Serial No. 32

DEPARTMENT OF COMMERCE

U. S. COAST AND GEODETIC SURVEY

E. LESTER JONES, SUPERINTENDENT

UNITED STATES COAST PILOT

ATLANTIC COAST

SECTION C

SANDY HOOK TO CAPE HENRY

INCLUDING DELAWARE AND CHESAPEAKE BAYS

VK
981
.N33
1st ed.
(1916)

PRICE, 50 CENTS

WASHINGTON
GOVERNMENT PRINTING OFFICE
1916

National Oceanic and Atmospheric Administration

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SUBOFFICES OF THE COAST AND GEODETIC SURVEY.

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At these offices complete files of United States Coast and Geodetic Survey charts, Coast Pilots, Tide Tables, and other publications relating to navigation may be consulted and information affecting navigation obtained without charge.

Light Lists, Buoy Lists, and Notices to Mariners are kept for free distribution to mariners.

The suboffices are also sales agencies for the Coast and Geodetic Survey publications.

A chart catalogue, giving lists of charts, coast pilots, tide tables, and agencies of the Coast and Geodetic Survey, can be obtained from any of the suboffices, or will be sent, free of charge, on application to the Coast and Geodetic Survey, Washington, D. C. Frequent changes occur in the agencies, and the list of agencies is published in the first notice each month of the Notices to Mariners.

DEPARTMENT OF COMMERCE,
U. S. COAST AND GEODETIC SURVEY,
Washington, D. C., May 12, 1916.

This publication covers the coast from Sandy Hook to Cape Henry, including Delaware and Chesapeake Bays and tributaries and the inside route from New York to Norfolk. It is based mainly upon the work of the United States Coast and Geodetic Survey, including the results of special examinations in 1914 and 1915.

This volume covers, with the exception of New York Harbor and tributaries, the same territory formerly included in United States Coast Pilots, Part V, New York to Chesapeake Bay Entrance; and Part VI, Chesapeake Bay and Tributaries, of which four editions of each were published, the first editions having been prepared by Lieut. Edwin H. Tillman, United States Navy, and Mr. John Ross.

The present volume has been prepared by L. A. Potter, nautical expert, under the direction of Herbert C. Graves, chief of division of hydrography and topography, Coast and Geodetic Survey.

Great courtesy has been shown by the United States engineers, the Lighthouse Service, and local authorities in furnishing information for use in this publication.

The aids to navigation are corrected to May 12, 1916.

Navigators are requested to notify the Superintendent of the Coast and Geodetic Survey of any errors or omissions they may find in this publication, or of additional matter which they think should be inserted for the information of mariners.

E. LESTER JONES,
Superintendent.

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NOTE.

The courses and bearings given in degrees are *true*, reading clockwise from 0° at north to 360°, and are followed by the equivalent *magnetic* value in points in parentheses. General directions, such as northeastward, west-southwestward, etc., are magnetic.

Distances are in *nautical miles*, and may be converted approximately to statute miles by adding 15 per cent to the distances given.

Currents are expressed in knots, which are nautical miles per hour.

Except where otherwise stated, all depths are at *mean low water*.

Supplements and other corrections for this volume are issued from time to time and will be furnished, free of charge, on application to the Coast and Geodetic Survey, Washington, D. C., provided the volume itself has not been superseded by a subsequent edition.

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UNITED STATES COAST PILOT.

ATLANTIC COAST—SECTION C—SANDY HOOK TO CAPE HENRY.

NAVIGATIONAL AIDS AND THE USE OF CHARTS.

The Coast and Geodetic Survey is charged with the survey of the coasts, harbors, and tidal estuaries of the United States and its insular possessions and issues the following publications relating to these waters as guides to navigation: Charts, Coast Pilots, Tide Tables, a catalogue of these publications, and Notice to Mariners, the last named published weekly by the Bureau of Lighthouses and Coast and Geodetic Survey.

CHARTS bear three dates, which should be understood by persons using them: (1) The date (month and year) of the edition, *printed* on the late charts below the border in a central position, and on the older ones on the face of the chart; (2) the date of the latest correction to the chart plate, *printed* in the lower left-hand corner below the border; (3) the *date of issue*, *stamped* below the border and just to the left of the subtitle.

Charts show all necessary corrections as to lights, beacons, buoys, and dangers, which have been received to the *date of issue*, being hand corrected since the latest date printed in the lower left-hand corner. All small but important corrections occurring subsequent to the *date of issue* of the chart are published in Notice to Mariners, and should be applied by hand to the chart immediately after the receipt of the notices.

The date of the edition of the chart remains unchanged until an extensive correction is made on the plate from which the chart is printed. The date is then changed and the issue is known as a new edition.

When a correction, not of sufficient importance to require a new edition, is made to a chart plate, the year, month, and day are noted in the lower left-hand corner.

All the notes on a chart should be read carefully, as in some cases they relate to the aids to navigation or to dangers that can not be clearly charted.

The charts are various in character, according to the objects which they are designed to subserve. The most important distinctions are the following:

1. Sailing charts, mostly on a scale of approximately $\frac{1}{1,200,000}$ which exhibit the approaches to a large extent of coast, give the offshore soundings and enable the navigator to identify his position as he approaches from the open sea.

2. General charts of the coast, on scales of $\frac{1}{400,000}$ and $\frac{1}{200,000}$ intended especially for coastwise navigation.

3. Coast charts, on a scale of $\frac{1}{80,000}$ by means of which the navigator is enabled to avail himself of the channels for entering the larger bays and harbors.

4. Harbor charts, on larger scales, intended to meet the needs of local navigation.

Coast Pilots, relating to the surveyed waters of the United States, Porto Rico, and a part of Alaska, and Sailing Directions of the Philippine Islands, contain full nautical descriptions of the coast, harbors, dangers, and directions for coasting and entering harbors. Similar information relating to parts of Alaska and Hawaii is published in Coast Pilot Notes.

Coast Pilots are corrected for important information received to the date of issue, which is stamped on the correction sheets accompanying the volume. From time to time, as the material accumulates, supplements are issued containing the more important corrections since the publication of the volume. The supplements are printed on one side of the paper only, so that they may be cut and pasted in the appropriate places in the volume. Supplements and other corrections for any volume can be furnished free of charge on application to the Coast and Geodetic Survey, Washington, D. C., provided the volume itself has not been superseded by a subsequent edition.

Tide Tables.—The Coast and Geodetic Survey Tide Tables are issued annually in advance of the year for which they are made, and contain the predicted time and height of the tides for each day in the year at the principal ports of the world, including the United States and its possessions. A table of tidal differences is given, by means of which the tides at more than 3,000 intermediate ports may be obtained. Separate reprints from the general Tide Tables are issued for the Atlantic and Pacific coasts of the United States and its dependencies.

Agencies for the sale of the Charts, Coast Pilots, and Tide Tables of the Coast and Geodetic Survey are established in many ports of the United States and in some foreign ports. They can also be purchased in the office of the Coast and Geodetic Survey, Washington, D. C., or any of the suboffices. If ordered by mail, prepayment is obligatory. Remittances should be made by postal money order or express order, payable to the "Coast and Geodetic Survey." Postage stamps, checks, and drafts can not be accepted. The sending of money in an unregistered letter is unsafe. Only catalogue numbers of charts need be mentioned. The catalogue of charts and other publications of the Survey can be obtained free of charge on application at any of the sale agencies or to the Coast and Geodetic Survey Office, Washington, D. C.

Other Publications.—Lists of Lights, Buoys, and other Daymarks of the United States, its insular possessions, and the Great Lakes, are published by the Bureau of Lighthouses. Notice to Mariners, relating to the same waters, are published weekly by the Bureau of Lighthouses and Coast and Geodetic Survey. These publications can be obtained free of charge on application to the Division of Publications, Department of Commerce, Washington, D. C.

USE OF CHARTS.

ACCURACY OF CHART.—The value of a chart depends upon the character and accuracy of the survey on which it is based, and the larger the scale of the chart the more important do these become. In these respects the source from which the information has been compiled is a good guide.

This applies particularly to the charts of the Alaska Peninsula, Aleutian Islands, Arctic Ocean, and part of Bering Sea and the Philippine Islands. The early Russian and Spanish surveys were not made with great accuracy, and until they are replaced by later surveys these charts must be used with caution.

With respect to these regions the fullness or scantiness of the soundings is another method of estimating the completeness of a chart. When the soundings are sparse or unevenly distributed it may be taken for granted that the survey was not in great detail.

A wide berth should therefore be given to every rocky shore or patch, and this rule should invariably be followed, viz, that instead of considering a coast to be clear unless it is shown to be foul, the contrary should be assumed.

With respect to a well-surveyed coast only a fractional part of the soundings obtained are shown on the chart, a sufficient number being selected to clearly indicate the contour of the bottom. When the bottom is uneven the soundings will be found grouped closely together, and when the slopes are gradual fewer soundings are given. Each sounding represents an actual measure of depth and location at the time the survey was made.

Shores and shoals where sand and mud prevail, and especially bar harbors and the entrances of bays and rivers exposed to strong tidal currents and a heavy sea, are subject to continual change of a greater or less extent, and important ones may have taken place since the date of the last survey. In localities which are noted for frequent and radical changes, such as the entrance to a number of estuaries on the Atlantic, Gulf, and Pacific coasts, notes are printed on the charts calling attention to the fact.

It should also be remembered that in coral regions and where rocks abound it is always possible that a survey with lead and line, however detailed, may have failed to find every small obstruction. For these reasons, when navigating such waters the customary sailing lines and channels should be followed, and those areas avoided where the irregular and sudden changes in depth indicate conditions which are associated with pinnacle rocks or coral heads.

DREDGED CHANNELS.—These are generally shown on the chart by two broken lines to represent the side limits of the improvement. Before completion of the project the depth given is that shown by the latest survey received from the engineer in charge. After completion the depth given is the one proposed to be maintained by redredging when necessary.

The actual depth of a completed channel may be greater than the charted depth shortly after dredging, and less when shoaling occurs as a result of storms or other causes. These changes are of too frequent occurrence and uncertain duration to chart. Therefore when a vessel's draft approximates the charted depth of a dredged channel the latest information should be obtained before entering.

Danger Curves.—The curves of depth will be found useful in giving greater prominence to outlying dangers. It is a good plan to trace out with a colored pencil the curve next greater than the draft of the vessel using the chart, and regard this as a "danger curve," which is not to be crossed without precaution.

Isolated soundings shoaler than surrounding depths should be avoided, as there is always the possibility that the shoalest spot may not have been found.

Caution in Using Small-Scale Charts.—It is obvious that dangers to navigation can not be shown with the same amount of detail on small-scale charts as on those of larger scale, therefore in approaching the land or dangerous banks regard should be had to the scale of the chart used. A small error in laying down a position means only yards on a large-scale chart, whereas on a small scale the same amount of displacement means large fractions of a mile.

For the same reason, bearings to near objects should be used in preference to objects farther off, although the latter may be more prominent, as a small error in bearing or in laying it down on the chart has a greater effect in misplacing the position the longer the line to be drawn

Distortion of Printed Charts.—The paper on which charts are printed has to be dampened. On drying, distortion takes place from the inequalities in the paper, which varies with the paper and the amount of the original dampening; but it is not sufficient to affect ordinary navigation. It must not, however, be expected that accurate series of angles taken to different points will always exactly agree, when carefully plotted upon the chart, especially if the lines to objects be long. The larger the chart the greater the amount of this distortion.

Buoys.—Too much reliance should not be placed on buoys always maintaining their exact position, especially when in exposed positions; it is safer, when possible, to navigate by bearings or angles to fixed objects on shore and by the use of soundings.

Gas buoys and other unwatched lights can not be implicitly relied on; the light may be altogether extinguished, or, if intermittent, the apparatus may get out of order.

Lights.—The distances given in the light lists and on the charts for the visibility of lights are computed for a height of 15 feet for the observer's eye. The table of distances of visibility due to height, published in the light list, affords a means of ascertaining the effect of a greater or less height of the eye. The glare of a powerful light is often seen far beyond the limit of visibility of the actual rays of the light, but this must not be confounded with the true range. Again, refraction may often cause a light to be seen farther than under ordinary circumstances.

When looking for a light the fact may be forgotten that from aloft the range of vision is increased. By noting a star immediately over the light a bearing may be afterwards obtained from the standard compass.

The actual power of a light should be considered when expecting to make it in thick weather. A weak light is easily obscured by haze, and no dependence can be placed on its being seen.

The power of a light can be estimated by its candlepower as given in the light lists and in some cases by noting how much its visibility

in clear weather falls short of the range due to the height at which it is placed. Thus a light standing 200 feet above the sea and recorded as visible only 10 miles in clear weather is manifestly of little brilliancy, as its height would permit it to be seen over 20 miles if of sufficient power.

Fog Signals.—Sound is conveyed in a very capricious way through the atmosphere. Apart from the wind, large areas of silence have been found in different directions and at different distances from the origin of the sound signal, even in clear weather. Therefore too much confidence should not be felt as to hearing a fog signal. The apparatus, moreover, for sounding the signal may require some time before it is in readiness to act. A fog often creeps imperceptibly toward the land and is not observed by those at a lighthouse until it is upon them, whereas a vessel may have been in it for many hours while approaching the land. In such a case no signal may be sounded. When sound travels against the wind it may be thrown upward; in such a case a man aloft might hear it when it is inaudible on deck. The conditions for hearing a signal will vary at the same station within short intervals of time; mariners must not, therefore, judge their distance from a fog signal by the force of the sound and must not assume that a signal is not sounding because they do not hear it.

Taken together, these facts should induce the utmost caution when nearing the land or danger in fog. The lead is generally the only safe guide and should be faithfully used.

Submarine Bells have an effective range of audibility greater than signals sounded in air, and a vessel equipped with receiving apparatus can determine the approximate bearing of the signal. These signals can be heard also on vessels not equipped with receiving apparatus by observers below the water line, but a bearing of the signal can not then be readily determined.

Tides.—A knowledge of the tide, or vertical rise and fall of the water, is of great and direct importance whenever the depth at low water approximates to or is less than the draft of the vessel and wherever docks are constructed so as to be entered and left near the time of high water. But under all conditions such knowledge may be of indirect use, as it often enables the mariner to estimate in advance whether at a given time and place the current will be running flood or ebb. In using the tables slack water should not be confounded with high or low tide nor a flood or ebb current with flood or ebb tide. In some localities the rise or fall may be at a stand while the current is at its maximum velocity.

The Tide Tables published by the Coast and Geodetic Survey give the predicted times and heights of high and low waters for most of the principal ports of the world and tidal differences and constants for obtaining the tides at all important ports.

Plane of Reference for Soundings on Charts.—For the Atlantic coast of the United States and Porto Rico the plane of reference for soundings is the mean of all low waters; for the Pacific coast of the United States and Alaska, with the two exceptions noted below, and for the Hawaiian and Philippine Islands, it is the mean of the lower low waters. For Puget Sound, Wash., the plane of reference is 2 feet below mean lower low water, and for Wrangell Strait, Alaska, it is 3 feet below mean lower low water.

For the Atlantic coast of the Canal Zone, Panama, the plane of reference for soundings is mean low water, and for the Pacific coast of the same it is low-water springs.

For foreign charts many different planes of reference are in use, but that most frequently adopted is low-water springs.

It should be remembered that whatever plane of reference is used for a chart there may be times when the tide falls below it. When the plane is mean low water or mean lower low water there will generally be as many low waters or lower low waters below those planes as above them. Also the wind may at times cause the water to fall below the plane of reference.

Tidal Currents.—In navigating coasts where the tidal range is considerable special caution is necessary. It should be remembered that there are indrafts into all bays and bights, although the general set of the current is parallel to the shore.

The turn of the tidal current offshore is seldom coincident with the time of high and low water on the shore.

At the entrance to most harbors without important tributaries or branches the current turns at or soon after the times of high and low water within. The diurnal inequality in the velocity of current will be proportionately but half as great as in the height of the tides. Hence, though the heights of the tide may be such as to cause the surface of the water to vary but little in level for 10 or 12 hours, the ebb and flow will be much more regular in occurrence.

A swift current often occurs in narrow openings between two bodies of water, because the water at a given instant may be at different levels.

Along most shores not seriously affected by bays, tidal rivers, etc., the current usually turns soon after high and low waters.

Where there is a large tidal basin with a narrow entrance, the strength of the current in the entrance may occur near the time of high and low water, and slack water at about half tide, outside.

The swiftest current in straight portions of tidal rivers is usually in the mid-channel, but in curved portions the strongest current is toward the outer edge of the curve.

Counter currents and eddies may occur near the shores of straits, especially in bights and near points.

Tide Rips and Swirls occur in places where strong currents occur, caused by a change in the direction of the current, and especially over shoals or in places where the bottom is uneven. Such places should be avoided if exposed also to a heavy sea, especially with the wind opposing the current; when these conditions are at their worst the water is broken into heavy choppy seas from all directions, which board the vessel, and also make it difficult to keep control, owing to the baring of the propeller and rudder.

Current Arrows on charts show only the usual or mean direction of a tidal stream or current. It must not be assumed that the direction of the current will not vary from that indicated by the arrow. In the same manner, the velocity of the current constantly varies with circumstances, and the rate given on the chart is a mean value, corresponding to an average range of tide. At some stations but few observations have been made.

Fixing Position.—The most accurate method available to the navigator of fixing a position relative to the shore is by plotting with

a protractor sextant angles between well-defined objects on the chart; this method, based on the "three-point problem" of geometry, should be in general use.

