3.59
Mean sea level.....	1.73
Mean low water.....	0.00
Lowest tide.....	-4.00

#### SANDY HOOK

The elevations of the following bench marks are based on six years of continuous tidal observations made with an automatic tide gauge by this bureau during the years 1876 to 1881, inclusive, and on several series of automatic gauge records by the United States Army Engineers during the years 1910 to 1916, inclusive, together with the mean sea level elevation of State geological survey monument at Perth Amboy referred back to bench mark "C" at Sandy Hook by first-order levels in 1914. Bench mark "C" appears to have settled since the determination of the elevation of 19.531 feet above mean sea level, given on page 91 of Special Publication No. 18, and the elevation now adopted is 19.357 feet above mean sea level.

**Bench mark C (1856), *Sandy Hook***, is the horizontal line of a cross cut on the head of a copper bolt inserted in the wall of the main lighthouse tower at Sandy Hook. It is a few inches west of the northwest angle of the tower and 9 inches above the sloping ledge near its base and 2 feet above the ground. The lighthouse is built on quicksand and may be settling. Elevation: 21.70 feet above mean low water; 19.36 feet above mean sea level.

**Bench mark J (1915)**, *Sandy Hook*, is a Coast and Geodetic Survey standard disk, stamped "1/1915," set flush with a block of granite at the southeast corner of the granite foundation on which sits a large cylindrical water tank. The mark is about 9 feet above the ground in the fourth tier of blocks and is 3.2 meters north of a one-story, red brick building. Elevation: 15.05 feet above mean low water; 12.71 feet above mean sea level.

**Bench mark 2 (1923)**, *Sandy Hook*, is a Coast and Geodetic Survey standard disk, stamped "2/1923," set in cement in a hole drilled into a granite block which is a part of the retaining wall which supports the road leading to the quartermaster's wharf. It is the block next to a conspicuous white block and 34 feet from the east end of the wall and 95 feet southwest of a pyramid of cannon balls. Elevation: 9.74 feet above mean low water; 7.40 feet above mean sea level.

**Bench mark 4 (1923)**, *Sandy Hook*, is a Coast and Geodetic Survey standard disk, stamped "4/1923," set in cement in a hole drilled into the lowest platform of the easternmost gun of the Lewis Morris battery of 3-inch guns. Elevation: 15.14 feet above mean low water; 12.80 feet above mean sea level.

**Bench mark 5 (1923)**, *Sandy Hook*, is a Coast and Geodetic Survey standard disk, stamped "5/1923," set in cement in the fourth step from the bottom in front of the house of the United States Weather Bureau. Elevation: 17.15 feet above mean low water; 14.81 feet above mean sea level.

**Bench mark 6 (1923)**, *Sandy Hook*, is a Coast and Geodetic Survey standard disk, stamped "6/1923," set in cement in the concrete base of the steel flagpole in front of the post headquarters. Elevation: 10.77 feet above mean low water; 8.43 feet above mean sea level.

**Bench mark "W. B." (1926)**, *Sandy Hook*, is a United States Weather Bureau metal disk set flush in the concrete floor of the veranda of the front of the house of the United States Weather Bureau. Elevation: 19.08 feet above mean low water; 16.74 feet above mean sea level.

The elevations of other tide planes at Sandy Hook referred to mean low water are as follows:

	Feet
Highest tide.....	8.50
Mean high water.....	4.68
Mean sea level.....	2.34
Mean low water.....	0.00
Lowest tide.....	-4.00

#### BEACH HAVEN INLET, LITTLE EGG HARBOR

The elevations of the following bench marks are based on seven high waters and seven low waters observed during the period October 16, to 29, 1924, reduced to mean values by comparison with simultaneous observations at Atlantic City, where the datum is based on 13 years of observations.

**Bench mark 1 (1924)**, *Beach Haven Inlet*, is a Coast and Geodetic Survey standard disk set in the center of the top of a 3-foot square of concrete. It is on the west side of the point 275 meters south of the Bonds Coast Guard Station and 91 meters east of the tide staff of October, 1924. It is also about 33 meters from the high-water line. The top of the concrete block is 6 inches above the surface of the ground. Elevation: 6.45 feet above mean low water; 4.00 feet above half tide level.