In many narrow waters, also, where the objects may yet be at some distance, as in coral harbors or narrow passages among mud banks, navigation by sextant and protractor is invaluable, as a true position can in general be obtained only by its means. Positions by bearings are too rough to depend upon, and a small error in either taking or plotting a bearing might under such circumstances put the ship ashore.

For its successful employment it is necessary, first, that the objects be well chosen, and, second, that the observer be skillful and rapid in his use of the sextant. The latter is only a matter of practice.

Near objects should be used either for bearings or angles for position in preference to distant ones, although the latter may be more prominent, as a small error in the bearing or angle or in laying it on the chart has a greater effect in misplacing the position the longer the line to be drawn.

On the other hand, distant objects should be used for direction because less affected by a small error or change of position.

The three-arm protractor consists of a graduated circle with one fixed and two movable radial arms. The zero of the graduation is at the fixed arm and by turning the movable arms each one can be set at any desired angle with reference to the fixed arm.

To plot a position, the two angles observed between the three selected objects are set on the instrument, which is then moved over the chart until the three beveled edges in case of a metal instrument, or the radial lines in the case of a transparent or celluloid instrument, pass respectively and simultaneously through the three objects. The center of the instrument will then mark the ship's position, which may be pricked on the chart or marked with a pencil point through the center hole.

The tracing-paper protractor, consisting of a graduated circle printed on tracing paper, can be used as a substitute for the brass or celluloid instrument. The paper protractor also permits the laying down for simultaneous trial of a number of angles in cases of fixing important positions. Plain tracing paper may also be used if there are any suitable means of laying off the angles.

The value of a determination depends greatly on the relative positions of the objects observed. If the position sought lies on the circle passing through the three objects it will be indeterminate, as it will plot all around the circle. An approach to this condition, which is called a revolver, must be avoided. In case of doubt select from the chart three objects nearly in a straight line, or with the middle object nearest the observer. Near objects are better than distant ones, and, in general, up to 90° the larger the angles the better, remembering always that large as well as small angles may plot on or near the circle and hence be worthless. If the objects are well situated, even very small angles will give for navigating purposes a fair position, when that obtained by bearings of the same objects would be of little value.

Accuracy requires that the two angles be simultaneous. If under way and there is but one observer, the angle that changes less rapidly

may be observed both before and after the other angle and the proper value obtained by interpolation.

A single angle and a range give in general an excellent fix, easily obtained and plotted.

THE COMPASS.—It is not intended that the use of the compass to fix the position should be given up; there are many circumstances in which it may be usefully employed, but errors more readily creep into a position so fixed. Where accuracy of position is desired, angles should invariably be used, such as the fixing of a rock or shoal, or of additions to a chart, as fresh soundings or new buildings. In such cases angles should be taken to several objects, the more the better; but five objects is a good number, as the four angles thus obtained prevent any errors.

When only two objects are visible, a sextant angle can be used to advantage with the compass bearings and a better fix obtained than by two bearings alone.

DOUBLING THE ANGLE ON THE BOW.—The method of fixing by doubling the angle on the bow is invaluable. The ordinary form of it, the so-called "bow and beam bearing," the distance from the object at the latter position being the distance run between the times of taking the two bearings, gives the maximum of accuracy, and is an excellent fix for a departure, but does not insure safety, as the object observed and any dangers off it are abeam before the position is obtained.

By taking the bearings at two points and four points on the bow, a fair position is obtained before the object is passed, the distance of the latter at the second position being, as before, equal to the distance run in the interval, allowing for current. Taking afterwards the beam bearing gives, with slight additional trouble, the distance of the object when abeam; such beam bearings and distances, with the times, should be continuously recorded as fresh departures, the importance of which will be appreciated in cases of being suddenly shut in by fog.

A graphic solution of the problem for any two bearings of the same object is frequently used. The two bearings are drawn on the chart, and the course is then drawn by means of the parallel rulers so that the distance measured from the chart between the lines is equal to the distance made good by the vessel between the times of taking the bearings.

DANGER ANGLE.—The utility of the danger angle in passing outlying rocks or dangers should not be forgotten. In employing the horizontal danger angle, however, charts compiled from early Russian and Spanish sources, referred to in a preceding paragraph, should not be used.

SOUNDINGS.—In thick weather, when near or approaching the land or danger, soundings should be taken continuously and at regular intervals, and, with the character of the bottom, systematically recorded. By marking the soundings on tracing paper, according to the scale of the chart, along a line representing the track of the ship, and then moving the paper over the chart parallel with the course until the observed soundings agree with those of the chart, the ship's position will in general be quite well determined.

SUMNER'S METHOD.—Among astronomical methods of fixing a ship's position the great utility of Sumner's method should be well

understood, and this method should be in constant use. The Sumner line—that is, the line drawn through the two positions obtained by working the chronometer observation for longitude with two assumed latitudes, or by drawing through the position obtained with one latitude a line at right angles to the bearing of the body as obtained from the azimuth tables—gives at times invaluable information, as the ship must be somewhere on that line, provided the chronometer is correct. If directed toward the coast, it marks the bearing of a definite point; if parallel with the coast, the distance of the latter is shown. Thus the direction of the line may often be usefully taken as a course. A sounding at the same time with the observation may often give an approximate position on the line. A very accurate position can be obtained by observing two or more stars at morning or evening twilight, at which time the horizon is well defined. The Sumner lines thus obtained will, if the bearings of the stars differ three points or more, give an excellent result. A star or planet at twilight and the sun afterwards or before may be combined; also two observations of the sun with sufficient interval to admit of a considerable change of bearing. In these cases one of the lines must be moved for the run of the ship. The moon is often visible during the day and in combination with the sun gives an excellent fix.

Change of Variation of the Compass.—The gradual change in the variation must not be forgotten in laying down positions by bearings on charts. The magnetic compasses placed on the charts for the purpose of facilitating plotting become in time slightly in error, and in some cases, such as with small scales, or when the lines are long, the displacement of position from neglect of this change may be of importance. The compasses are reengraved for every new edition if the error is appreciable. Means for determining the amount of this error are provided by printing the date of constructing the compass and the annual change in variation near its edge.

The change in the magnetic variation in passing along some parts of the coast of the United States is so rapid as to materially affect the course of a vessel unless given constant attention. This is particularly the case in New England and parts of Alaska, where the lines of equal magnetic variation are close together and show rapid changes in magnetic variation from place to place, as indicated by the large differences in variation given on neighboring compass roses.

Local Magnetic Disturbance.—The term "local magnetic disturbance" or "local attraction" has reference only to the effects on the compass of magnetic masses external to the ship. Observation shows that such disturbance of the compass in a ship afloat is experienced only in a few places.

Magnetic laws do not permit of the supposition that it is the visible land which causes such disturbances, because the effect of a magnetic force diminishes in such rapid proportion as the distance from it increases that it would require a local center of magnetic force of an amount absolutely unknown to affect a compass half a mile distant.

Such deflections of the compass are due to magnetic minerals in the bed of the sea under the ship, and when the water is shallow, and the force strong, the compass may be temporarily deflected when passing over such a spot, but the area of disturbance will be small, unless there are many centers near together.

The law which has hitherto been found to hold good as regards local magnetic disturbances is, that north of the magnetic equator the north end of the compass needle is attracted toward any center of disturbance; south of the magnetic equator it is repelled.

It is very desirable that whenever an area of local magnetic disturbance is noted, the position should be fixed, and the facts reported as far as they can be ascertained.

USE OF OIL FOR MODIFYING THE EFFECT OF BREAKING WAVES.—Many experiences of late years have shown that the utility of oil for this purpose is undoubted and the application simple.

The following may serve for the guidance of seamen, whose attention is called to the fact that a very small quantity of oil skillfully applied may prevent much damage both to ships (especially of the smaller classes) and to boats by modifying the action of breaking seas.

The principal facts as to the use of oil are as follows:

1. On free waves, i. e., waves in deep water, the effect is greatest.

2. In a surf, or waves breaking on a bar, where a mass of liquid is in actual motion in shallow water, the effect of the oil is uncertain, as nothing can prevent the larger waves from breaking under such circumstances, but even here it is of some service.

3. The heaviest and thickest oils are most effectual. Refined kerosene is of little use; crude petroleum is serviceable when nothing else is obtainable; but all animal and vegetable oils, such as waste oil from the engines, have great effect.

4. A small quantity of oil suffices if applied in such a manner as to spread to windward.

5. It is useful in a ship or boat, either when running or lying-to, or in wearing.

6. No experiences are related of its use when hoisting a boat at sea or in a seaway, but it is highly probable that much time would be saved and injury to the boat avoided by its use on such occasions.

7. In cold water the oil, being thickened by the lower temperature and not being able to spread freely, will have its effect much reduced. This will vary with the description of oil used.

8. For a ship at sea the best method of application appears to be to hang over the side, in such a manner as to be in the water, small canvas bags, capable of holding from 1 to 2 gallons of oil, the bags being pricked with a sail needle to facilitate leakage of the oil. The oil is also frequently distributed from canvas bags or oakum inserted in the closet bowls.

The positions of these bags should vary with the circumstances. Running before the wind, they should be hung on either bow—e. g., from the cathead—and allowed to tow in the water.

With the wind on the quarter the effect seems to be less than in any other position, as the oil goes astern while the waves come up on the quarter.

Lying-to, the weather bow, and another position farther aft, seem the best places from which to hang the bags, using sufficient line to permit them to draw to windward while the ship drifts.

9. Crossing a bar with a flood tide, to pour oil overboard and allow it to float in ahead of the boat, which would follow with a bag towing astern, would appear to be the best plan. As before remarked, under these circumstances the effect can not be so much trusted.

On a bar, with the ebb tide running, it would seem to be useless to try oil for the purpose of entering.

10. For boarding a wreck, it is recommended to pour oil overboard to windward of her before going alongside. The effect in this case must greatly depend upon the set of the current and the circumstances of the depth of water.

11. For a boat riding in bad weather from a sea anchor, it is recommended to fasten the bag to an endless line rove through a block on the sea anchor, by which means the oil can be diffused well ahead of the boat and the bag readily hauled on board for refilling, if necessary.

COAST AND INLAND WATERS, SANDY HOOK TO CAPE HENRY.

GENERAL INFORMATION.

The information contained in this volume, Section C of the "United States Coast Pilot, Atlantic Coast," relates to the coast and inland waters from Sandy Hook to Cape Henry, including Delaware and Chesapeake Bays and tributaries, and the inside route from New York to Norfolk, and embraces the coast of New Jersey, Delaware, Maryland, and a part of Virginia.

The general character of the coast is low and sandy, backed by woods, except in the vicinity of Navesink Highlands, where the land reaches a height of 180 feet. The coast of New Jersey is distinguished by the large number of summer resorts, and the coast southward has few natural landmarks except the lighthouses and Coast Guard stations. The depths along the coast are irregular, there being many outlying sand shoals, and the lead is of little assistance to the navigator.

The coast is broken by two important entrances, Delaware and Chesapeake Bays, having broad and deep channels leading into them, and all of the other entrances are narrow inlets, subject to frequent change in depth and position. Inside the entrances there is generally little natural change in the shore, shoals, and other features, except in the more open parts of Delaware and Chesapeake Bays. The only rocky areas within the limits of this volume are a few scattered spots in Delaware River, in Chesapeake Bay above Patapsco River, and near the heads of the larger tributaries on the western side of Chesapeake Bay.

Harbors and ports.—The most important places, either commercially or as harbors of refuge, are Delaware Breakwater, Wilmington, Chester, Philadelphia, Assateague Anchorage, Hampton Roads, Norfolk, Newport News, Richmond, Washington, and Baltimore.

The only **anchorages** between New York Harbor and Chesapeake Bay entrance available for vessels bound along the coast are Delaware Breakwater, used by vessels of all classes, and Assateague Anchorage, used by small coasting vessels. Small local craft often seek shelter inside the inlets, but they can not be entered in safety during heavy weather, and are often difficult for strangers even in good weather. Hampton Roads is the most important anchorage in the southern part of Chesapeake Bay, though vessels entering the bay for shelter often anchor in Lynnhaven Roads in southerly weather. The principal anchorages in Delaware Bay and River are described on page 66, and those in Chesapeake Bay on page 120.

System of buoyage.—In conformity with section 4678 of the Revised Statutes of the United States, the following order is observed in coloring and numbering buoys in United States waters, viz:

In approaching the channel, etc., from seaward, red buoys, with even numbers, will be found on the starboard side.

In approaching the channel, etc., from seaward, black buoys, with odd numbers, will be found on the port side.

Buoys painted with red and black horizontal stripes will be found on obstructions, with channel ways on either side of them, and may be left on either hand in passing in.

Buoys painted with white and black perpendicular stripes will be found in mid-channel, and must be passed close-to to avoid danger.

All other distinguishing marks to buoys will be in addition to the foregoing, and may be employed to mark particular spots.

Perches, with balls, cages, etc., will, when placed on buoys, be at turning points, the color and number indicating on what side they shall be passed.

Nun buoys, properly colored and numbered, are usually placed on the starboard side, and can buoys on the port side of channels.

Day beacons (except such as are on the sides of channels, which will be colored like buoys) are constructed and distinguished with special reference to each locality, and particularly in regard to the background upon which they are projected.

Aids to navigation.—The lighthouses and other aids to navigation are the principal guides, and mark the approach and channels to the important ports. The buoyage accords with the system adopted in United States waters. The principal coast lights are described in the text of this volume. For a complete description of all lighted aids, see the Light List, Atlantic and Gulf Coasts of the United States, published by the Lighthouse Service, which can be obtained free of charge from the Division of Publications, Department of Commerce, Washington, D. C.

Pilots.—Pilotage is compulsory for certain inward and outward bound vessels in Delaware Bay and River and Chesapeake Bay. Pilots cruise off the entrances of both bays and are always available. Further information concerning pilotage in Delaware Bay and River is given on page 68, and in Chesapeake Bay on page 119.

Local boatmen competent to act as pilots can usually be found near the entrances to the principal inlets and to the tributaries of Delaware and Chesapeake Bays; the charge for piloting in this case is by special agreement with the pilot.

Towboats are stationed at Wilmington, Philadelphia, Norfolk, Newport News, West Point, Washington, and Baltimore.

Harbor masters are appointed for the principal ports, and they have charge of the anchorage and berthing of vessels in their respective harbors. Harbor and anchorage regulations are given under the descriptions of the ports. The laws prohibit the dumping of ashes or other materials in the channels.

Navigation laws of the United States are published by the Bureau of Navigation, Department of Commerce, at intervals of four years, the present edition being that of 1915. A supplement is issued after every session of Congress. The volume and supplements can be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C.; price, $1 for the volume and 5 cents each for the supplements.

Rules of the Road.—International and inland "Rules to prevent collisions of vessels," lines within which the inland rules apply, and "Regulation of motor boats" are published by the Bureau of Navigation, Department of Commerce.

Pilot Rules for certain inland waters of the Atlantic and Pacific coasts and of the coast of the Gulf of Mexico are published by the Steamboat-Inspection Service in Form 804.

Copies of these pamphlets are furnished by the officers of the Steamboat-Inspection Service, and can also be had from the Division of Publications, Department of Commerce, Washington, D. C.

Quarantine.—Quarantine for all ports within the limits of this volume is enforced in accordance with the regulations of the United States Public Health Service, except at the port of Baltimore, where quarantine laws of Maryland and sanitary regulations of the local board of health are in force. The laws of Pennsylvania also govern the ports in that State, and vessels subject to inspection are inspected by both National and State quarantine officials at Marcus Hook. For quarantine for Delaware Bay and River see page 69, and for Chesapeake Bay see page 121. There are national quarantine stations at Delaware Breakwater, Del., Reedy Island, Pa., Fort Monroe, Va., and Alexandria, Va.

Where State quarantine is in force the minimum requirements are, in general, in accordance with the regulations of the United States Public Health Service. National quarantine regulations will be found at the stations of the service and at American consulates, and will be furnished to vessels upon application, either by officers of the service or by the bureau in Washington, D. C. Every vessel should be provided with the quarantine regulations.

Marine hospital.—Information as to relief furnished seamen will be found in the regulations of the United States Public Health Service, which can be consulted at all stations of the service. Such stations are located at ports of any importance, and if not in charge of a service officer relief will be provided by collectors of customs upon application.

The following stations are in charge of a service officer: Lewes, Del.; Philadelphia, Pa.; Norfolk, Va.; Newport News, Va.; Richmond, Va.; Irvington, Va.; Washington, D. C.; Solomons, Md.; Baltimore (marine hospital), Md.; and Cambridge, Md.

Bridge regulations.—Regulations for lighting bridges over navigable waters, also for lights on sheer booms, piers, dams, and similar obstructions to navigation are prescribed by the Department of Commerce. A copy of these regulations will be sent free of charge to any shipmaster, pilot, or bridge owner on application to the Division of Publications, Department of Commerce, Washington, D. C. The lighthouse inspectors have immediate authority over lighting of structures in their respective districts and are charged with the enforcement of the regulations.

Regulations for the operation of drawbridges are prescribed by the Secretary of War, and extracts from these regulations are given in the describtion of the waters affected.

Fish weirs are numerous along the outside coast and in Chesapeake Bay and tributaries. The stakes often become broken off and form a

danger to navigation, especially at night. Regulations limiting the areas within which fish weirs may be established have been prescribed by the Secretary of War, and the supervision of the fishing structures is controlled by the Chief of Engineers, United States Army. Strangers should proceed with caution when crossing areas of possible fish weirs, and should avoid crossing such areas at night, whenever possible. The areas within which fish weirs are allowed along the coast from Sandy Hook to Cape May are described on page 45, and from Cape Henlopen to Cape Charles on page 106; further information concerning fish weirs in Chesapeake Bay is given on page 122.

Fishing structures and appliances in navigable waters of the United States shall be lighted for the safety of navigation, as follows:

The lights shall be displayed between sunset and sunrise. They shall be placed at each end of the structure excepting where the inner end terminates in such situation that there is no practicable navigation between it and the high-water line of the adjacent coast, in which case no inner light shall be displayed. The outer light shall be white and the inner light shall be red. The size, capacity, and manner of maintenance of the lights shall be such as may be specified in the War Department permit authorizing the erection of the structure or appliance.

When several structures or appliances are placed on one line with no navigable passage between them, they will be considered, for lighting purposes, as one structure.

Regulations for passing dredges are prescribed by the Secretary of War for many channels and are given under the descriptions of the channels.

Lighthouse tenders, when working on buoys in channels or other frequented water, may display a red flag (international signal-code letter B) and a black ball at the fore, as a warning to other vessels to slow down in passing.

Supplies.—Coal, gasoline, fresh water, and supplies of all kinds are obtainable at Wilmington, Philadelphia, Norfolk, Newport News, Richmond, Washington, and Baltimore. Coal in limited quantities can also be obtained at the other cities and many of the larger towns. Gasoline, provisions, and water are obtainable at practically all of the towns and villages. Further information is given under the different headings.

Repairs.—Philadelphia, Camden, Wilmington, Norfolk, Newport News, and Baltimore are the principal places at which extensive repairs to the hulls and machinery of vessels can be made. Small vessels and motor boats can be hauled out and minor repairs to machinery can be made at many other places, as mentioned under the descriptions of the towns.

LARGEST DRY DOCKS AND MARINE RAILWAYS.

Port.	Name.	Length over blocks.	Depth on sill at high water.	Capacity.
		Feet.	*Feet.*	*Tons.*
Sandy Hook to Cape May:				
Bay Head	Railway	[1] 65	4	.....
Atlantic City	do	[1] 65	5	.....
Delaware Bay and River:				
Bivalve	do	.....	7	150
Greenwich Pier	do	130	8	400
Wilmington	Dry dock	343	13	.....
Essington	Railway	120	6, 14	100
Camden	Floating dock	230	12	2,000
	Railway	300	11, 16	2,000
Philadelphia (navy yard)	Dry dock	732	30	.....
Port Richmomd	do	412	20	.....
Cape Henlopen to Cape Charles:				
Chincoteague	Railway	[1] 90	7	180
Chesapeake Bay:				
Hampton	do	[1] 125	6, 9	125
Norfolk	Floating dock	180	15	2,000
	Railway	240	6, 15	1,000
Berkley	do	326	26	1,500
Portsmouth (navy yard)	Dry dock	732	34	.....
Newport News	do	737	30	.....
West Point	Railway	120	12	200
Weems	do	148	6, 8	200
Alexandria	do	200	11, 15	.....
Solomons	do	[1] 125	10	200
Baltimore	Dry dock	600	22. 5	.....
	Railway	300	10, 17	1,500
Pocomoke City	do	125	7	200
Crisfield	do	100	6	125
Salisbury	do	125	5, 10	175
Sharptown	do	173	7, 13	1,000
Seaford	do	200	12	400
Bethel	do	100	7	100
Cambridge	do	[1] 100	4, 7	150

[1] Length of vessel that can be hauled.

Prevailing winds.—North of the thirty-eighth parallel the prevailing winds are westerly. South of the thirty-eighth parallel they are southerly throughout the year, except in September and October, when they are northeasterly. They are subject to many variations at all seasons. See also the meteorological tables in the appendix.

Fogs are most frequent along the coast during the months of March and April, but may be met with at other times during the year. Easterly winds bring them and westerly and northerly winds clear them away. In the late fall dense fogs are liable to occur, and may last two or three days, sometimes practically suspending navigation in the harbors and bays.

In Chesapeake Bay fogs are most frequent in the spring, fall, and winter months, and will sometimes remain for a period of several days, during which time navigation in the bay and its tributaries is seriously interrupted. The most dense fogs and those of longest duration occur from early in November to March. During the sum-

mer months there will sometimes be a fog in the tributaries of the bay during the early morning, but it rarely interrupts navigation after the sun is two hours high.

The following table shows the average number of hours per month, from a record of about five years, that the fog signals were operated at the stated light stations of the United States:

HOURS OF OPERATION OF FOG SIGNALS.

Light station.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Ambrose Channel light vessel	123	86	116	86	113	89	69	43	70	57	55	76	983
Northeast End light vessel	124	84	154	121	133	70	35	18	59	64	34	97	993
Overfalls light vessel	80	65	71	43	72	58	37	23	55	49	43	43	639
Fourteen-foot Bank	92	58	68	30	43	23	13	4	45	27	45	37	485
Ship John Shoal	85	48	61	24	27	16	11	5	30	22	52	43	424
Christiana North Jetty	59	31	49	12	12	7	6	6	19	12	42	43	298
Cherry Island	75	41	56	15	15	5	8	6	20	20	48	45	354
Fort Mifflin	48	33	48	16	10	9	11	12	46	24	42	44	343
Fenwick Island Shoal light vessel	48	51	57	50	74	49	15	10	23	17	29	29	452
Winter Quarter Shoal light vessel	35	50	67	48	68	50	8	6	23	16	25	23	419
Killick Shoal	29	38	28	13	26	13	2	1	11	10	26	29	226
Cape Charles light vessel	31	36	66	31	33	32	5	3	4	13	50	39	343
Cape Henry	46	42	55	41	35	19	0	1	4	18	18	35	314
Thimble Shoal	31	31	37	18	15	6	1	1	4	13	23	28	208
Newport News Middle Ground	29	23	27	10	8	2	5	1	8	14	23	26	176
Deep Water Shoals	32	21	24	6	4	3	1	0	8	9	22	28	158
Jordan Point	12	10	8	1	1	0	1	1	2	8	14	15	73
York Spit	40	40	47	15	15	6	1	0	4	8	27	35	238
Bells Rock	17	18	13	7	3	2	1	0	16	18	23	16	134
Bowlers Rock	27	16	8	3	3	3	3	2	8	11	28	14	126
Windmill Point	58	46	64	21	18	6	1	0	7	16	25	45	307
Janes Island	51	35	35	10	8	2	0	1	8	3	24	33	210
Smith Point	60	58	62	21	19	7	1	0	11	6	23	31	299
Blackistone Island	39	28	47	8	5	2	0	0	7	8	31	20	195
Maryland Point	39	30	39	6	8	4	1	1	13	14	28	21	204
Fort Washington	38	38	27	6	4	4	1	2	20	20	38	21	219
Great Shoals	52	37	42	11	7	11	2	3	21	13	26	28	253
Cedar Point	60	49	56	17	16	8	0	1	10	12	28	30	287
Sharps Island	51	46	45	10	12	3	0	0	4	6	24	22	223
Choptank River	59	54	45	10	12	6	4	3	18	13	37	32	293
Bloody Point Bar	62	42	46	11	15	4	0	0	8	3	32	22	245
Sandy Point	74	53	73	20	20	6	2	1	11	9	35	38	342
Fort Carroll	49	29	33	6	2	2	0	1	11	5	33	23	194
Pooles Island	30	15	10	5	4	2	0	1	4	3	23	14	111
Turkey Point	70	22	54	13	20	9	3	4	10	20	55	45	325

Ice rarely interferes with navigation along the coast, but in severe winters may form a serious obstacle to navigation inside the entrances. Ice conditions in Delaware Bay are described on page 70, and in Chesapeake Bay on page 122. Ice in the tributaries is treated under their descriptions.

Storm warnings are displayed by the United States Weather Bureau on the coasts of the United States and the Great Lakes.

Small-craft warning.—A red pennant indicates that moderately strong winds are expected.

Storm warning.—A red flag with a black center indicates that a storm of marked violence is expected.

The pennant displayed with the flag indicates the direction of the wind—white, westerly; red, easterly. The pennant above the flag indicates that the wind is expected to blow from the northerly quadrants; below, from the southerly quadrants.

By night a red light indicates easterly winds, and a white light below a red light, westerly winds.

Hurricane warning.—Two red flags with black centers, displayed one above the other, indicate the expected approach of a tropical hurricane, or of one of those extremely severe and dangerous storms which occasionally move across the Great Lakes and northern Atlantic coast. These warnings are displayed at all stations on the Atlantic and Gulf coasts of the United States and on the following islands in the Atlantic: Jamaica, Santo Domingo, Turks Island, Bermuda, Haiti, Curacao, Porto Rico, St. Kitts, Dominica, Barbados, Trinidad, and Cuba. Neither small-craft nor hurricane warnings are displayed at night.

The following are the storm-warning display stations within the limits covered by this volume:

NEW JERSEY:
- Atlantic City.[1]
- Avalon Coast Guard station.
- Bivalve.
- Cape May Point Coast Guard station.
- Great Egg Coast Guard station.
- Island Heights.
- Little Egg Coast Guard station.
- Long Branch.
- Ocean City Coast Guard station.
- Sandy Hook.

DELAWARE:
- Delaware Breakwater.[2]
- Reedy Island.

PENNSYLVANIA:
- Philadelphia (navy yard).[1]
- Philadelphia, The Bourse.[2]

MARYLAND:
- Annapolis.
- Baltimore (American Building).
- Baltimore (The Anchorage).
- Oxford.

VIRGINIA:
- Cape Henry.[1]
- Fort Monroe.
- Newport News.
- Norfolk (Royster Building).[1]
- Norfolk (navy wireless).
- Reedville.
- Weems.

DISTRICT OF COLUMBIA:
- Washington (Giesboro).

NOTE.—The Weather Bureau station at Cape Henry, Va., is equipped for day and night communication with passing vessels. The International Code is used by day and the Morse Code, flash-light, by night. Messages to or from vessels will be forwarded to destination.

WEST INDIA HURRICANES.

These are cyclonic storms with a center of lowest barometer, around which the wind blows in a more or less circular course (spirally) in a direction contrary to the hands of a watch. At the same time the storm field advances on a straight or curved track, sometimes with

[1] At these stations barometers will be compared with standards.
[2] Delaware Breakwater display duplicated on The Bourse, Philadelphia.

great velocity and sometimes not more than a few miles an hour, occasionally appearing to come to a pause in its onward movements. The estimated velocity on the Atlantic coast between Hatteras and the island of Cuba is 5 to 15 miles per hour. They cover simultaneously an approximate circular area from 150 to 500 miles in diameter. At the center, the area of lowest barometer, which is from 10 to 20 miles in diameter, comparative calm prevails; the seas within this center are violent and confused and, combined with the sudden shifts of wind which are encountered as the vessel passes through the center, make this the most dangerous part of the hurricane and the one to be avoided.

Hurricanes form eastward of the Windward Islands or in the Caribbean Sea and take a westerly or northwesterly course. Some curve gradually northward, passing north of the island of Cuba and northeasterly along and eastward of the Atlantic coast of the United States. Others pass over or southward of Cuba and enter the Gulf of Mexico, and while in the Gulf usually curve northward or northeastward so as to strike the coast somewhere between Tampa, Fla., and the Rio Grande. Tracks of hurricanes are shown on pilot charts of the North Atlantic Ocean, published monthly by the United States Hydrographic Office.

The months during which hurricanes are usually encountered are June to November, the months of their greatest frequency are August, September, and October. During these months mariners should be on the watch for indications of a hurricane and should frequently and carefully observe and record the barometer.

Signs of approach.—First, a long heavy swell, a slight rise followed by a continuous fall of the barometer; second, strong gusty wind from some northerly point (northeast, north, or northwest), blowing with increasing force; and, third, a rough, increasing sea. If one or more of these signs be wanting there is little cause for anticipating a hurricane.

The approach of a hurricane is usually indicated by a long heavy swell, propagated to a great distance two or three days in advance, where there is no intervening land to interrupt it, and which comes from the direction in which the storm is approaching.

One of the earliest signs of a hurricane are high cirrus clouds which converge toward a point on the horizon that indicates the direction of the center of the storm. The snow-white fibrous mare's tails appear when the center of the storm is about 300 or 400 miles distant.

As the storm center approaches the barometer continues to fall, the velocity of the wind increases and blows in heavy squalls, and the changes in its direction become more rapid. Rain in showers accompanies the squalls, and when closer to the center the rain is continuous and attended by furious gusts of wind; the air is frequently thick with rain and spume drift, making objects invisible at a short distance. A vessel on a line of the hurricane's advance will experience the above disturbances, except that as the center approaches the wind will remain from the same direction, or nearly so, until the vessel is close to or in the center.

Distance from center.—The distance from the center of a hurricane can only be estimated from a consideration of the height of the barometer and the rapidity of its fall, and the velocity of the wind

and rapidity of its change in direction. If the barometer falls slowly and the wind increases gradually it may be reasonably supposed that the center is distant; with a rapidly falling barometer and increasing winds the center may be supposed to be approaching dangerously near.

Practical rules.—When there are indications of a hurricane vessels should remain in port or seek one if possible, carefully observing and recording the changes in barometer and wind and taking every precaution to avert damage by striking light spars, strengthening moorings, and if a steamer preparing steam to assist the moorings. In the ports of the Southern States hurricanes are generally accompanied by very high tides, and vessels may be endangered by overriding the wharf where lying if the position is at all exposed.

Vessels in the Straits of Florida may not have the sea room to maneuver so as to avoid the storm track and should use every endeavor to make a harbor or stand out of the straits to obtain sea room. Vessels unable to reach port and having sea room to maneuver should observe the following rules:

When there are indications of a hurricane near, sailing vessels should heave to on the starboard tack and steamers remain stationary and carefully observe and record the changes in wind and barometer so as to find the bearing of the center and ascertain by the shift of wind in which semicircle the vessel is situated. Much will often depend on heaving to in time.

Bearings of center.—Facing the wind, the storm center will be 8 to 12 points to the right; when the storm is distant it will be from 10 to 12 points, and when the barometer has fallen five or six tenths it will be about 8 points.

A line drawn through the center of a hurricane in the direction in which it is moving is called the axis or line of progression, and looking in the direction in which it is traveling the semicircle on either side of the axis is called, respectively, the right hand or dangerous semicircle and the left hand or navigable semicircle.

To find in which semicircle the vessel is situated: If the wind shifts to the right, the vessel will be in the right hand or dangerous semicircle with regard to the direction in which the storm is traveling, in which case the vessel should be kept on the starboard tack and increase her distance from the center.

If the wind shifts to the left, the vessel will be in the left or safe semicircle. The helm should be put up and the vessel run with the wind on the starboard quarter, preserving the compass course, if possible, until the barometer rises, when the vessel may be hove to on the port tack, or if there is not sea room to run the vessel can be put on the port tack at once.

Should the wind remain steady and the barometer continue to fall, the vessel is in the path of the storm and should run with the wind on the starboard quarter into the safe semicircle.

In all cases act so as to increase as soon as possible the distance from the center, bearing in mind that the whole storm field is advancing.

In receding from the center of a hurricane the barometer will rise and the wind and sea subside.

RADIO SERVICE.

The United States naval coastwise radio stations and all ships of the United States Navy equipped with radio apparatus are open for commercial business. Information concerning regulations, rates, and the commercial work of the stations may be obtained by addressing the Superintendent, Naval Radio Service, Radio, Va. Hydrographic information, weather reports, storm warnings, and time signals are sent out from the stations for the benefit of shipping.

Time signals.—In connection with the service over the land telegraph lines, time signals by radio are sent daily, Sundays and holidays excepted, from certain United States naval coastwise radio stations at noon of the seventy-fifth meridian time on the Atlantic coast and at noon of the one hundred and twentieth meridian time on the Pacific coast. The signals begin at 11.55 and continue for 5 minutes. During this interval every tick of the clock is transmitted, except the twenty-ninth second of each minute, the last 5 seconds of each of the first 4 minutes, and finally the last 10 seconds of the last minute. The noon signal is a longer contact after this long break. Similar time signals are also sent at 10 p. m. from some of the stations.

The supervision of radio communication in the United States is controlled by the Bureau of Navigation, Department of Commerce. A list of the radio stations of the United States, including shore stations, merchant vessels, Coast Guard cutters, vessels of the United States Navy, and amateurs, and the radio laws and regulations of the United States are published by that bureau, and either publication can be obtained from the superintendent of documents, Government Printing Office, Washington, D. C.; price, 15 cents each. Changes or additions to the stations and to the laws and regulations are published in bulletins issued monthly; price, 5 cents per copy, or 25 cents per year.

The International List of Radio Stations of the World includes the stations of the United States, excepting amateurs, and contains additional information, such as geographical location, normal range in nautical miles, radio system, and rates. Persons desiring this list should communicate direct with the International Bureau of the Telegraphic Union (Radiotelegraphic Service), Berne, Switzerland. The price is 60 cents per copy, not including postage. The rates of postage are: One copy, 24 cents; two copies, 36 cents; three copies, 48 cents.

UNITED STATES COAST GUARD STATIONS.

Coast Guard stations are maintained at the places named in the following table. The stations are manned annually from August 1 to May 31, and are supplied with boats, wreck guns, beach apparatus, and all other appliances for affording assistance in case of shipwreck. Instructions to enable mariners to avail themselves fully of the assistance thus afforded will be sent free of charge upon application to the United States Coast Guard, Washington, D. C.

The Coast Guard stations are provided with the International Code of Signals. Where telephone or telegraph facilities are avail-

able, requests for a tug or Coast Guard cutter will be received and promptly forwarded.

Signals.—The following signals have been adopted by the United States Coast Guard:

Upon the discovery of a wreck by night the Coast Guard force will burn a red pyrotechnic light or a red rocket to signify "You are seen; assistance will be given as soon as possible."