**Bench mark 2 (1924)**, *Beach Haven Inlet*, is the top of the southwest corner of a square concrete water basin at the artesian well 7.1 meters south of the Bonds Coast Guard Station. It is 2.1 feet above the surface of the ground and 8.3 meters from the south wall of the Coast Guard station. No mark was made on the concrete, but the level rod was held on the corner about 2 inches from both edges. Elevation: 8.55 feet above mean low water; 7.00 feet above half tide level.

**Bench mark 3 (1924)**, *Beach Haven Inlet*, is the top of the southeast corner of a square concrete cesspool 1.2 meters from the south side of the Bonds Coast Guard Station. It is 1.8 feet above the surface of the ground and 2.1 meters from the south side of the Coast Guard station. No mark was made on the concrete, but the level rod was held on the corner, 2 inches from both edges. Elevation: 8.71 feet above mean low water; 7.16 feet above half tide level.

The elevations of other tide planes at Beach Haven Inlet referred to mean low water are as follows:

	Feet
Highest tide.....	6.00
Mean high water.....	3.10
Half tide level.....	1.55
Mean low water.....	0.00
Lowest tide.....	-2.50

## ATLANTIC CITY

The elevations of the following bench marks are based on 13 years of automatic gauge records observed during the period 1912 to 1926, which have been reduced to mean values by comparison with simultaneous observations at Baltimore, Md., where the datum is based on 19 years' observations. Nine years of the observations at Atlantic City, 1912 to 1920, inclusive, are from the records of an automatic tide gauge maintained on the Million Dollar Pier, and four years, 1923 to 1926, inclusive, are from the records of an automatic tide gauge still being maintained on the Steel Pier.

**Bench mark 1 (1867), Atlantic City,** called the "Absecon Light Bench Mark," is a plain chiseled surface upon the top of the ashlar coping of the stone foundation directly beneath the west corner of the north window and 3.1 feet below the upper outside edge of the iron window sill on the north side of the lighthouse. Measuring upon the first course of brick above the coping, it is 16 feet 7 inches from the north face of the wing wall containing the arcade entrance to the tower. Elevation: 10.74 feet above mean low water; 8.69 feet above mean sea level.

**Bench mark E-4 (1924), Atlantic City,** is a Coast and Geodetic Survey standard disk in a concrete post in a grass plot in Absecon Light reservation at Pacific and Vermont Avenues, 32.1 feet north of the lighthouse. Elevation: 10.34 feet above mean low water; 8.29 feet above mean sea level.

**Bench mark 28 (1911), Atlantic City,** is a cross of lines, about 1 inch long and  $\frac{1}{4}$  inch deep, cut on northeast end of stone sill at entrance to barber shop, the first door from corner on Pacific Avenue side, on Galen Hall, a brick building on east corner of Pacific and Connecticut Avenues. Elevation: 10.87 feet above mean low water; 8.82 feet above mean sea level.

**Bench mark 27 (1911), Atlantic City,** is a cross of lines, about 1 inch long and  $\frac{1}{4}$  inch deep, cut in the north corner of stone doorsill at corner entrance to Jackson's drug store, a brick building at the east corner of Pacific and Delaware Avenues. Elevation: 10.81 feet above mean low water; 8.76 feet above mean sea level.

**Bench mark 26 (1911), Atlantic City,** is a Coast and Geodetic Survey standard disk, stamped "26/1922," set in the vertical foundation of the post-office building at the southeast corner of Pacific and Pennsylvania Avenues. The mark is about 8 inches above the pavement and a few inches to the left of the steps at the entrance on Pennsylvania Avenue, near the corner of the building. Elevation: 12.52 feet above mean low water; 10.47 feet above mean sea level.

**Bench mark F-4 (1924), Atlantic City,** is a Coast and Geodetic Survey standard disk set horizontally in first stone step of Atlantic Avenue entrance to city hall, 5 inches from wall and 3 inches from west edge of step. Elevation: 11.45 feet above mean low water; 9.40 feet above mean sea level.

**Bench mark 34 (1922), Atlantic City,** is a Coast and Geodetic Survey standard disk, stamped "34/1922," in sill at left side of entrance to the Antoinette Apartment House, 140 South Virginia Avenue. Elevation: 12.27 feet above mean low water; 10.22 feet above mean sea level.