A red flag waved on shore by day or a red light, red rocket, or red Roman candle displayed by night will signify "Haul away."

A white flag waved on shore by day or a white light slowly swung back and forth or a white rocket or white Roman candle fired by night will signify "Slack away."

Two flags, a white and a red, waved at the same time on shore by day, or two lights, a white and a red, slowly swung at the same time, or a blue pyrotechnic light burned by night will signify "Do not attempt to land in your own boats; it is impossible."

A man on shore beckoning by day or two torches burning near together by night will signify "This is the best place to land."

Any of these signals may be answered from the vessels as follows: In the daytime, by waving a flag, a handkerchief, a hat, or even the hand; at night, by firing a rocket, a blue light, or a gun, or by showing a light over the ship's gunwale for a short time and then concealing it.

Cautions.—Masters are particularly cautioned, if they should be driven ashore anywhere in the neighborhood of the stations, to remain on board until assistance arrives, and under no circumstances should they attempt to land through the surf in their own boats until the last hope of assistance from the shore has vanished. Often when comparatively smooth at sea a dangerous surf is running which is not perceptible 400 yards offshore, and the surf when viewed from a vessel never appears as dangerous as it is. Many lives have been lost unnecessarily by the crews of stranded vessels being thus deceived and attempting to land in the ship's boats.

The difficulties of rescue by operations from the shore are greatly increased in cases where the anchors are let go after entering the breakers, as is frequently done, and the chances of saving life correspondingly lessened.

Name of station.	State.	Locality.
Sandy Hook	N. J.	On bay side, ½ mile south of point of Hook.
Spermaceti Cove	N. J.	2½ miles south of Sandy Hook light.
Seabright	N. J.	About 1 mile south of Navesink light.
Monmouth Beach	N. J.	About 1 mile south of Seabright.
Long Branch	N. J.	Greens Pond.
Deal	N. J.	Asbury Park.
Shark River	N. J.	Near the mouth of Shark River.
Spring Lake	N. J.	2½ miles south of Shark River.
Squan Beach	N. J.	1 mile southeast of Squan village.
Bayhead	N. J.	At the head of Barnegat Bay.
Mantoloking	N. J.	2½ miles south of head of Barnegat Bay.
Chadwick	N. J.	5 miles south of head of Barnegat Bay.
Toms River	N. J.	On the beach abreast mouth Toms River.

Name of station.	State.	Locality.
Island Beach	N. J.	1¼ miles south of Seaside Park.
Cedar Creek	N. J.	5⅜ miles north of Barnegat Inlet.
Forked River	N. J.	2 miles north of Barnegat Inlet.
Barnegat	N. J.	South side of Barnegat Inlet.
Loveladies Island	N. J.	2½ miles south of Barnegat Inlet.
Harveys Cedars	N. J.	5½ miles south of Barnegat Inlet.
Ship Bottom	N. J.	Midway of Long Beach.
Long Beach	N. J.	1⅝ miles north of Beach Haven.
Bonds	N. J.	2¼ miles south of Beach Haven.
Little Egg	N. J.	Near the light north of Inlet.
Little Beach	N. J.	South side of Little Egg Inlet.
Brigantine	N. J.	5½ miles north of Absecon light.
South Brigantine	N. J.	3⅛ miles north of Absecon light.
Atlantic City	N. J.	At Absecon light.
Absecon	N. J.	2¾ miles south of Absecon light.
Great Egg	N. J.	6¾ miles south of Absecon light.
Ocean City	N. J.	South side of Egg Harbor Inlet.
Pecks Beach	N. J.	3½ miles north of Corson Inlet.
Corson Inlet	N. J.	Near the Inlet, north side.
Sea Isle City	N. J.	3¼ miles north of Townsend Inlet.
Townsend Inlet	N. J.	Near the Inlet, north side.
Avalon	N. J.	3¾ miles southwest from Ludlam Beach light.
Stone Harbor	N. J.	2½ miles northeast of Hereford Inlet light.
Hereford Inlet	N. J.	Near Hereford light.
Holly Beach	N. J.	6 miles northeast of Cape May City.
Two Mile Beach	N. J.	4 miles northeast of Cape May City.
Cold Spring	N. J.	½ mile east of Cape May City.
Cape May	N. J.	Near the light.
Lewes	Del.	2 miles west from Cape Henlopen light.
Cape Henlopen	Del.	⅞ mile southerly of Cape Henlopen light.
Rehoboth Beach	Del.	Opposite north end of Rehoboth Bay.
Indian River Inlet	Del.	North of Inlet.
Bethany Beach	Del.	7½ miles north of Fenwick light.
Fenwick Island	Del.	1½ miles north of light.
Isle of Wight	Md.	3 miles south of Fenwick light.
Ocean City	Md.	At village.
North Beach	Md.	10 miles south of Ocean City.
Green Run Inlet	Md.	13½ miles northeast of Assateague light.
Popes Island	Va.	10 miles northeast of Assateague light.
Assateague Beach	Va.	1⅛ miles south of Assateague light.
Wallops Beach	Va.	1½ miles south of Chincoteague Inlet.
Metomkin Inlet	Va.	On Metomkin Beach, near the Inlet.
Wachapreague	Va.	South end of Cedar Island.
Parramore Beach	Va.	Midway of beach.
Hog Island	Va.	South end of Hog Island.
Cobb Island	Va.	South end of Cobb Island.
Smith Island	Va.	At Cape Charles light.
Cape Henry	Va.	¾ mile southeast of Cape Henry light.

VARIATION OF THE COMPASS.

The magnetic variations for 1918 and annual increase at points mentioned are as follows:

Locality.	Variation.		Annual increase.
	°	′	′
Sandy Hook	10	00 W.	5
Atlantic City	8	30	5
Overfalls light vessel	7	30	5
Ship John Shoal lighthouse	7	45	5
Reedy Island	7	45	5
Philadelphia	8	15	5
Winter Quarter Shoal light vessel	7	00	5
Cape Charles light vessel	6	00	4
Hampton Roads	5	30	4
Richmond	5	00	4
Wolf Trap lighthouse	5	45	4
West Point	5	15	4
Pocomoke Sound	6	15	4
Vienna	6	45	5
Potomac River entrance	6	00	4
Washington	6	15	4
Cambridge	6	45	5
Bloody Point Bar lighthouse	6	45	5
Baltimore Harbor	7	00	5
Havre de Grace	7	30	5

TIDES.

Locality.	Lunitidal interval, high water.[1]		Mean range.	Lowest tide.
	h.	m.	Feet.	Feet.
Sandy Hook	7	35	4.7	−4.0
Atlantic City, Gardners Basin	7	20	3.8	−3.0
Great Egg Inlet	7	36	4.1	−2.5
Delaware Breakwater	8	06	4.3	−2.5
Reedy Island	10	43	5.9	−3.5
Philadelphia	1	30	5.3	−3.5
Trenton	4	30	4.2	−3.5
Assateague Anchorage	7	20	3.8	−2.0
Franklin City	9	33	1.0	−2.5
Cape Henry lighthouse	8	00	2.8	−2.0
Old Point Comfort	8	44	2.5	−3.5
City Point, James River	2	21	2.8	−3.5
Richmond	4	18	3.7	−3.5
York Spit lighthouse	8	48	2.0	−3.0
West Point	10	47	2.9	−3.5
Stingray Point lighthouse	10	20	1.2	−2.5
Tappahannock	0	49	1.6	−3.5
Smith Point lighthouse	12	18	1.2	−3.0
Lower Cedar Point	2	24	1.4	−3.0
Washington	7	49	2.9	−4.0
Crisfield	0	23	1.9	−3.5
Cambridge	3	27	1.6	−3.5
Sandy Point lighthouse	5	05	0.8	−4.0
Baltimore Harbor	6	34	1.2	−4.5
Havre de Grace	9	15	2.1	−4.0
Chesapeake City	8	57	2.6	−4.0

[1] The mean lunitidal interval for high water is the average time from the meridian transit of the moon to the next following high water; it is also called the corrected establishment.

The effect of strong winds, in combination with the regular tidal action, may at times cause the water to fall below the plane of reference of the chart, mean low water; the lowest level observed below the plane of reference is given under the column headed "Lowest tide." The water has been known also to rise about the same amounts above mean high water, due to similar causes.

Tide Tables for the Atlantic coast of the United States, including Canada and the West Indies, are published annually in advance by the United States Coast and Geodetic Survey. This volume furnishes, at the nominal cost of 10 cents, full tidal data for the Atlantic and Gulf coasts of North America.

It contains a table of full daily predictions of the times and heights of high and low waters for certain standard or principal ports along the coast; full explanations for the use of this table are given at the bottom of each page. The use of Table 3 of the tide tables should be known to every navigator. By means of this table the predictions given for the standard ports are extended so as to enable one to obtain complete tidal data for each day for stations only a few miles apart for the greater part of the coast, and with almost the same accuracy as though full predictions were given for all of these points.

Instead of using the height differences of Table 3, however, a more accurate method is that of multiplying both high and low water heights at the standard port by the ratio of ranges for the given port to obtain the heights of the corresponding high and low waters. The ratio of ranges is given in the right column of the left page of Table 3 of the tide tables. The minus sign before the predicted heights in the tide tables indicates that the water is below the plane of reference, which is mean low water.

The time of high or low water at any given port in Table 3 is found by taking the time of the corresponding tide for that day from the standard port for reference and applying to it the time difference for the given port from the left page of Table 3, adding it if the sign is plus and subtracting if minus.

INLAND WATERWAYS.

The following data about the inland waterways are included for ready reference:

The inland waters extending eastward from New York include Long Island Sound, Narragansett Bay, Buzzards Bay, and Vineyard and Nantucket Sounds. From the head of Buzzards Bay there is an available passage through Cape Cod Canal, from which the passage to the New England coast must be made mostly outside, although there are harbors at short intervals.

Long Island Sound has harbors at short intervals on both sides from its west end to Eatons Neck, and thence on its north side to and including Fishers Island Sound. From Watch Hill boats must go outside to the bays and sounds eastward, but Point Judith Harbor of Refuge is available, and shortens the distance between harbors.

On the south coast of Long Island there is at present no inside route between Jamaica Bay and the inland waters eastward. Boats must go outside from New York to East Rockaway Inlet, and the latter requires local knowledge, because of frequent changes. But from East Rockaway Inlet boats of 5 feet draft can be taken inside through

Great South Bay and 3 feet draft through Moriches and Shinnecock Bays and Shinnecock Canal to Great Peconic Bay. Masted boats are limited to a height of less than 20 feet above the water by the fixed bridges over Shinnecock Canal, and otherwise all bridges have draw openings. This route is described in Coast Pilot, Part IV, under the heading "Inland waters, south coast of Long Island."

By the Hudson River and Erie Canal or Hudson River, Champlain Canal, and Richelieu River boats can be taken through to the Great Lakes or St. Lawrence River, respectively.

The maximum dimensions of boats which can pass through to the Great Lakes at the present time are length 98 feet, beam 17½ feet, draft 6 feet, height above water 11 feet; and to the St. Lawrence River, length 98 feet, beam 17½ feet, draft 4½ feet, height 11½ feet. The new Erie Canal, which is expected to be completed in 1918, will have lock dimensions of 311 feet available length, 45 feet width, and 12 feet depth on sills. The bridges will have an overhead clearance of 15½ feet. The Champlain Canal is expected to be completed in 1917 to the same dimensions.

The nearest inlet connecting with the inside waters on the **coast of New Jersey** is nearly 45 miles southward of Sandy Hook, and boats must pass outside between these points, unless taking the route through the Delaware & Raritan Canal. But from the head of Barnegat Bay to Cold Spring Inlet at Cape May there is an inside route for boats of 5 feet draft by taking advantage of the tide in places.

There is an inside route, good for small boats, along the **coast of Delaware, Maryland, and Virginia**, from Rehoboth Bay southward to Cape Charles. The nearest inlet connecting with the inside waters at present is 64 miles southward of Cape Henlopen, but work is in progress to connect Rehoboth Bay with Delaware Bay by a canal.

New York to Key West.—Vessels of 7 feet draft can pass inside from New York Bay to Delaware River through the Delaware & Raritan Canal. Masted vessels are limited to a height of 50 feet above canal level by a bridge without draw at New Brunswick, N. J.

Vessels of 9 feet draft can pass inside from Delaware River to Beaufort, N. C., through the Chesapeake & Delaware Canal, Chesapeake Bay, Elizabeth River, Dismal Swamp Canal or Albemarle & Chesapeake Canal, Albemarle and Pamlico Sounds, Neuse River, Adams Creek, canal to Core Creek, and Newport River. A draft of 3 feet can be taken inside about 40 miles southward from Beaufort, N. C., to New River Inlet. All bridges have draw openings.

There is no inside passage from Beaufort, N. C., to Winyah Bay, a distance of about 160 nautical miles, and vessels must pass outside between these points. Cape Fear River, halfway between them, is available as a harbor.

Vessels of 5 feet draft can pass inside from Winyah Bay, S. C., to St. Johns River, Fla. All bridges have draw openings.

Vessels of 4 feet draft can pass inside from St. Johns River to Miami, Fla., through Pablo Creek, North, Matanzas, Halifax, and Hillsborough Rivers, Mosquito Lagoon, Indian River, South Jupiter Narrows, Hobe and Jupiter Sounds, Lake Worth, Key Biscayne Bay, and the canals connecting them. All bridges have draw openings.

From Miami to Key West, Fla., there is practically an inside route through the Hawk Channel that can be used by vessels of 10 feet draft. Cuts with a depth of 5 feet have been made in places so

that vessels of 4 feet draft can go from Miami through Key Biscayne Bay, Card Sound, Barnes Sound, railroad drawbridge at Cross Key, Blackwater Sound, Tarpon Basin, Florida Bay along the north side of the keys to Long Key, and thence northwestward into the Gulf of Mexico at Cape Sable, or can continue in Florida Bay along the north side of the keys, through Big Spanish Key Channel, and thence in the Gulf of Mexico to Key West.

Boats of 1½ to 4 feet draft (depending on the rainfall) have been taken across Florida by way of some of the drainage canals, Lake Okeechobee, and Caloosahatchee River, but the route is at present impracticable.

Gulf of Mexico.—From Key West to New Orleans there are several detached stretches of inside waters, available for a draft of 4 to 5 feet, and a partially sheltered route with frequent harbors for small craft along the entire coast.

From New Orleans westward through Louisiana there is a network of inside waters affording a through route, for drafts of 3 to 5 feet, to Sabine Pass. From Sabine Pass to Galveston there is no inside route.

From Galveston southwestward to Corpus Christi there is an inside route for a draft of 4 feet by way of several extensive bays and dredged canals connecting them. Beyond Corpus Christi there is no inside route available.

Charts covering the routes along the Atlantic coast and Gulf of Mexico are published by the United States Coast and Geodetic Survey. Charts of the Erie Canal, Champlain Canal, Lake Champlain, and Great Lakes are published by the United States Lake Survey Office, Detroit Mich.

A catalogue showing the charts of the route along the Atlantic and Gulf coasts can be obtained free of charge on application to the Coast and Geodetic Survey, Washington, D. C., or to any of its agents. A list of agents for the sale of charts and other publications of the Coast and Geodetic Survey is given in the catalogue and in the first notice each month of the Notice to Mariners, published weekly by the Bureau of Lighthouses and the Coast and Geodetic Survey.

The inland waters are covered in the following publications of the Coast and Geodetic Survey:

United States Coast Pilot, Part III, Cape Ann to Point Judith.

United States Coast Pilot, Part IV, covering the coast and inland waters from Point Judith to Sandy Hook, including Long Island Sound, New York Harbor, and tributaries.

United States Coast Pilot, Section C (this volume), covering the coast and inland waters from Sandy Hook to Cape Henry, including Delaware and Chesapeake Bays, and the inside route from New York to Norfolk.

Inside Route Pilot, coast of New Jersey.

United States Coast Pilot, Section D, covering the coast and inland waters from Cape Henry to Key West.

Inside Route Pilot, New York to Key West.

United States Coast Pilot, Section E (in press), covering the coast and inland waters of the Gulf of Mexico.

Inside Route Pilot, Key West to New Orleans.

Tide Tables, Atlantic coast ports of the United States.

CURRENTS, SANDY HOOK TO CAPE HENRY.

The following statements are deduced from current observations which have been made at all the light vessels along this section of the coast for about three months during the winter of 1912–13, and from other sources:

Tidal currents.—These are weakly rotary in character, revolving clockwise, with minimum velocities three hours after strength of flood and ebb in a direction at right angles to that at the time of strength. When not influenced by the larger bays or rivers, such as Delaware River, Chesapeake Bay, and New York Bay, these tidal currents are weak, averaging about 0.2 knot at strength, the direction of the flood and ebb at strength being on and off shore, respectively. In the immediate vicinity of the larger bays or rivers, the direction of flood and ebb at strength is directly in and out, and the strength of the current is increased, depending on the proximity of the mouth. These three rivers and bays affect the direction of the tidal currents to a distance of about 20 miles from their entrances, but the strength of the offshore current is not affected until within a tew miles of the mouth.

Wind currents.—Moderate to heavy winds set up strong currents in the direction of the wind, reversing or greatly accelerating the normal currents; in fact, the principal currents along this stretch of coast, when away from the larger bays, are the wind currents. Their strength and set depend on the direction, strength, and duration of the wind. The greatest observed velocities of the current at the light vessels are, Ambrose Channel 1.4 knots, Northeast End 1.2 knots, Overfalls 3.6 knots, Winter Quarter 0.8 knot, Fenwick Island 2 knots, Cape Charles 1.6 knots, and Tail of the Horseshoe 2.8 knots. These results are for three winter months, and probably closely approximate the maximum which might be expected.