**Bench mark 33 (1922), Atlantic City,** is a Coast and Geodetic Survey standard disk, stamped "33/1922," set in top of large concrete pile or pier on the east side of Steeplechase Pier. It is the first large pile from the Board Walk. Elevation: 10.08 feet above mean low water; 8.03 feet above mean sea level.

**Bench mark 32 (1922), Atlantic City,** is a Coast and Geodetic Survey standard disk, stamped "32/1922," set in the cement surface on the east side of the most easterly column of the arcade of Haddon Hall, Board Walk between North Carolina and Pennsylvania Avenues. Elevation: 15.83 feet above mean low water; 13.78 feet above mean sea level.

**Bench mark 31 (1922), Atlantic City,** is a Coast and Geodetic Survey standard disk, stamped "31/1922," in sill at left side of main entrance to apartment house and business building at southwest corner of New York and Pacific Avenues. Elevation: 11.17 feet above mean low water; 9.12 feet above mean sea level.

**Bench mark 23 (1911), Atlantic City,** is a cross of lines, about 1 inch long and  $\frac{1}{4}$  inch deep, cut on the top of granite siding at southeast end of steps at main entrance on Illinois Avenue to the library building at the north corner of Pacific and Illinois Avenues. It is about 3 inches from east corner of siding and is on level with the top of the dark-colored granite foundation of the

building. Elevation: 12.73 feet above mean low water; 10.68 feet above mean sea level.

**Bench mark 30 (1922)**, *Atlantic City*, is a Coast and Geodetic Survey standard disk, stamped "30/1922," at high-school building, corner of Ohio and Pacific Avenues. The disk is set in the stone sill on the northerly side of the center archway entrance from Ohio Avenue. Elevation: 11.72 feet above mean low water; 9.67 feet above mean sea level.

**Bench mark 18 (1911)**, *Atlantic City*, is a cross of lines, about 1 inch long and 1/4 inch deep, cut in the northwest end of stone doorsill of a brick building on Arkansas Avenue, about 100 feet from the east corner of the building which is at the west corner of Board Walk and Arkansas Avenue. Elevation: 13.72 feet above mean low water; 11.67 feet above mean sea level.

The elevations of other tide planes at Atlantic City referred to mean low water are as follows:

	Feet
Highest tide observed (Feb. 5, 1920)-----	7.50
Mean high water-----	4.04
Mean sea level-----	2.05
Half tide level-----	2.02
Mean low water-----	0.00
Lowest tide observed (Jan. 4, 1913; Jan. 29, 1926)-----	-3.00

#### LONGPORT, GREAT EGG HARBOR

The elevations of the following bench marks are based on five months of tidal observations made by an automatic tide gauge maintained on Nugent's Pier during the months of August and October, 1925, and January, February, and March, 1926, in cooperation with the Department of Conservation and Development of the State of New Jersey. These observations were reduced to mean values by comparison with simultaneous observations at Atlantic City, where the datum is based on 13 years' observations.

**Bench mark 1 (1901)**, *Longport*, is the top of the corner of the granite corner stone on the north corner of the Longport Borough Hall at the south corner of Atlantic and Fifteenth Avenues. The stone has the date "1890" cut into its side. Elevation: 11.96 feet above mean low water; 10.01 feet above half tide level.

**Bench mark 2 (1901)**, *Longport*, is the base of a triangle cut into the brick on the north corner of the large chimney on the rear of the Aberdeen Hotel at Sixteenth Avenue. It is marked "U. S. B. M." It is about 4 feet above the ground on the northwesterly side of the chimney close to a small porch. Elevation: 15.63 feet above mean low water; 13.68 feet above half tide level.

**Bench mark 4 (1925)**, *Longport*, is the top of the outer corner of the corner stone on the north corner of the Church of the Redeemer, situated on the south corner of Atlantic and Twentieth Avenues. The stone, which is about 3 feet above the sidewalk, has the date "1908" cut into its northwest face and a cross cut into its northeast face. Elevation: 11.06 feet above mean low water; 9.11 feet above half tide level.