Offshore currents.—Observations made offshore have developed the existence of weak tidal currents, veering around the compass, similar in character to those inshore, although of less strength. These are accompanied by a general drift in a southerly to southwesterly direction, amounting to about ¼ of a knot per hour; this extends from about the 20-fathom curve out nearly to the Gulf stream.

The following is a more detailed statement of the observations at each light vessel. The wind currents are of more importance than the tidal currents, and the two must be combined in making allowance for set.

Ambrose Channel light vessel.—The tidal currents have a mean velocity of 0.2 knot at strength of flood and ebb, the flood setting in a westerly and the ebb in an easterly direction. The strength of flood occurs at 1 hour 25 minutes before time of high water at Sandy Hook, and the strength of ebb at 1 hour 20 minutes before time of low water at Sandy Hook. Wind velocities of 10 to 25 miles produce currents of about 0.5 to 1 knot, setting approximately fair with the wind. The greatest observed velocity of the current was 1.4 knots during a 50 mile an hour gale.

Northeast End light vessel.—The tidal currents have a mean velocity of 0.2 knot at strength of flood and ebb, the flood setting in a

westerly and the ebb in an easterly direction. The strength of flood occurs at 2 hours 35 minutes before time of high water at Sandy Hook, and the strength of ebb 2 hours 40 minutes before time of low water at Sandy Hook. Wind velocities of 10 to 30 miles produce currents of about 0.5 to 0.9 knot, setting approximately fair with the wind. This wind current must be combined with the tidal currents in making an allowance for set. The greatest observed velocity of the current was 1.2 knots during a 50 mile an hour gale.

Overfalls light vessel.—See Currents, Delaware Bay.

Fenwick Island Shoal light vessel.—The tidal currents have a mean velocity of 0.3 knot at strength of flood and ebb, the flood setting in a north by west (true) direction and the ebb in a south by east (true) direction. The strength of flood occurs at 1 hour before time of high water at Sandy Hook and the strength of ebb at 1 hour 5 minutes before time of low water at Sandy Hook. Wind velocities of 10 to 30 miles produce currents of about 0.5 to 1 knot, setting approximately fair with the wind; except that the greatest current in a westerly direction observed was 0.7 knot. This wind current must be combined with the tidal current in making an allowance for set. The greatest observed velocity of the current was 2 knots during a 60 mile an hour gale.

Winter Quarter Shoal light vessel.—The tidal currents have a mean velocity of 0.1 knot at strength of flood and ebb, the flood setting in a west-southwest (true) direction and the ebb in an east-northeast (true) direction, occurring 4 hours 20 minutes before time of high water and low water, respectively, at Sandy Hook. Wind velocities of 15 to 30 miles produce currents of about 0.3 to 0.6 knot, setting approximately fair with the wind. The greatest observed velocity of the current was 0.8 knot.

Cape Charles light vessel.—The tidal currents have a mean velocity of 0.3 knot at strength of flood and ebb, the flood setting in a westerly and the ebb in an easterly direction. The strength of flood occurs at 1 hour before time of high water at Sandy Hook or 2 hours 15 minutes before time of high water at Old Point Comfort; the strength of the ebb occurs at 1 hour before time of low water at Sandy Hook or 2 hours before time of low water at Old Point Comfort. Wind velocities of 10 to 25 miles produce currents of about 0.5 to 1 knot, setting approximately fair with the wind. The greatest observed velocity of the current was 1.6 knots in a 40 mile an hour gale.

DIRECTIONS, NEW YORK TO CHESAPEAKE BAY ENTRANCE.

A description of the coast and outlying shoals from Sandy Hook to Cape May is given on page 41, and from Cape Henlopen to Cape Charles on page 102.

General remarks.—From Sandy Hook southward to Brigantine Shoal, a distance of about 70 miles, the coast is comparatively free from off-lying shoals, but southward of this point the coast is fringed with extensive areas of broken ground, depths of 10 fathoms and less being found at distances of nearly 20 miles offshore in places.

Owing to the numerous outlying shoals this coast is a dangerous one for deep-draft vessels, and unless sure of the vessel's position the lead should be used to give warning of too close an approach from seaward. The 15-fathom curve extends from 15 to 20 miles offshore northward of Winter Quarter Shoal light vessel and 20 to 25 miles offshore southward, and in thick weather vessels should keep outside this depth. The water shoals quite regularly from 30 fathoms to 15 fathoms, but inshore of the latter depth the soundings are irregular, and shoals rise abruptly in many cases from about 10 fathoms of water. In case one of the lights or light vessels are not made when in a depth of 15 fathoms it is advisable to stand alongshore until one of them is sighted.

Standing along the coast, vessels of the deepest draft usually pass outside of the light vessels and out of sight of land, except between Northeast End light vessel and New York. At night, if on this track, some of the lighthouses and the light vessels will be sighted, so that the vessel's position can be readily determined. The large number of sailing vessels, steamers, and tows passing up and down this coast make it necessary to keep a bright lookout to prevent collisions.

The routes followed by vessels along this part of the coast vary greatly, according to their draft and the condition of wind and weather. Complete directions to meet all conditions can not be given, but the following suggestions may be of some assistance to strangers.

Vessels of the deepest draft should in all cases keep outside of the light vessels and should, wherever possible, avoid crossing areas of a less charted depth than about 9 fathoms. The following courses lead in a least depth of about 9 fathoms, except in approaching the entrance to Chesapeake Bay, where they lead across a least depth of 7 fathoms, but close to 6-fathom spots.

From Ambrose Channel light vessel steer 186° true (S by W ⅜ W mag.) for 43 miles, to a position 8 miles off Barnegat lighthouse, bearing 276° true (WNW ⅝ W mag.). Then steer 203° true (SSW ¾ W mag.) for 119 miles to a position ½ mile eastward of Winter Quarter Shoal light vessel, passing 5 miles outside Brigantine Shoal gas and whistling buoy, 5½ miles outside Northeast End light vessel, 5 miles outside Five Fathom Bank light vessel, and 5 miles outside Fenwick Island Shoal light vessel. From here a 213° true (SW ½ S mag.) course for 75 miles will lead 4¾ miles southeastward of Cape Charles light vessel and to a position 3 miles eastward of Chesapeake Bay entrance gas, whistling, and submarine bell buoy. The last course, if closely followed, leads over a least found depth of 43 feet, but leads 2 miles southeastward of 36-foot depths about 10 miles northeastward of Cape Charles light vessel, and the light vessel should not be passed closer than 4 miles. The last 5 miles of the course leads between shoals of 33 to 36 feet depth; care should be taken not to make the entrance buoy anywhere on the port bow on this course, and not to make it more than 4 miles to the eastward unless passing well outside.

Many large vessels entering Chesapeake Bay from northward run from Winter Quarter Shoal light vessel to Cape Charles light vessel, thence to Cape Henry gas and whistling buoy. The least found depth crossed on these courses is 30 feet.

Coasting vessels of 17 to 24 feet draft and the largest tows, except those trading between Delaware Bay and points northward, usually keep outside the light vessels.

The following courses represent approximately the mean of the courses followed by vessels of this class. They are varied but little on account of weather conditions except northward of Five Fathom Bank, where courses leading farther offshore are sometimes followed during easterly weather and closer inshore during westerly weather. These courses depend entirely on making the aids, and the lead is of little use to insure safety; in thick weather it is safer to keep farther offshore between Five Fathom Bank and Sandy Hook and exercise care to keep outside of the buoy off Barnegat.

	Course.		Distance in nautical miles.
	True.	Magnetic.	
1. Gedney Channel gas and whistling buoy to Barnegat Shoal gas, whistling, and submarine bell buoy	° 188	S by W ⅝ W	44
This course leads ⅜ mile eastward of Shrewsbury Rocks gas and bell buoy and 3¼ miles eastward of Sea Girt lighthouse. Or, from Scotland light vessel a 187° true (S by W ½ W mag.) course will lead ⅜ mile westward of Shrewsbury Rocks gas and bell buoy and to Barnegat Shoal gas, whistling, and submarine bell buoy.			
2. To ½ mile eastward of Five Fathom Bank light vessel	204	SSW ⅞ W	64
This course leads ¾ mile eastward of Brigantine Shoal gas and whistling buoy and 1 mile eastward of Northeast End light vessel.			
3. To ½ mile eastward of Fenwick Island Shoal light vessel	203	SSW ¾ W	22¾
For vessels bound to or from Delaware Bay, a 272° true (W ⅞ N mag.) course from Five Fathom Bank light vessel will lead to Overfalls light vessel, or a 150° true (SSE mag.) course from Overfalls light vessel will lead to Fenwick Island Shoal light vessel.			
4. To ½ mile eastward of Winter Quarter Shoal light vessel	195	SSW	32¼
5. To ½ mile southeastward of Cape Charles light vessel	217	SW ⅛ S	63
6. To Cape Henry gas and whistling buoy	226	SW ⅝ W	12¼

Tows and other local vessels of less than 17 feet draft usually pass inside of Five Fathom Bank and Fenwick Island Shoal at all times, and inside of McCrie Shoal and Winter Quarter Shoal, except in easterly weather. The route most often followed both northward and southward in good weather by vessels with local knowledge is as follows:

From the outer end of Ambrose Channel or from Scotland light vessel to ½ mile westward of Shrewsbury Rocks gas and bell buoy; thence to Barnegat Shoal gas, whistling, and submarine bell buoy; thence to Brigantine Shoal gas and whistling buoy; thence to 1 mile northwestward of McCrie Shoal gas and whistling buoy; thence to Overfalls light vessel; thence to close eastward of Little Gull Bank

gas and whistling buoy; thence to close eastward of Black Fish Bank gas and whistling buoy; thence to close eastward of Cape Charles light vessel; thence to Tail of the Horseshoe light vessel.

The course from Overfalls light vessel to Little Gull Bank gas and whistling buoy leads close to least found depths of 3¼ to 4 fathoms, and also leads through an area of possible fish traps; strangers are advised to follow a more easterly course and to pass from ½ to 2 miles westward of Fenwick Island Shoal whistling buoy. The course from Little Gull Bank gas and whistling buoy to Black Fish Bank gas and whistling buoy crosses Black Fish Bank where the depths are 18 to 20 feet. The course from Black Fish Bank gas and whistling buoy to Cape Charles light vessel leads close eastward of Parramore Banks, on which the least found depth is 21 feet.

In westerly or northwesterly weather vessels of this class bound northward run closer inshore in places. The generally used route for vessels with local knowledge is as follows: From Cape Charles light vessel to Great Machipongo Inlet bell buoy; thence along shore at a distance of about 3 miles to Assateague Anchorage; the outer limit of possible fish traps is 3 to 3½ miles from shore. Tows and small coasting vessels bound northward usually anchor in Assateague Anchorage in heavy weather.

Bound northward from Assateague Anchorage, the generally used route of coasting vessels in good weather is to pass southward of Turners Lump and between Black Fish Bank and Chincoteague Shoals. In easterly weather they usually pass southward and eastward of Black Fish Bank. In westerly weather they often pass ¼ mile southward of the two red buoys marking the southern edge of Ship Shoal and then follow the channel westward of Chincoteague Shoals; this channel had a least depth of 16 feet in 1915.

Between the northern end of Chincoteague Shoals and Little Gull Bank vessels with local knowledge follow the shore close in in westerly weather, but always pass outside of Little Gull Bank. Between Little Gull Bank and Barnegat Inlet the ordinary courses are varied but little during westerly weather, but from Barnegat Inlet to Shrewsbury Rocks they follow the shore close in, not more than 1 mile off, but always pass outside of Shrewsbury Rocks can buoy.

In easterly weather the route often used by vessels of this class is from Cape Charles light vessel to Winter Quarter Shoal gas and whistling buoy; thence to 1 mile westward of Fenwick Island Shoal whistling buoy; thence to 1 mile eastward of McCrie Shoal gas and whistling buoy; thence to Brigantine Shoal gas and whistling buoy; thence to Barnegat Shoal gas, whistling, and submarine bell buoy; and thence to Scotland light vessel. This route is also sometimes used by vessels bound southward in heavy easterly weather. The least found depth crossed is about 27 feet.

The following courses are suggested for strangers of 15 feet or less draft in **good weather**. In bad weather or with a deeper draft, follow the directions for vessels of 17 to 24 feet draft, preceding.

	Course.		Distance in nautical miles.
	True.	Magnetic.	
1. Gedney Channel gas and whistling buoy to Barnegat Shoal gas, whistling, and submarine bell buoy	° 188	S by W 5/8 W.	44
This course leads 3/8 mile eastward of Shrewsbury Rocks gas and bell buoy. Or, from Scotland light vessel a 187° true (S by W 1/2 W mag.) course will lead 3/8 mile westward of Shrewsbury Rocks gas and bell buoy and to Barnegat Shoal gas, whistling, and submarine bell buoy.			
2. To Brigantine Shoal gas and whistling buoy	205	SW by S	24 1/4
3. To 1 mile northwestward of McCrie Shoal gas and whistling buoy	222	SW 1/2 W	43
The course leads 2 miles southeastward of Hereford Inlet bell buoy and 3 3/8 miles eastward of Hereford Inlet lighthouse.			
4. To Overfalls light vessel	244	WSW 3/8 W	8 1/4
5. To 1 mile westward of Fenwick Island Shoal whistling buoy	173	S	21
6. To Little Gull Bank gas and whistling buoy	197	SSW 1/8 W	9 1/2
7. To 1 mile westward of Black Fish Bank gas and whistling buoy	204	SSW 3/4 W	30
8. To 1/2 mile eastward of Cape Charles light vessel	204	SSW 3/4 W	50 1/2
9. To Tail of the Horseshoe light vessel	245	WSW 1/4 W	15

COAST FROM SANDY HOOK TO CAPE MAY.

The coast of New Jersey has a general south-southwesterly trend for 43 miles from Sandy Hook to Barnegat Inlet, and then a southwesterly trend for 67 miles to Cape May Point. The coast from Sandy Hook southward to Corson Inlet is free from dangers if it be given a berth of 5 miles or more. From Corson Inlet southwestward to Cape May there are shoals with a least depth of 15 feet extending about 14 miles offshore, but with channels inside of them.

Shoals extend for a considerable distance off many of the inlets; all of the inlets are obstructed by shifting bars and require local knowledge to carry the best water. The principal ones, with their approximate depths are: Barnegat Inlet, depth 6 feet; Little Egg Inlet, depth 12 feet; Absecon Inlet, depth 12 feet; Great Egg Inlet, depth 9 feet; and Cold Spring Inlet, depth 18 feet. These inlets are described under "Inside Waters, Coast of New Jersey," following. The most favorable time for entering the inlets is on a flood tide with a smooth sea; in easterly gales or in a heavy sea they can not be entered in safety.

New York Bay, including Navesink and Shrewsbury Rivers, is described in Coast Pilot, Part IV, Point Judith to New York.

Sandy Hook, the northern point of the New Jersey coast, is a low sand spit. On the north end is North Hook beacon, and at the northwest end of the hook is Sandy Hook fog bell (triple stroke every 10 seconds). Southward of these are a fort, some houses, Sandy Hook lighthouse, a Coast Guard station, and a storm warning display station. Near North Hook beacon is a vessel reporting station from

which vessels are reported to the Maritime Exchange in New York City.

Sandy Hook lighthouse is a white stone tower. The light is fixed white, 88 feet above the water, and visible 15 miles.

North Hook beacon is a brown conical tower, which with Sandy Hook lighthouse forms a range for the inner section of Ambrose Channel. The light is fixed white, 44 feet above the water, and visible 12 miles. The fog signal is a siren, blast 3 seconds, silent 27 seconds.

Navesink Highlands is a prominent high wooded ridge 5 miles southward of the north end of Sandy Hook, on the side of which, in a cleared space, is **Navesink lighthouse.** The latter consists of two brownstone towers connected by dwelling. The light, shown from the south tower, is flashing white of high power (light 0.1 second, eclipse 4.9 seconds), 246 feet above the water, and visible 22 miles. In case of accidental extinguishment of the flashing light, a fixed white light will be shown from the north tower.

There is a practically continuous line of summer resorts along the coast from Navesink Highlands southward to Bay Head. The following are the names of the most important, with their distances southward of Navesink lighthouse: **Seabright,** 2 miles; **Long Branch,** 6 miles; **Asbury Park,** 10½ miles; **Ocean Grove,** 11 miles; **Bradley Beach,** 12 miles; **Belmar** (south side of Shark River Inlet), 13 miles; **Spring Lake,** 15 miles; **Sea Girt,** 16 miles; **Manasquan,** 17 miles; **Point Pleasant,** 19 miles; and **Bay Head,** 20 miles. Long Branch and Asbury Park are most conspicuous on account of the greater number of large buildings; Manasquan is marked by twin water tanks about 1 mile southwest of Sea Girt lighthouse; Point Pleasant by a standpipe, the first one north of Atlantic City; and Bay Head by a water tank with a conical top and bottom.

Shrewsbury Rocks, 3½ miles southward of Navesink lighthouse, extend 1¼ miles from shore, have a least depth of 15 feet, and are marked at the eastern end by a black can buoy and by a gas and bell buoy ⅞ mile farther eastward. From Shrewsbury Rocks southward to within 4 miles of Barnegat Inlet the coast is clear, and the 5-fathom curve lies nowhere more than ¾ mile from shore.