**Bench mark 5 (1925)**, *Longport*, is a Coast and Geodetic Survey standard disk set in the west face of the north corner of the Longport Borough Hall at Atlantic and Fifteenth Avenues. It is about a foot below the northwesterly face of the corner stone that constitutes bench mark 1 and 2.1 feet above the sidewalk. Elevation: 10.28 above mean low water; 8.33 feet above half tide level.

**Bench mark 6 (1925)**, *Longport*, is a Coast and Geodetic Survey standard disk set in the north corner of the top of a heavy concrete cover over a buried septic tank of the Longport sewage system at the south corner of Atlantic and Fourteenth Avenues. It is about 10 feet northeast of a small brick house that is part of the septic system. The surface of the concrete is about level with the ground. Elevation: 7.30 feet above mean low water; 5.35 feet above half tide level.

**Bench mark 7 (1925)**, *Longport*, is a Coast and Geodetic Survey standard disk set in the southwesterly face (near the south corner) of the concrete foundation of the United States Coast Guard Station on the northwest side of Atlantic Avenue near Twenty-third Avenue. It is 2 feet above the ground level. Elevation 10.10 feet above mean low water; 8.15 feet above half tide level.

The elevations of other tide planes at Longport referred to mean low water are as follows:

	Feet
Highest tide-----	7.50
Mean high water-----	3.90
Half tide level-----	1.95
Mean low water-----	0.00
Lowest tide-----	-3.00

#### CAPE MAY HARBOR, COLD SPRING INLET

The elevations of the following bench marks are based on 19 months of automatic gauge records made during the period October, 1924, to May, 1926, inclusive, reduced to mean values by comparison with simultaneous observations at Atlantic City, where the datum is based on 13 years of observations.

**Bench mark 1 (1924)**, *Cape May Harbor*, is a Coast and Geodetic Survey standard disk, stamped "No. 1/1924," set in cement in a drill hole in the northeast corner of the concrete base of the steel signal tower just north of the Coast Guard station at Cold Spring Inlet. Bench mark is on the Naval Air Service reservation. Elevation: 9.62 feet above mean low water; 7.38 feet above mean sea level.

**Bench mark 2 (1924)**, *Cape May Harbor*, is a Coast and Geodetic Survey standard disk, stamped "No. 2/1924," set with cement in a drill hole in concrete in the northwest corner of the top of the manhole at the northeast corner of the intersection of the street leading south from the Coast Guard dock and the first street running east and west, south of the Coast Guard station. Elevation: 10.82 feet above mean low water; 8.58 feet above mean sea level.

**Bench mark 3 (1924)**, *Cape May Harbor*, is a Coast and Geodetic Survey standard disk, stamped "No. 3/1924," set in cement in a drill hole in the northeast concrete pier supporting the low, black water tank on the Naval Air Service reservation at Sewell Point. This tank is at the southeast corner of the intersection of the entrance street of the reservation and the first street running north and south from the entrance. Elevation: 12.14 feet above mean low water; 9.90 feet above mean sea level.

**Bench mark 4 (1924)**, *Cape May Harbor*, is a Coast and Geodetic Survey standard disk, stamped "No. 4/1924," set in cement in a drill hole in the southwest concrete pier supporting the tall water tank on the Naval Air Service reservation at Sewell Point. This tank is about 100 feet northeast of the intersection of the entrance street of the reservation and the first street running north and south. Elevation: 12.27 feet above mean low water; 10.03 feet above mean sea level.

**Bench mark 5 (1924)**, *Cape May Harbor*, is a Coast and Geodetic Survey standard disk, stamped "No. 5/1924," set in cement in a drill hole in the concrete porch of a large warehouse on the Naval Air Service reservation at Sewell Point. The warehouse is on the north side of the road leading from the entrance to the reservation and about 100 yards east of the intersection of this road and the road leading to the Coast Guard dock. The mark was set at the western end of the porch near the side of the building. Elevation: 15.60 feet above mean low water; 13.36 feet above mean sea level.

**Bench mark 6 (1914)**, *Cape May Harbor*, is a Coast and Geodetic Survey standard disk set in the center of top of a brick pier, located in the center of western jetty at Cold Spring Inlet, 32 feet 11 inches southeast of its shore end near Sewell Point amusement pavilion. A hole was excavated in the rocks forming the jetty, and a brick pier 12 inches square and 3 feet high was laid in cement in the hole and projecting a few inches above the surface of jetty and surrounded by broken stone and cement. In September, 1924, it was stamped "No. 6, 1924." Elevation: 10.45 feet above mean low water; 8.21 feet above mean sea level.

**Bench mark Z-4 (1924)**, *Cape May*, is a Coast and Geodetic Survey standard disk in a vertical drill mark in the precast foundation coping of the Merchants National Bank on the southeast corner of Washington Avenue and Decatur Street, 9 inches above the sidewalk and 2 feet 9 inches north of the southwest corner of the building. Elevation: 17.58 feet above mean low water; 15.34 feet above mean sea level.

**Bench mark Y-4 (1924)**, *Cape May*, is a Coast and Geodetic Survey standard disk in a vertical drill mark in the brick wall of Cape May High School on Washington Avenue. It faces street in south face of west wing of building, 5 feet 10 inches west of west wall of building, 1 foot 1 inch above the ground,

5 feet 2 inches below the bottom of concrete water table, and about 100 feet back from the street. Elevation: 18.43 feet above mean low water; 16.19 feet above mean sea level.

**Bench mark A-5 (1924), Cape May,** is a Coast and Geodetic Survey standard disk in concrete post set in small triangular grass plot of Soldiers and Sailors Monument at Columbia Avenue and Guernsey Street. It is in line with the monument and electric lamp-post at the west corner of the plot, 25 feet 9 inches west of the monument, and 10 feet 3 inches east of the lamp-post. Elevation: 11.76 feet above mean low water; 9.52 feet above mean sea level.

The elevations of other tide planes at Cape May Harbor referred to mean low water are as follows:

	Feet
Highest tide.....	8.00
Mean high water.....	4.40
Mean sea level.....	2.24
Half tide level.....	2.20
Mean low water.....	0.00
Lowest tide.....	-2.00

#### CAPE MAY, MUNICIPAL PIER

The elevations of the following bench marks are based on 130 high waters and 120 low waters observed during the period August 6 to October 22, 1927, reduced to mean values by comparison with simultaneous observations at Atlantic City, where the datum is based on 13 years of observations.

**Bench mark 3 (1927), Cape May,** is a Coast and Geodetic Survey standard disk set in curbstone on the north side of Beach Boulevard. It is 108 feet to the intersection of the tangents of north side of Beach Boulevard and the west side of Howard Street, and 100 feet to the intersection of the tangents of north side of Beach Boulevard and east side of Dupont Place. Elevation: 9.55 feet above mean low water; 7.40 feet above half tide level.

**Bench mark 4 (1927), Cape May,** is a Coast and Geodetic Survey standard disk set in the top face of curbstone on west side of Howard Street, 36.4 feet from southeast corner of the new Stockton Villa and 8 feet north of intersection of tangents of north side of Beach Boulevard and west side of Howard Street. Elevation: 9.48 feet above mean low water; 7.33 feet above half tide level.

The elevations of other tide planes at Cape May, Municipal Pier, referred to mean low water are as follows:

	Feet
Highest tide.....	8.00
Mean high water.....	4.30
Half tide level.....	2.15
Mean low water.....	0.00
Lowest tide.....	-2.00

#### CAPE MAY POINT, BAY SHORE CHANNEL

The elevations of the following bench marks are based on 156 high waters and 156 low waters observed during the period August 4 to October 24, 1927, reduced to mean values by comparison with simultaneous observations at Atlantic City, where the datum is based on 13 years of observations.

**Bench mark 1 (1927), Cape May Point,** is a Coast and Geodetic Survey standard disk, stamped "1/1927," set in a concrete foundation of what was formerly an old mill. The concrete block is 6 feet long, 3 feet wide, and 2 feet high. It is located at high-water mark and is 895 feet north of center of the sewerage outlet located at the intersection of north side of Sunset Boulevard and high-water line. Elevation: 10.19 feet above mean low water; 7.89 feet above half tide level.

**Bench mark 2 (1927), Cape May Point,** is a Coast and Geodetic Survey standard disk, stamped "2/1927," set in a concrete monument 16 inches square and 40 inches deep, about 2 inches above the surface of the ground. The monument is located 308 feet east from end of concrete of Sunset Boulevard, 423 feet from high-water mark, and 60 feet south of southern edge of concrete of Sunset Boulevard. It is 225 feet east of southeast corner of Cape May Concrete Co. building located near end of Sunset Boulevard. Elevation: 15.01 feet above mean low water; 12.71 feet above half tide level.