Sea Girt lighthouse, 16 miles south-southwestward of Navesink lighthouse, is a square brick tower in front of a dwelling. The light is flashing white (flash 0.3 second, eclipse 0.7 second), 52 feet above the water, and visible 13 miles.

There is an inland waterway from Bay Head southward to Cold Spring Inlet, good for a draft of 5 feet by taking advantage of high water at the shoal places. The beaches separating the inside waters from the ocean are low, and the summer resorts are more widely separated than those northward. To vessels bound southward along the coast the first landmark southward of Bay Head is the town of **Mantoloking,** a large group of houses with a water tank showing only a little above the buildings. Southward of this are **Chadwick** and **Lavallette,** small groups of houses without prominent marks, and a hotel at Ortley. About 1 mile southward of Ortley is **Seaside Heights,** a town with tanks at the north and south ends; and 1½ miles farther south is **Seaside Park,** marked by a water tank and low chimney close together. There is a small group of houses around Island Beach Coast Guard station, 1½ miles southward of Seaside

Park, and from there to Barnegat Inlet, a distance of about 7½ miles, the only marks are the Coast Guard stations.

In the vicinity of Barnegat Inlet, shoals with depths less than 5 fathoms extend 2 miles offshore and form a menace to navigation, especially to vessels bound northward along the coast in thick weather. There is a gas, whistling, and submarine bell buoy 4 miles east-southeastward of Barnegat lighthouse.

Barnegat lighthouse, the most prominent mark in the vicinity of Barnegat Inlet, is a conical tower, lower half white, upper half red. The light is flashing white (flash 2.5 seconds, eclipse 7.5 seconds), 163 feet above the water, and visible 19 miles. A large hotel near the lighthouse is prominent.

Lying 4½ miles southwestward of Barnegat lighthouse is **Harvey Cedars,** a small settlement without prominent marks, and 2 miles farther southwestward is **Surf City,** marked by a red water tank. Southwestward of this are several small settlements with water tanks, and 14 miles southwestward of Barnegat lighthouse is **Beach Haven,** a large town marked by two water tanks. There is a small group of houses around Bond Coast Guard station, 1½ miles southwestward of Beach Haven, and another group around Tucker Beach lighthouse, 2½ miles farther southwestward. There is broken ground along the shore between Barnegat and Little Egg Inlets, and it should be given a berth of 3 miles or more to insure a depth of 30 feet.

Tucker Beach lighthouse, 2 miles northward of Little Egg Inlet, is a black tower on a white dwelling. The light is fixed white with red flashes (fixed 15 seconds and 6 red flashes of 0.7 second duration every 30 seconds), 49 feet above the water, and visible 12 miles.

Sea Haven light is on the point of beach on the north side of Little Egg Inlet. There is a perpendicularly striped bell buoy off the entrance.

From Little Egg Inlet to Absecon Inlet, a distance of 8 miles, there are no marks except the Coast Guard stations and scattered groups of houses. Broken ground extends nearly 5 miles offshore and is marked at its eastern end by a gas and whistling buoy, which lies 8 miles eastward of Absecon lighthouse and 5 miles from shore. There is a black can buoy about 3 miles westward of the gas buoy, marking the outer end of the 18-foot depth on the shoal.

Atlantic City, on the south side of Absecon Inlet, is the most conspicuous resort on the coast, on account of its size and many prominent marks.

Absecon lighthouse, showing above the buildings at Atlantic City, is a conical tower, lower and upper thirds yellow, middle third black. The light is fixed white, 165 feet above the water, and visible 19 miles. There is a perpendicularly striped bell buoy off the entrance of Absecon Inlet.

There are a standpipe and chimney close together at **Ventnor,** 3½ miles southwestward of Absecon lighthouse, a slender and a broad standpipe about 1 mile apart at **South Atlantic City,** and a tank at **Longport,** on the north side of Great Egg Inlet. A perpendicularly striped bell buoy marks the entrance to Great Egg Inlet.

On the south side of Great Egg Inlet is **Ocean City,** second only in size to Atlantic City, and having several prominent marks. There are small groups of houses on the north and south sides of Corson

Inlet, but the first conspicuous resort southwestward of Ocean City is **Sea Isle City**, marked by a slender standpipe, a brick chimney, and two church spires.

Ludlam Beach lighthouse, at Sea Isle City, is a drab dwelling and is not prominent by day. The light is flashing white (light 2 seconds, eclipse 3 seconds), with a flashing red sector westward of 356° true (N 3/8 E mag.), 36 feet above the water, and visible 11 miles.

There is a shoal with a depth of about 15 feet and marked by a horizontally striped nun buoy, about 3 miles southeastward of Ludlam Beach lighthouse. Broken ground, with a least found depth of 4 fathoms, extends about 3 miles east-northeastward from the buoy. There is deeper water inside these shoals but, on account of the broken bottom and abrupt changes in depth, vessels of greater draft than 15 feet should pass outside of them.

The resorts, named in order, between Sea Isle City and Hereford Inlet are: **Avalon**, marked by a tank; **Peermont**, a small settlement without prominent marks; and the town of **Stone Harbor**, marked by a slender standpipe. There is a perpendicularly striped gas and whistling buoy off Townsend Inlet, and a black bell buoy off Hereford Inlet.

Hereford Inlet lighthouse, on the south side of Hereford Inlet, is a white tower on a dwelling. The light is flashing white (flash 0.3 second, eclipse 3.4 seconds, flash 0.3 second, eclipse 11 seconds), with a flashing red sector westward of 226° true (SW 3/4 W mag.), 53 feet above the water and visible 13 miles.

There is a practically continuous line of summer resorts, with many prominent marks, from Hereford Inlet to Turtle Gut Inlet. From Turtle Gut Inlet southwestward the first prominent marks are the jetties at Cold Spring Inlet and the Casino at the inner end of the west jetty. There is a perpendicularly striped bell buoy off the jetties, and a flashing white light on the end of the east jetty. About 2 miles westward of Cold Spring Inlet is **Cape May**, a summer resort having several large and prominent hotels; and 2 miles westward of Cape May is the summer resort of Cape May Point, marked by Cape May lighthouse.

Cape May lighthouse is a gray tower; the light is flashing white (flash 5 seconds, eclipse 25 seconds), 165 feet above the water, and visible 19 miles.

Five Fathom Bank is an area of broken ground about 13 miles eastward of Cape May. It is about 9 miles long in a northerly and southerly direction inside the 5-fathom curve, and about 2 miles wide, and there are detached shoal spots eastward and northward of it. The least depth found is 15 feet, lying 10 miles 133° true (SE 1/2 S mag.) from Hereford Inlet lighthouse, and is marked on the northeast side by a horizontally striped nun buoy. There is a red nun buoy marking a 21-foot spot about 3 1/2 miles southward of the horizontally striped buoy. It is near the south end of the shoals and should be given a berth of 1/2 mile or more when passing eastward and southward of it. A 15-foot spot has been reported at the northern end of Five-Fathom Bank, 8 1/4 miles, 98° true (ESE 1/2 E mag.) from Hereford Inlet lighthouse.

There is very broken ground, with 5 fathoms or less, and abrupt changes in depth, between Five Fathom Bank and Cape May, and

there is broken ground extending to a distance of about 6 miles southward of Cold Spring Inlet and Cape May.

The passage inside of **Five Fathom Bank**, passing either eastward or westward of McCrie Shoal, is generally used by coasting vessels entering Delaware Bay from northward. In a heavy sea, vessels of a greater draft than 18 feet should pass outside of Five Fathom Bank, and this is also the safer course at all times for strangers in vessels of a greater draft than 18 feet.

Northeast End light vessel, about 6½ miles eastward of the north end of Five Fathom Bank, has a red hull with "Northeast" on the sides. It has two skeleton towers with square daymarks at the top of each, and a light above the daymark on the fore tower. The light is occulting white (light 1 second, eclipse 1 second), 49 feet above the water, and visible 12 miles. If the occulting light is extinguished a fixed white light will be shown from the fore tower. The fog signal is a siren (blast 4 seconds, silent 5 seconds, blast 4 seconds, silent 107 seconds). If the fog signal is disabled, a bell will be struck by hand. The submarine bell strikes "45" every 36 seconds.

Five Fathom Bank light vessel, about 4 miles southeastward of the south end of Five Fathom Bank. has a straw-colored hull with "Five Fathom" on the sides, and two masts with round daymarks and light at the head of each. The lights are fixed white, 50 feet above the water, and visible 11 miles. The fog signal is a whistle (blast 4 seconds, silent 56 seconds). A bell will be struck by hand if the whistle is disabled. The submarine bell strikes "42" every 28 seconds.

McCrie Shoal, having a least depth of 17 feet, lies 7 miles 136° true (SE ¾ S mag.) from Cape May lighthouse. It is marked on the southeast side by a gas and whistling buoy. The shoals and channels southwestward of Cape May are described under "Delaware Bay, Eastern Side."

Tides.—The mean rise and fall of tide on the outside coast is about 4.6 feet. Tidal data for the inside waters and the inlets are given in the description of the inland waters, coast of New Jersey.

Current information for the outside coast is given on page 36.

Fish weirs may be found along the seacoast between Sandy Hook and Island Beach Coast Guard station at distances between ¼ and 1¼ miles offshore, except in front of coast guard stations, where a belt ½ mile wide inshore and 1½ miles wide offshore must be left clear.

Fish wiers between Island Beach Coast Guard station and Cape May are limited to the following areas: Inside of a line 1¼ miles offshore between Island Beach Coast Guard station and Barnegat Inlet; inside of a line between points 2 miles south-southeastward of Barnegat lighthouse and 2⅝ miles eastward of Tucker Beach lighthouse; inside of a line between points 1¼ miles offshore abreast Chelsea and 2⅜ miles offshore abreast Stone Harbor Coast Guard station, Hereford Inlet; and within a distance of 2 miles of shore between Hereford and Turtle Gut Inlets. Belts approximately 2 miles wide at the inshore end and wider at the outer end are left clear in front of each inlet. Fish weirs are permitted on the shoalest part of Five Fathom Bank, in a belt 7 miles long north and south (true) and 2 miles wide; but a track with a least width of about 5 miles is left clear of fish weirs inside of Five Fathom Bank.

All fish weirs are required to be marked by fixed lights, a white light on the outer end and a red light on the inner end where navigation is possible inside of them.

Storm warnings of the United States Weather Bureau are displayed at Long Branch, Little Egg Coast Guard station, Atlantic City, Great Egg Coast Guard station, Avalon Coast Guard station, and Cape May Point Coast Guard station.

INLAND WATERS, COAST OF NEW JERSEY.

The coast of New Jersey from Sandy Hook southward to Barnegat Inlet, a distance of 43 miles, is broken by several small inlets; but the inside waters are not connected, and boats bound southward from New York must pass outside for this distance. The inlets north of Barnegat Inlet are shoal and of little use at present, except to local boats; Shark River Inlet and Manasquan Inlet are the only ones that can be entered from sea.

Shark River Inlet is being improved by the State of New Jersey by the construction of retaining walls on both sides at the entrance and a jetty 300 feet long on the north side to protect the entrance and form a harbor for small boats. In November, 1915, the cut had not yet been made through the beach, and the natural channel farther north had little depth. From just inside the inlet to the first bridge the river is bulkheaded on the south side and has been dredged by private enterprise to a depth of 15 feet from the bulkhead northward for about two-thirds the width of the channel. There are two fixed bridges crossing the river ¾ mile westward of the inlet, with a headroom of 4 or 5 feet and a depth of 3 feet at high water. The bay westward of the bridges has a depth of 1 to 3 feet and is frequented only by small boats of about 2 feet draft. Gasoline and provisions can be had below the bridges.

Manasquan Inlet has a narrow changeable entrance, with a depth across the bar in 1914 of about 3 feet, but it is sometimes almost entirely closed. It is not used except by small boats in case of necessity. The river has a general depth of 4 to 5 feet for 4½ miles from the inlet and is navigable for small boats to Manasquan Park, about 7 miles from the inlet. It is frequented by fishing and pleasure boats of about 2 feet draft. Three drawbridges cross the river, the least width of span being 30 feet and least headroom 3 feet at high water. The range of tide inside is about 1 foot. Improvements are contemplated by the State of New Jersey to extend the waterway from Bay Head to Manasquan Inlet, and dredging for a part of the distance had been authorized in November, 1915.

Barnegat Bay and the bays and connecting channels southward form a continuous inside waterway from Bay Head to Cold Spring Inlet. The inside waters are entered from seaward by a number of inlets with shifting entrances, in most cases marked by buoys. The inlets and interior waters give access to the large number of summer resorts along the beach and many villages on the mainland adjacent to them. They are used by many pleasure boats and boats engaged in the oyster and clam industry and inside and outside fishing. There is considerable passenger and general freight business between points inside, but little coasting trade.

Improvements have been in progress by the State of New Jersey for several years to form an inland waterway from Bay Head to

Cold Spring Inlet with a depth of 6 feet and width of 100 feet. The work has been completed to project dimensions, with the exception of short stretches at the northern end of Barnegat Bay, but some shoaling has occurred in places, and redredging is done at irregular intervals. The waterway follows the natural channels in the bays and thoroughfares, joined by many cut-offs and connecting canals. In November, 1915, a draft of about 4½ feet at low water could be carried from Bay Head to Cold Spring Inlet, except at a few places just inside the inlets where some shoaling has occurred. By taking advantage of the tide at these points the passage is good at all times for boats of 4½ feet draft or more. It is marked throughout its entire length, as described under "Aids to Navigation" following.

Supplies.—Gasoline, provisions, and water can be obtained at practically all of the villages and resorts along the interior waters. In summer supplies of this kind can often be obtained at the bridges. Coal can be had at Atlantic City and in limited quantities at Ocean City and others of the larger places. There are telephones at all places and telegraph at the principal railroad stations.

Repairs.—There are railways capable of hauling out most of the boats navigating the inside waters at Bay Head, Tuckerton, Atlantic City, Ocean City, Stone Harbor, and Cold Spring Inlet; and there are smaller railways at Island Heights, Forked River, and Sea Isle City. Shops for ordinary repairs to hulls and motors are located at Bay Head, Atlantic City, and Ocean City.

Pilots.—There are no regular pilots for the inside passages or the inlets; but any of the local boatmen are competent pilots. In good weather there are fishing boats outside all of the inlets, and strangers can obtain a fisherman for a pilot, or signal may be set off the town nearest the inlet, and one will come off from shore. In places where there are no towns near the inlets, a member from the Coast Guard station will usually go out if a signal is set.

Ice.—The inside waters are entirely closed to navigation by ice during extreme winters. During ordinary winters the more open channels, especially near the inlets where the currents are strong, remain open during most of the winter, though ice always forms on the flats. The inlets themselves are rarely closed by ice, though navigation through them is often rendered difficult by running ice. All of the principal inlets and the channels adjacent to them are used in winter by local fishing and oyster boats, but through navigation is usually blocked.

Bridges.—All bridges crossing the inland waterway have draw openings. New bridges crossing the inland waterway are required to have draw openings not less than 50 feet wide. The older bridges have draw openings about 30 feet or more wide, the only one with less width being the railroad bridge at Sea Isle City, width of draw 25.4 feet.

Bridge regulations are prescribed for the two railroad bridges crossing Beach Thoroughfare at Atlantic City. The whistle signal for all bridges is three blasts.

Tides.—In the inland waterways the tides are greatly affected by winds, both in time and height, westerly winds producing low water and easterly winds high water. In Barnegat Bay, northerly and southerly winds drive the water to the ends of the bay.

With strong winds of long duration the change in depth may amount to a maximum of 3 feet or more above or below the normal

high or low water, respectively, and the time of high or low water may be accelerated or retarded by more than an hour.

The tides meet in the vicinity of Manahawken Bay; Little and Grassy Bays; junction of Beach and Great Thoroughfares, west side of Atlantic City; Crook Horn Thoroughfare; Ben Hands Thoroughfare; Ludlam Bay; Leaming Bay; southwest end of Grassy Sound; and Jarvis Sound.

The following table is intended for use with the daily predictions for Sandy Hook, which are contained in the Tide Tables for the Atlantic Coast of the United States, including Canada and the West Indies, published annually in advance by the United States Coast and Geodetic Survey. These tables furnish, at the nominal cost of 10 cents, full tidal information for the Atlantic and Gulf coasts of North America.

In the following table, apply time differences, according to sign, to the times of high and low waters at Sandy Hook, N. J., plus (+) indicating that the tide is later than at Sandy Hook, and minus (—) that it is earlier.