**Bench mark 3 (1927), Cape May Point,** is a Coast and Geodetic Survey standard disk, stamped "3/1927," set in a concrete monument 12 inches square, 36 inches deep, about 2 inches above the surface of the ground. It is located 770 feet south of Sunset Boulevard and 112 feet east of high water line. A Coast

Guard patrol signal box lies 10 feet southwest of bench mark. Elevation: 10.67 feet above mean low water; 8.37 feet above half tide level.

**Bench mark 4 (1927), Cape May Point**, is a Coast and Geodetic Survey standard disk, stamped "4/1927," placed in fourth brick from ground, second brick from corner, on west face of foundation at southwest corner of Presbyterian Home, Alexander and Knox Avenues. Elevation: 12.67 feet above mean low water; 10.37 feet above half tide level.

The elevations of other tide planes at Cape May Point referred to mean low water are as follows:

	Feet
Highest tide.....	8.00
Mean high water.....	4.60
Half tide level.....	2.30
Mean low water.....	0.00
Lowest tide.....	-2.00

#### MAURICE RIVER LIGHT

The elevation of the following bench mark is based on 74 high waters and 71 low waters observed during the period August 14 to October 26, 1885.

**Bench mark 1 (1885), Maurice River Light**, is the top of the foundation at the northwest corner of Maurice River Light on East Point. Elevation: 11.07 feet above mean low water; 8.19 feet above half tide level.

The elevations of other tide planes at Maurice River Light referred to mean low water are as follows:

	Feet
Highest tide.....	8.50
Mean high water.....	5.76
Half tide level.....	2.88
Mean low water.....	0.00
Lowest tide.....	-2.50

#### MILLVILLE, MAURICE RIVER

The elevations of the following bench marks are based on two and one-half months of automatic gauge records made during the period October 14 to December 31, 1926, by the United States Army Engineers in cooperation with this bureau. The observations were reduced to mean values by comparison with simultaneous observations at Philadelphia, Pa., where the datum is based on 19 years of observations.

**Bench mark 1 (1927), Millville**, is a cross cut in top of concrete wall on the left bank of the stream, about 1 inch from face of wall and 4 inches downstream from southeast wing wall of Main Street Bridge. Elevation: 9.52 feet above mean low water; 6.52 feet above half tide level.

**Bench mark 2 (1927), Millville**, is a cross cut in top of concrete wall on left bank of the stream, about 1 inch from face at downstream corner of wall around bridge tender's house on south side of Main Street Drawbridge. Elevation: 9.48 feet above mean low water; 6.48 feet above half tide level.

**Bench mark 3 (1927), Millville**, is a cross cut in top of west bridge seat of Main Street Drawbridge at Millville, about 3 inches from face of abutment and 4 inches from downstream corner. Elevation: 9.32 feet above mean low water; 6.32 feet above half tide level.

The elevations of other tide planes at Millville referred to mean low water are as follows:

	Feet
Highest tide.....	9.00
Mean high water.....	6.00
Half tide level.....	3.00
Mean low water.....	0.00
Lowest tide.....	-3.00

#### SEA BREEZE, DELAWARE BAY

The elevation of the following bench mark is based on 70 high waters and 68 low waters observed during the period July 18 to August 29, 1880.

**Bench mark 3 (1882), Sea Breeze**, is the horizontal line of a cross cut with a cold chisel in the stone underpinning at the northwest corner of the main building of the Warner House. It is about 8 inches east of corner and about 14 inches above surface of ground. Elevation: 10.08 feet above mean low water; 7.06 feet above half tide level.

The elevations of other tide planes at Sea Breeze referred to mean low water are as follows:

	Feet
Highest tide.....	9.00
Mean high water.....	6.04
Half tide level.....	3.02
Mean low water.....	0.00
Lowest tide.....	-3.00

## BRIDGETON, COHANSEY RIVER

The elevations of the following bench marks are based on two and one-half months of automatic gauge records made during the period October 14 to December 31, 1926, by the United States Army Engineers in cooperation with this bureau. The observations were reduced to mean values by comparison with simultaneous observations at Millville, Maurice River, which in turn had been corrected by comparison with simultaneous observations at Philadelphia, Pa., where the datum is based on 19 years of observations.

**Bench mark 1 (1927), Bridgeton,** is a cross cut in top of stone wall on left bank of stream, about 6 inches downstream from south edge of bridge and 2 inches from face of wall. Elevation: 15.12 feet above mean low water; 11.87 feet above half tide level.

**Bench mark 2 (1927), Bridgeton,** is a cross cut in top of stone wall on right bank of stream, about 1½ feet downstream from south edge of bridge and 1½ inches from face of wall. Elevation: 15.29 feet above mean low water; 12.04 feet above half tide level.

The elevations of other tide planes at Bridgeton referred to mean low water are as follows:

	Feet
Highest tide.....	9.00
Mean high water.....	6.50
Half tide level.....	3.25
Mean low water.....	0.00
Lowest tide.....	-3.00

## BAY SIDE, DELAWARE RIVER

The elevations of the following bench marks are based on 31 high waters and 33 low waters observed during the period August 15 to 31, 1924, reduced to means values by comparison with simultaneous observations at Philadelphia, Pa., where the datum is based on 19 years of observations.

**Bench mark 1 (1924), Bay Side,** is a Coast and Geodetic Survey standard disk, stamped "B. M. 1/1924," set in stringer at the southeast corner of the Central Railroad of New Jersey dock at Bay Side. Elevation: 9.28 feet above mean low water; 6.48 feet above half tide level.

**Bench mark 2 (1924), Bay Side,** is a Coast and Geodetic Survey standard disk, stamped "B. M. 2/1924," set in the top of a 12 by 12 inch wooden bumper at the end of the tracks of the Central Railroad of New Jersey at Bay Side. Elevation: 6.00 feet above mean low water; 3.20 feet above half tide level.

**Bench mark 3 (1924), Bay Side,** is a Coast and Geodetic Survey standard disk, stamped "B. M. 3/1924," set in concrete in a 2-foot tile on the south side of the railroad about 15 feet from the center line of the track and about 500 feet from the end of the railroad. The top of the tile, flange up, was set level with the surface of the ground. Elevation: 6.32 feet above mean low water; 3.52 feet above half tide level.

**Bench mark 4 (1924), Bay Side,** is a cross cut in the iron base of the switch stand of the Central Railroad of New Jersey at Bay Side. It is stamped "B. M. 4/1924." Elevation: 5.98 feet above mean low water; 3.18 feet above half tide level.

**Bench mark 5 (1924), Bay Side,** is a Coast and Geodetic Survey standard disk, stamped "B. M. 5/1924," set in concrete in a 2-foot tile, flange up, the tile being 1½ feet in the ground about 10 feet north of the center line of the railroad, 800 feet from the end of the track. Elevation: 7.08 feet above mean low water; 4.28 feet above half tide level.

The elevations of other tide planes at Bay Side referred to mean low water are as follows:

	Feet
Highest tide.....	9.00
Mean high water.....	5.60
Half tide level.....	2.80
Mean low water.....	0.00
Lowest tide.....	-3.00

#### CAMDEN, DELAWARE RIVER

The elevations of the following bench marks are based on 19 years of automatic gauge records made at Chestnut Street Pier, Philadelphia, Pa., during the period 1901 to 1919, inclusive. The results of these observations were carried to Camden by first-order levels in 1924.

**Bench mark G-3 (1924), Camden,** is a Coast and Geodetic Survey standard disk in concrete post, set 3 feet from wall and 8.5 feet from most north-westerly corner of police-court wing of city hall at Railroad Avenue, midway between two most westerly subsurface windows on north face. Elevation: 26.91 feet above mean low water; 24.30 feet above half tide level.

**Bench mark S-3 (1924), Camden,** is a Coast and Geodetic Survey standard disk, set in water table at southeast corner of new Philadelphia & Reading Railroad terminal at foot of Atlantic Avenue. It is south of most southerly track in train shed and about 3 inches west of east face of terminal. Elevation: 23.10 feet above mean low water; 20.49 feet above half tide level.