Place.	Mean range.	Time difference.	
BARNEGAT BAY.	*Feet.*	*h.*	*m.*
Bay Head	0.7	+5	21
Kettle Creek	0.7	+4	42
Island Heights	0.7	+3	34
Seaside Park	0.8	+3	16
Cedar Creek	0.9	+2	20
Forked River	1.1	+1	52
Waretown	1.2	+1	30
Barnegat Inlet	2.2	+0	15
Double Creek	1.1	+1	45
Harvey Cedars	1.2	+2	35
LITTLE EGG INLET.			
Cedar Bonnet	1.4	+3	00
Dinner Point	1.8	+2	32
Long Point	2.3	+2	10
Beach Haven	2.4	+1	42
Bonds Coast Guard station	2.6	+1	14
Little Egg Coast Guard station	3.0	+0	30
Little Egg Inlet	3.3	+0	07
Great Bay Entrance	2.9	+0	36
Deep Point, Mullica River	2.6	+1	13
Main Marsh Thoroughfare	2.8	+0	48
Simkins Thoroughfare	2.9	+0	58
ABSECON INLET.			
Grassy Bay	3.2	+1	21
Golden Thoroughfare	3.6	+0	54
Atlantic City, Gardners Basin	3.8	—0	06
Atlantic City, near bridges	3.6	+1	08
Ventnor	3.4	+1	21
GREAT EGG INLET.	*Feet.*	*h.*	*m.*
S. Atlantic City	3.8	+0	28
Risley Channel	3.8	+0	18
Longport	3.9	+0	06
Ocean City, Fourth Street	3.7	+0	16
Ocean City, Thirty-fourth Street	3.0	+1	01
CORSON INLET.			
Crook Horn Thoroughfare	4.0	+0	57
Ben Hands Thoroughfare	4.0	+0	34
TOWNSEND INLET.			
Sea Isle City	4.0	+0	50
Townsend Inlet	4.2	—0	03
HEREFORD INLET.			
Leaming Bay	3.4	+1	07
Stone Harbor	3.3	+1	07
Great Channel	3.6	+0	42
Grassy Sound Channel	3.6	+0	32
Grassy Sound	3.6	+0	42
TURTLE GUT INLET.			
Richardson Channel	4.0	+0	18
Swann Channel	4.2	+0	18
COLD SPRING INLET.			
Jarvis Sound	4.4	+0	28
Middle Thoroughfare	4.4	+0	10
Cold Spring Inlet	4.4	+0	02

Currents.—The currents have considerable velocity in the inlets and the narrow channels connecting the inlets with the adjacent bays and sounds. No observations are available, but it is estimated that current velocities of as much as 3 knots may be experienced at times in places of maximum velocities.

Aids to navigation.—Most of the inlets are marked by buoys, usually a bell or gas buoy outside the bar and a line of perpendicularly striped buoys to mark the best water until inside the inlet; but the bars are shifting in position and depth, and the buoys do not always lead in the best water. The buoys are omitted on the charts. Breakers form on the shoal areas even in ordinary weather and are often a good guide.

The following portions of the inland waterway are marked by the Lighthouse Service: Barnegat Bay from Cedar Creek to Sandy Island; Little Egg Harbor and Great Bay from Beach Haven to Main Marsh Thoroughfare; and in the vicinity of Great Egg Inlet, from Shelter Island to Ocean City. The marks are red or black spar buoys, numbered from north to south, the red on the starboard side of the channel and black on the port side when bound southward.

The remainder of the inland waterway is marked by stakes, beacons, and buoys maintained by the State of New Jersey. The barrel buoys are removed before the freezing of the channels and the spar buoys, stakes, and beacons are left in position, but many of them are carried away during the winter, and all are restored about May of each year.

Black and white striped buoys, either barrels or small spars, are used to mark the deeper and more open channels marked by the State. They are usually intervisible, and can be passed close-to on either side.

Beacons, either red or black, made of painted nail kegs supported by three stakes, are used at important angles and places where there are branches in the channels. They are often arranged in pairs, with the channel midway between them. The aids are placed for vessels bound south; when bound south, red beacons will be left to starboard and black to port.

Small stakes, with daymarks either red or black, are used on both sides in shoal water to indicate the position of the channel. When bound southward, the stakes with red crosses are left to starboard and those with black triangles to port.

DIRECTIONS, BAY HEAD TO COLD SPRING INLET.

The directions and description following are written for use with charts 1216, 1217, and 1218, published by the Coast and Geodetic Survey.

The depth and position of the channel along the inland waterway is comparatively stable, except where it approaches close to the inlets, where it is subject to some shoaling, and these places are redredged at irregular intervals. Strangers navigating the inland waterway should make inquiries of local people as to the through depths, as they are subject to considerable change, even during a single season. In November, 1915, a depth of 5 feet at low water existed throughout practically the entire waterway from Bay Head

to Cold Spring Inlet, except just northward of Rum Point, inside Absecon Inlet, where the channel was nearly bare at low water; at the south end of Broad Thoroughfare, just inside Great Egg Inlet, where the depth was about 2½ feet at low water, and in Main Thoroughfare, just inside Corson Inlet, where the depth was about 2 feet at low water. Latest information concerning the condition of the waterway can be obtained from the State of New Jersey, Board of Commerce and Navigation, Trenton, N. J.

Bay Head to Beach Haven, distance 37 miles.—From the wharves at Bay Head the channel leads southward in mid-harbor, close around the marshy point ⅝ mile southward of the wharves, in midstream eastward of a large and a very small island, and then leads for the draw of the bridge at **Mantoloking**. Either opening can be used. The channel is marked by beacons and stakes.

There is a shoal on the west side below the bridge, which can be avoided by keeping well to the eastern side abreast the water tank. Then the channel leads southwestward and southward along the western side of Barnegat Bay, to the drawbridge just north of Toms River. It is marked by buoys and beacons, has ample width, and is easily followed.

The waterway leads 270 yards southeastward of Coates Point, then southward and southeastward across the entrance of **Toms River**, about 350 yards northeastward and ⅜ mile eastward of Good Luck Point, and then leads for the draw at Barnegat Pier. There are several beacons to mark the channel across Toms River, and the channel is buoyed to the bridge.

From the draw the best water favors the western side of Barnegat Bay for 10 miles until off the mouth of **Double Creek**, marked by a group of houses at the mouth. From about midway between Clam Islands and the western shore, it follows the natural channel south-southeastward and southward, passing about 300 yards eastward of Sloop Sedge, and 200 yards eastward of Sandy Island, as shown on the chart. It then leads about ¼ mile off the marsh abreast Harvey Cedars, then southwestward and passes about 200 yards eastward of Carvel Island, and the same distance eastward of Pettit Island.

From Pettit Island the waterway follows the natural channel close along the marsh, eastward of all the islands at **Cedar Bonnet**, then westward for about ¾ mile, northwestward for ¼ mile, and then follows the natural channel westward between Reed Island and Poplar Point. The channel then leads along the western side of the bay to **Long Point**, marked by a group of three houses.

It passes close southeastward of Long Point and leads south-southwestward for 1 mile, then follows the natural channel south-southeastward for 1½ miles to the can buoy in the channel off Beach Haven. The difficult part of the channel from above Sloop Sedge to Popular Point is marked by beacons and buoys, and the remainder by buoys.

Beach Haven to Atlantic City, distance 20 miles.—From the buoy off Beach Haven the inland waterway follows the natural channel south-southwestward along the beach and close to **Tucker Point** (north end of Tucker Island), marked by a clump of cedar bushes. The channel here is narrow and difficult, but is well marked by buoys.

From Tucker Point the waterway leads west-southwestward across the channel, then westward through **Shooting Thoroughfare** for about

¾ mile, then west-southwestward south of Seven Islands for nearly 1 mile.

From the channel southward of Seven Islands the waterway leads northwestward for about 1½ miles, southwestward for about ⅞ mile, and southward for a little over ½ mile to Main Marsh Thoroughfare. The depth across **Great Bay** is about 6 feet. The channel from Beach Haven to Main Marsh Thoroughfare is marked by buoys, and by beacons and stakes at the most difficult points.

From Great Bay the channel leads through **Main Marsh Thoroughfare**, then southwestward for ½ mile, then southward between Shad Island and the marsh westward, then across the mouth of Perch Cove and close around the marshy point between Little Bay and Grassy Bay, and then close along the western side of **Grassy Bay**. It leads through the second opening from the western end of the ruins of an old bridge crossing Grassy Bay and westward of the two islets below the bridge.

From the south end of Grassy Bay the waterway trends south-southwestward for 1 mile across **Eagle Bay** to the mouth of a cut-off channel through the long narrow island westward of Golden Thoroughfare. It passes through this cut, which is marked by a shanty on the west side, then trends southward nearly for Absecon lighthouse, and passes eastward of a small island and southeastward of the large island to **Rum Point**. The latter is marked on its northeast end by a slatted day beacon, and on its south end by a house. Passing 300 yards southward of Rum Point boats can haul across south-southwestward for Gardners Basin at Atlantic City.

From Rum Point the inland waterway trends northwestward for ¾ mile to the mouth of **Beach Thoroughfare**, marked by a small hotel on the small island on its north side. It follows Beach Thoroughfare westward and southwestward for 1½ miles to a broadening with a small island in the northwest end, passes northward and westward of this island, and follows the thoroughfare southeastward to the first bridge and in mid-channel between the bridges.

There is a shoal, bare at low water, a little southward of mid-channel, about 300 yards southwestward of the last draw. It can be avoided by keeping close along the south shore.

The waterway from Main Marsh Thoroughfare to the bridges at Atlantic City is marked by stakes and beacons, except the open water from Rum Point to Beach Thoroughfare, which is buoyed.

Atlantic City to Ocean City, distance 11 miles.—From the bridges on the west side of Atlantic City the channel leads west-southwestward across the expansion of Beach Thoroughfare and follows the narrow thoroughfare along the beach for 1½ miles to **Ventnor**. Just westward of a standpipe and chimney of the same height the waterway enters **Ventnor Canal** and leads northwestward for ¾ mile to Beach Thoroughfare, which it follows southwestward for 3 miles to the south end of Risley Channel.

Boats bound to **Longport** can continue in mid-channel southwestward to the wharves, but the inland waterway leads westward of the small island in the mouth of **Risley Channel** and northwestward in the channel for ½ mile above the island to the mouth of a canal leading southwestward to Broad Thoroughfare.

The channel leads southwestward through the canal and **Broad Thoroughfare** for 1¼ miles, then southward across the open water to

the north point of the beach at Ocean City (a clubhouse nearly ahead is prominent), and then along the bulkhead on the northwest side of **Ocean City** to the wharves. It is marked by buoys in the more open waters and by stakes and beacons in the narrow channels.

Ocean City to Anglesea, distance 25 miles.—From the bridges at Ocean City the channel leads southeastward of an islet a little below them, then close around the south end of Cowpens Island, and westward to the north end of Shooting Island. The standpipe is nearly astern on this reach.

It then leads through **Back Thoroughfare** for ¾ mile, and then westward between the two islands just southwestward of Shooting Island. It follows the shore of the southern island to its western end, leaving three small islands on the starboard hand, and then leads southwestward across **Peck Bay** to a drawbridge at its south end.

From the bridge the channel leads southward through a cut-off channel 300 yards long to **Crook Horn Thoroughfare** and follows this southwestward to Devils Island. The channel has been straightened in several places. It leads southward along the east side of Devils Island and continues this course through an artificial cut to **Main Thoroughfare,** then westward through it and **Ben Hands Thoroughfare,** crossed by a bridge, and through Upper Thoroughfare to Ludlam Bay.

From **Upper Thoroughfare** the channel leads southward close eastward of an island, then between two smaller islands, then across the open water of **Ludlam Bay,** and through a short cut-off channel into the thoroughfare leading southward to the bridges at **Sea Isle City.** The openings to several private basins on the east side of the thoroughfare at Sea Isle City are passed. The channel continues southwestward for ½ mile from the lower bridge to the mouth of a cut-off channel then southward through the cut-off, and then follows the marsh on the east side to the north end of the railroad bridge crossing Townsend Inlet.

The waterway follows along the west side of the bridge at **Townsend Inlet** to near the draw at the south end. It then leads southwestward through **Ingram Thoroughfare,** across Long Reach, then westward through a short thoroughfare, and passes close around the point of marsh into **Leaming Bay.** The channel leads south-southwestward across the bay, then along the west side of **Gull Island Thoroughfare,** then follows the marsh on the northeast side to **Stone Harbor.**

From Stone Harbor the waterway leads southwestward along the northwest side of Great Channel to the mouth of Dung Thoroughfare. From here a channel good in 1915 for a depth of about 4 feet at high water, and marked by buoys and stakes, leads along the southeast side of Nummy Island to Anglesea. It is sometimes used by local boats, but is difficult; strangers are advised to follow the main channel, which leads westward in **Dung Thoroughfare** and along the northwest side of Nummy Island to the broad channel leading to Hereford Inlet. To go to **Anglesea,** follow the broad channel southeastward and southward to the wharves just inside the inlet. **Gull Bar** is a shoal bare at low water, and there is good water on either side.

Anglesea to Cold Spring Inlet, distance 7 miles.—From the western point of Nummy Island the channel leads westward and southward through **Grassy Sound Channel,** crossed by a drawbridge, to the northeast end of Grassy Sound, and passes between the large islands in

the northeast end of the sound. The waterway follows a curved channel across **Grassy Sound,** passes through a drawbridge at its southwest end, and then follows Grassy Sound Channel southward to Holly Beach Bridge.

From the bridge the channel follows a narrow slough southwestward and westward between several small islands, to Richardson Channel, and then down that channel to an island between it and Swann (Swain) Channel.

The channel leads in an artificial cut through the middle of the island, then southwestward across **Swann (Swain)** Channel, and through two artificial canals to the northeast end of Jarvis Sound. It then leads southwestward across **Jarvis Sound** and through **Middle Thoroughfare** to the eastern end of Cold Spring Harbor.

BARNEGAT BAY

is 26 miles long, and has a general depth of 6 to 8 feet along the western side, with extensive flats extending westward from the beaches. Boats of about 7 feet draft enter through Barnegat Inlet, and 6 feet draft from southward. The usual draft of boats frequenting the bay is 2 to 5 feet.

Bay Head is a village and summer resort at the head of Barnegat Bay. It is at present the head of navigation on the inland waterway, though work is in progress by the State of New Jersey to extend the waterway northward to Manasquan River. Bay Head is frequented by many motor boats up to 5 feet draft, and this depth can be carried to the town, the upper end being a dredged channel. The most prominent mark from inside or out is a black water tank, conical above and below.

Metedeconk River is navigable with a draft of 4 or 5 feet for 3 miles to the fork. There are no large settlements above Bay Head. For a distance of ½ mile westward from Bay Head, until off the mouth of Beaver Dam Creek, the best water is close to the north shore.

Mantoloking is a summer resort, 2 miles southward of Bay Head. A highway drawbridge crosses the bay at this point. There is 6 feet of water at the wharf.

Kettle Creek has a depth of 4 feet in mid-channel to the fork. There are no wharves.

Mosquito Cove has a depth of 5 feet for a distance of 1 mile above the mouth, and 3 feet to near the head. There are no wharves.

Chadwick and **Lavallette** are small summer resorts on the beach, 3 and 4 miles, respectively, southward of Mantoloking. They are frequented by a few small boats in summer.

Seaside Heights is a summer resort on the beach, 6 miles southward of Mantoloking, and at the eastern end of a new highway bridge crossing the bay. There is little business from here by water. **Berkeley** is a small resort ¾ mile southward of it.

Toms River, the most important tributary of Barnegat Bay, is about 11 miles northward of Barnegat lighthouse. There is a depth of 5 feet to the entrance, 6 feet in mid-channel for 3½ miles above the entrance, and 5 feet to the wharves at Toms River, a town at the head of navigation. The upper ½ mile is through a dredged channel, which is subject to slight shoaling. The lower end of the river is frequented by a large number of pleasure boats up to 5 feet

draft. There is considerable sea food and produce run to Toms River for shipment, and some outgoing freight. A railroad drawbridge crosses the river 2 miles above the mouth. In summer a small steamer connects the towns on Toms River with Seaside Park.

To enter Toms River from northward, round Coates Point just southward of the drawbridge, at a distance of 200 yards or more. Or from southward, follow the buoys of the inland waterway to Good Luck Point, and round it at a distance of 400 yards. From here the mid-river is clear to the beginning of the dredged channel, which is marked by spoil banks to the head. Shoals make off from some of the sharp points in the river; the one extending from Long Point is marked by a red barrel buoy.

Island Heights is a summer resort on the high wooded point at the northern end of the bridge crossing Toms River. There is 5 feet at the several wharves eastward of the bridge, and 6 feet in the channel off the town, which is extensively used as an anchorage.

Pine Beach is a post village and summer resort at the south end of the bridge crossing Toms River.

Ocean Gate is a post office and small resort on the south side of Toms River, 1 mile inside the entrance.

Seaside Park is a summer resort on the beach southeastward of the mouth of Toms River, and just north of the eastern end of the railroad bridge crossing the bay. There is 4 feet at the public wharf and 5 feet at the clubhouse wharf, and these depths can be brought to them from westward. It is much frequented by cruiser yachts and small pleasure boats. A distinguishing mark is a black water tank with a low brick chimney close to it. The railroad which crosses the bay at this point runs northward along the beach and connects all the seaside resorts with New York.

Barnegat Pier, a small settlement at the western end of the railroad bridge from Seaside Park, is the headquarters for many fishing boats in summer. There is about 3 feet of water at the wharf. The buildings are prominent.

Potter Creek, on the west side, 1½ miles below the railroad bridge, is used only as an anchorage for small oyster boats. There is 4 feet of water in the mouth.

Cedar Creek, 3 miles below the Pennsylvania Railroad bridge, has a depth of 3 feet for 1 mile to the landing near the post village of **Lanoka**. Above the entrance the channel favors the south side of the creek.

Forked River, a little over 4 miles northwestward of Barnegat lighthouse, is frequented by boats of about 2 feet draft, and this depth can be carried in midchannel for 1¼ miles to the public landing on the north branch, just above the second fork. About 1 foot can be carried ½ mile above, through a crooked channel, to the town of Forked River, a railroad station at the head of the north branch.

Oyster Creek has a depth of 1 to 2 feet and is little used.

Waretown is a village and railroad station, ¾ mile from the western shore of the bay, opposite Barnegat Inlet. A landing at the foot of the road leading from the town has 4 feet at its end. The approach is clear.