**Bench mark H-3 (1924), Camden,** is a Coast and Geodetic Survey standard disk, set in foundation of banjo signal, 60 feet northeast of grade crossing of Philadelphia & Reading (Atlantic City) Railroad and Pennsylvania electrified line to Atlantic City; 8 feet southeast of southeast rail of Philadelphia & Reading line; about 100 yards northeast of Broadway Street Bridge over Philadelphia & Reading tracks at Shipyard Station. Elevation: 16.95 feet above mean low water; 14.34 feet above half tide level.

The elevations of other tide planes at Camden referred to mean low water are as follows:

	Feet
Highest tide.....	9.50
Mean high water.....	5.20
Half tide level.....	2.60
Mean low water.....	0.00
Lowest tide.....	-4.00

### PUBLICATIONS BY THE UNITED STATES COAST AND GEODETIC SURVEY RELATING TO BENCH MARKS AND DATUM PLANES

	Price
Special Publication No. 83 (Serial 193), Tidal Bench Marks, State of New York, 1922.....	\$0.20
Special Publication No. 119 (Serial 320), Tidal Bench Marks, District of Columbia, 1925.....	.05
Special Publication No. 128 (Serial 370), Tidal Bench Marks, State of Rhode Island, 1927.....	.10
Special Publication No. 136, Tidal Bench Marks, State of Connecticut, 1927.....	.10
Special Publication No. 141, Tidal Bench Marks, State of California, 1928.....	.15

#### FIRST-ORDER LEVELING

Precise leveling in United States, 1900-1903, with readjustment of level net and resulting elevations; by J. F. Hayford. Report for 1903. App. 3, p. 189-810, 2 illus.....	.40
Same, reprint with changes of pp. 580-809, descriptions of bench marks.....	.35
Precise leveling in United States, 1903-1907, with readjustment of level net and resulting elevations; by J. F. Hayford and L. Pike. 280 p., 1 illus.....	.45
Fourth general adjustment of precise level net in the United States and resulting standard elevations; by William Bowie and H. G. Avers. Special Publication 18. 328 p., 5 illus. 1914.....	.40

	Price
Precise leveling from Brigham, Utah, to San Francisco, Calif.; by William Bowle. Special Publication 22. 67 p., 5 illus. 1914-----	\$0.15
Precise leveling from Reno to Las Vegas, Nev., and from Tonopah Junction, Nev., to Laws, Calif.; by H. G. Avers and G. D. Cowie. Special Publication 39; Serial 49. 49 p., 5 illus. 1916-----	.10
Precise leveling in Texas; by H. G. Avers. Special Publication 77; Serial 177. 185 p., 19 illus. 1922-----	.15
Precise leveling in Georgia; by H. G. Avers. Special Publication 95; Serial 240. 109 p., 8 illus-----	.15
First-order leveling in Oregon; by H. G. Avers. Special Publication 122; Serial 334. 80 p., 9 illus-----	.15

## DATUM PLANES

Special Publication No. 41 (Serial 60), Use of Mean Sea Level as the Datum for Elevations, 1917-----	.05
Special Publication No. 135, Tidal Datum Planes, 1927-----	.30

All of the above publications are for sale by the Superintendent of Documents, Government Printing Office, Washington, D. C., to whom remittance should be sent.

# INDEX

---

	Page		Page	
Bases of elevations-----	4	Descriptions and elevations of bench marks—Continued.		
Changes in elevation-----	4		Highlands Bridge-----	8
Datum planes-----	2		Lincoln Highway Bridge, Passaic River-----	5, 6
Descriptions and elevations of bench marks:			Longport-----	11, 12
Atlantic City-----	10, 11		Maurice River Light-----	14
Bayside, Delaware River-----	15, 16		Millville, Maurice River-----	14
Beach Haven Inlet-----	9		Port Newark-----	6
Belvedere Beach-----	7, 8		Sandy Hook-----	8, 9
Bergen Point-----	5		Sea Breeze, Delaware Bay-----	14, 15
Bridgeton, Cobansey River-----	15		Secaucus, Hackensack River-----	5
Camden-----	16		Introduction-----	1
Cape May-----	13		Publications relating to bench marks and datum planes-----	16, 17
Cape May Harbor-----	12, 13		Standard bench mark-----	2
Cape May Point-----	13, 14			
Elizabethport-----	6, 7			