Barnegat Inlet, marked on the south side by Barnegat lighthouse, had a depth across the bar in 1914 of about 6 feet. The deepest

draft taken across the bar is about 7 feet at high water. The channel is marked by perpendicularly striped buoys which are intervisible, but is subject to change both in depth and position, and the buoys can not always be depended upon to mark the best water. Strangers usually take a pilot, either picking up a fisherman outside or setting signal and waiting for one from Barnegat City. With a smooth sea, it is usually safe for boats of 3 to 4 feet draft to enter by following the buoys.

Barnegat Inlet has been moving slowly southward for many years. The successive surveys show the channel leading across the bar to the point of the beach on the north side of the inlet, and then across to the lighthouse as shown on the chart, and this was the approximate position of the channel in 1914. Inside the inlet the channels are more stable, and there is good anchorage in the channel westward of the lighthouse. From the inlet the principal inside channel, which is buoyed and has a least depth of about 7 feet, leads westward and northward, as shown on the chart, until westward of Sedge Island, and then through Oyster Creek Channel. Local boats bound to Barnegat or southward usually leave the buoyed channel about midway between Clam and Sedge Islands and follow the slough westward and southwestward toward the mouth of Double Creek. It is unmarked, and strangers should not attempt to run it. There are no channels from the inlet southward between the islands except for small boats at high water.

Barnegat City, the terminus of the railroad on the south side of the inlet, is a summer resort with a permanent settlement of oystermen and fishermen. A privately dredged channel, with a depth of about 6 feet, leads from the main channel southward to the landings on the inner beach just inside the point.

Double Creek is on the western side of the bay, 4 miles westward of Barnegat lighthouse. It is the headquarters of a large number of fishing and oyster boats, and some pleasure boats in summer. There is a dike on the north side at the entrance and a public landing just inside, where gasoline is obtainable. A channel 40 feet wide and 5 feet deep has been dredged from the mouth for ¾ mile to the highway drawbridge, which is 1 mile from the town of **Barnegat**. There are public landings at the drawbridge. The channel leads 120 feet southward of the dike at the entrance, then midway between a bare spoil bank and the public landing on the north and the north end of Conklin Island on the south, then southwestward through a cut-off, then 50 feet southward of a spoil bank until the creek narrows, and then favors the north side. Small boats can go about ½ mile above the highway drawbridge. There is a prominent group of houses on the north side at the entrance and a black water tank at Barnegat.

Gunning River, 4 miles southwestward of Barnegat lighthouse, has a depth of 3 feet for ¾ mile and about 2 feet for ½ mile farther through a crooked channel. A draft of 2 feet can be carried to the mouth from eastward.

Harvey Cedars (High Point post office) is a summer resort and railroad station on the outer beach, 5 miles southward of Barnegat Inlet. A draft of 6 feet can be carried in the channel to abreast the village from northward or southward, but it is shoal close to shore.

MANAHAWKEN BAY TO GREAT BAY.

Manahawken Bay, 8 miles southward of Barnegat Inlet, has a large group of marshy islands on its eastern side. A railroad and a highway bridge cross the bay at this point, and each has a center pier draw eastward of the islands. The channel eastward and southward of the islands, on the line of the inland waterway, has been dredged to 6 feet. The bay westward of the islands has a ruling depth of 1 to 2 feet, but 6 feet can be carried from southward nearly to the bridges through a narrow unmarked channel.

Surf City is a railroad station and summer resort on the beach, just northward of the bridges. It is marked by a red water tank on a steel tower. The railroad extends northward along the beach to Barnegat City and southward through the small resorts of Brant Beach, Beach Haven Crest, and Beach Haven Terrace to Beach Haven.

Manahawken Creek, at the western end of the bridges, has only 1 foot of water at the mouth.

Manahawken is a town on the railroad, 2½ miles westward of Manahawken Bay. The nearest approach by water is through **Mill Creek**, which has a depth of about 2 feet for 1½ miles to the foot of a road 2 miles from Manahawken.

The body of water between Manahawken Bay and Little Egg Harbor is shoal. There are sloughs leading along the beach from southward and westward, but they are poorly marked, and a stranger should not attempt them. A channel with a least depth of 6 feet and well marked leads along the north and west sides.

Cedar Run, Dinner Point, and **West Creeks** are shoal at the mouth, usually about 2 feet, with a little deeper water inside. They are navigable for about 1¾ miles to within about ¾ mile of the small towns at their heads, which are located along the line of the railroad and main highway, and have roads leading down to the landings. They are frequented by small oyster and fishing boats and a few truck boats.

Beach Haven, a summer resort on the beach 6 miles northward of Little Egg Inlet, is marked by two black water tanks. A draft of 11 feet at low water can be carried to abreast the town from Little Egg Inlet, and about 4 feet to the wharf. It is frequented by many pleasure boats in summer, and is connected by boat with Atlantic City. There is good anchorage in a depth of 15 to 25 feet in the channel westward of the town in the vicinity of the can buoy. In 1914 the channel from the can buoy to the town was staked. There is a small group of houses around Bond Coast Guard station, 1½ miles southward of Beach Haven, and a small group around Tucker Beach lighthouse.

Little Egg Inlet, 2 miles southward of Tucker Beach lighthouse, had a depth of about 12 feet across the bar in 1915, and is extensively used by fish steamers up to 10 feet draft and many smaller schooners and motor boats. The shore and channels at the inlet are subject to rapid change, but the channel across the bar is comparatively stable. In 1915 it led across the bar on a westerly course, close along the point on the north side. It is marked by perpendicularly striped buoys, which are intervisible until inside the inlet. There are no regular pilots, but strangers can usually pick up a

fisherman outside to act as a pilot, or can set signal and wait for one from the Coast Guard station. Breakers form all the way across the inlet only in very heavy weather. There is good anchorage in a depth of about 8 fathoms in the channel northward of Sea Haven light.

Little Egg Harbor, northward of the inlet, has a general depth of 4 or 5 feet along its northwest side, and is covered by oyster stakes. A draft of 10 feet can be carried from the inlet through **Marchelder Channel** southward of **Story Island**; the latter is marked by a fish factory on its southern end. A channel 6 feet deep has been dredged from the upper end of Marchelder Channel to the mouth of **Tuckerton Creek** and 1¼ miles up the creek to West Tuckerton Landing, 5 feet deep for ⅓ mile to Scow Landing, and 3 feet deep for ¼ mile farther to Tuckerton. In 1915 about 4 feet could be carried through the dredged channel to Tuckerton. The limit of speed in Tuckerton Creek for power boats or other vessels propelled by machinery is 6 statute miles per hour.

Tuckerton is a town with railroad connections at the head of navigation on Tuckerton Creek. It is frequented in summer by many boats, the usual draft of which is 2 to 4 feet. A black water tank in the town, and a tall radio mast 3 miles southwestward are prominent.

A draft of 4 feet can be taken to Tuckerton Creek from northeastward by passing northward of the extensive flats which extend northward from Story Island and the islands eastward. The northwest end of these flats lie ¼ to ⅜ mile east-northeastward, and 400 yards southeastward of the point (marked by a shanty) on the north side of the bight at the entrance of Tuckerton Creek. Passing 250 yards off the point, steer west-southwestward to the dredged channel.

From southward, from abreast the north end of Tucker Island follow the channel which leads about ¼ mile from the western shore and through Marchelder Channel, southward and westward of Story Island, as shown on the chart. The bend southeastward of Story Island was well marked by barrel buoys and stakes in 1914. From close southwestward of **Parker Island** (marshy and without marks) the dredged cut to the mouth of Tuckerton Creek has a 324° true (NNW ⅜ W mag.) direction, and is marked on both sides at frequent intervals by bush stakes or by posts with red or black barrels.

There are several thoroughfares leading from Little Egg Harbor to Great Bay. **Willett Thoroughfare** is used by small local boats, but is shoal and should not be attempted by a stranger. **Sheepshead Creek** is shoal at the eastern end and is little used. **Little Sheepshead Creek** has a depth of about 4 feet and is extensively used.

Great Bay, northwestward of Little Egg Inlet, has a ruling depth of 4 to 6 feet. The main entrance is through **Shooting Thoroughfare**, eastward of Seven Islands, and has a depth of 8 feet. The line of the inland waterway passes southwestward of Seven Islands and through Main Marsh Thoroughfare. Great Bay is frequented by many small boats and by fish steamers and schooners up to 9 feet draft at a good high water, bound to Mullica River. There is a fish factory on the east side of Shooting Thoroughfare, opposite Seven Islands.

Mullica River empties into the western side of Great Bay. It is navigable for 20 miles to **Pleasant Mills**. Fish steamers lay up in the river in winter, and there are many small local boats. An occa-

sional schooner up to 8 feet draft loads wood or produce in the river for New York. A draft of 4½ feet at low water and 9 feet at a good high water can be carried from the northern end of Shooting Thoroughfare across the flats in Great Bay to the mouth of the river. The most difficult place is off the mouth of Sheepshead Creek, where the channel is ¼ mile off the marsh northward of the creek and then follows the main slough westward, as shown on the chart. The shoals are sometimes marked by bush stakes.

There is deep water inside Mullica River and the mid-channel is clear for a long distance. A draft of about 9 feet at high water can be taken to **Crowleytown**, and about 2 feet at high water for about 3½ miles farther to **Pleasant Mills**, where there are paper mills, 20 miles above the mouth. The river is comparatively easy of navigation to Crowleytown, but shoal and difficult above. There are drawbridges across the river at the villages of **Lower Bank** and **Green Bank**, 12 and 14 miles, respectively, above the mouth.

Nacote Creek is a tributary on the south side of Mullica River, 4 miles above the mouth. **Port Republic** is a village at its head.

Bass River is a tributary on the north side of Mullica River, 5 miles above the mouth.

Wading River, on the north side of Mullica River, 7 miles above the mouth, is the most important tributary. It is said to have deep water for several miles. **Bridgeport** (Wading River post office) is 4½ miles above the mouth. A drawbridge crosses the river at this point.

BRIGANTINE INLET TO ATLANTIC CITY.

Brigantine Inlet is 7 miles northeastward of Absecon lighthouse and 4 miles southwestward of Tucker Beach lighthouse. It is nearly bare at extreme low water and has 5 or 6 feet at high water. It is not buoyed, and the only boats using it are small local oyster and fishing boats, and then only with a smooth sea and on a rising tide. Strangers should not attempt to enter. The Coast Guard stations are the only marks. The several thoroughfares leading from Brigantine Inlet are shoal at their western ends, and can only be navigated by small boats at high water. Strangers should not enter them.

Brigantine is a post office and small summer resort on the beach, midway between Brigantine and Absecon Inlets. It can be reached by small boats at high water from southward or northwestward, but the channels are difficult.

Little Bay and **Grassy Bay** are shoal, having large areas bare at low water. The inland waterway leads along the west side. Crossing Grassy Bay is an abandoned railroad bridge which has several clear openings, but the second opening from the western side of the bay is the one generally used.

Absecon Inlet is marked on the south side by Absecon lighthouse and Atlantic City. It is being improved under a project to maintain a channel 12 feet deep and 300 feet wide, to be increased ultimately to 600 feet wide; in November, 1915, the project depth had been obtained. The channel in 1915 led across the bar on a northerly course, passing about ¼ mile eastward of the end of Heinz pier, about 200 yards offshore at the bend in the boardwalk, gradually drawing in to a distance of 75 yards offshore abreast the pavilion at the north end. The channel is marked by buoys, easily intervisible,

to an anchorage in the channel between the pavilion at the north end of Atlantic City and the bend northwestward of Rum Point. The shore on the south side is protected from extensive change by artificial means.

Most of the business through Absecon Inlet is to Atlantic City, but there are some boats running to the town of Absecon, and to points north and south on the line of the inland waterway. The deepest draft of boats entering the inlet is a passenger steamer drawing 9 feet, and a few freight schooners drawing up to 8 feet. Strangers sometimes take a pilot, either picking up a fisherman outside or signaling for a pilot from shore. If of not more than about 6 feet draft they can enter with a smooth sea and on a rising tide by following the buoys, keeping well away from rough water. Breakers extend across the inlet in heavy weather.

Atlantic City is the largest resort on the Atlantic coast, and is frequented by many boats, both from outside and from points along the interior waterways. It has several railroad connections with the mainland, an electric road connecting it with Pleasantville, Somers Point, and Ocean City, and an electric road along the beach southward to Longport, where boat connections can be made to Ocean City and points southward. In 1915 a steamer ran between Atlantic City and Philadelphia, and motor boats through the inside passage to Beach Haven.

The casino at the north end of Atlantic City has a long wharf westward of it, with a depth of 12 to 15 feet, inside of which is a small basin with a depth of 2 to 4 feet, which is used only by fishing boats kept for hire.

Gardners Basin, a bulkheaded basin nearly ½ mile long and 60 yards wide, has its entrance 500 yards westward of the casino. It has a depth of 8 feet in mid-channel to the head, and is used by many motor boats. All boats make fast to the bulkheads, for which a small wharfage charge is made. All kinds of supplies are obtainable, and there are railways and machine shops.

Clam Creek is a narrow creek, the entrance to which lies 50 yards westward of the entrance to Gardners Basin. Seven feet can be carried 600 yards above the mouth to the steamboat wharf. Just above the steamboat wharf is a basin 400 yards long and 50 to 100 yards wide with a depth of 8 feet in the entrance and 10 to 20 feet inside.

There are also numerous wharves and boathouses on the west front of Atlantic City, along Beach and Inside Thoroughfares.

Reed Bay, 5 miles northward of Absecon lighthouse, has a general depth of 1 to 2 feet, with large areas bare at low water. There are no wharves.

Absecon Bay, 4 miles northwestward of Absecon lighthouse, has a general depth of 1 to 2 feet, and there are large areas bare at low water. A channel 80 feet wide and 5 feet deep has been dredged northwestward across Absecon Bay to the mouth of **Absecon Creek**, and 50 feet wide and 5 feet deep in the creek to **Absecon**, with a turning basin at the head. There are two fixed bridges just above the turning basin, the lower having 6.6 feet and the upper 5.1 feet headroom at low water.

From Absecon Inlet the channel to Absecon Bay leads southward and close westward of the island of which Rum Point is the south

end, then northwestward until past Middle Thoroughfare, then west-southwestward, and passes between the long island lying southward of Sloop Thoroughfare and the island southwestward. The channel from the inlet to the west end of the long island lying southward of Sloop Thoroughfare is shown on the chart. The channel then trends northwestward along the south side of the next island (Siplers Island) and is marked on both sides by bush stakes. The dredged cut then leads 317° true (NW ⅞ N mag.) with Absecon lighthouse astern across Absecon Bay to the entrance of Absecon Creek, and was marked in 1914 by pairs of bush stakes on the north side and single ones on the south side. The mid-channel in Absecon Creek is clear to Absecon, a town on the railroad.

Beach Thoroughfare and **Inside Thoroughfare** are parts of the inland waterway along the northwest side of Atlantic City. There are a large number of boathouses and several wharves and industrial plants on them. A depth of 8 feet at low water can be carried from the inlet through Beach Thoroughfare to the western side of Atlantic City and 6 feet from southward through the inland waterway.

Five drawbridges cross Beach Thoroughfare within a distance of ¼ mile. They are all center-pier draws, both openings clear, and the least width of draw opening is 32 feet. The draws are low, but have higher openings at the sides, least height about 5 feet at high water. The two northern bridges and the southern bridge are highway and street railway bridges, and are opened at all times both day and night on signal.

The other two are railroad bridges which are opened only from 20 minutes after to 30 minutes after each hour between 6.30 a. m. and 9.20 p. m. From 9.20 p. m. to 6.30 a. m. the bridges are opened on signal unless a train is approaching. The signal for the railroad bridges is three blasts of a whistle or horn, to be answered by three blasts on the bridge if the draw is ready to be opened immediately, or two blasts if the draw is not ready to be opened immediately. Vessels of too great dimensions, or otherwise unable to pass within the 10-minute periods, must pass between 9.20 p. m. and 6.30 a. m.

ATLANTIC CITY TO OCEAN CITY.

Ventnor is a resort on the beach 3 miles southwestward of Absecon lighthouse. It is marked by a standpipe and brick chimney of the same height, close together.

Ventnor Canal is a cut leading from Inside Thoroughfare at Ventnor north-northwestward to Beach Thoroughfare, and is a part of the inland waterway.

Lake Bay, 3 miles westward of Atlantic City, is shoal and little used. **Smith Landing**, on the northwest side, can be reached only by small boats at half tide or higher by following close around the east and north shores of the bay. **Pleasantville** is a town on the railroad ¾ mile northward of Smith Landing.

Risley Landing, on Dock Thoroughfare, 4 miles northward of Great Egg Inlet, can be reached with a draft of 6 feet or more from southward, but the wharf is in bad repair and is used only by small boats.

Scull Bay, 2½ miles northward of Great Egg Inlet, has a depth of 1 to 2 feet, and 4 to 5 feet can be carried to it through Broad or Scull Thoroughfares. There is a landing on the northwest side at the foot

of a road leading to **Linwood**, a village on the railroad ¾ mile from the bay.

Great Egg Inlet, 7½ miles southwestward of Absecon lighthouse, had a depth in 1914 of about 9 feet at low water in the buoyed channel across the bar. It is used by many yachts of 4 or 5 feet draft and local fishing and pleasure boats. The deepest draft entering is an occasional tugboat up to 9 or 10 feet draft. The shore line on the south side and the position of the channel are fairly stable, and the buoys usually mark the best water. Strangers of 4 or 5 feet draft do not usually take a pilot in smooth weather, but follow the buoys, preferably on a rising tide, being also guided by the appearance of the water. Pilots may usually be had from fishing boats outside, or from Ocean City in answer to signal. Breakers extend across the inlet in moderately heavy weather. In winter it is used only by a few fishermen, and is often rendered dangerous by floating ice.

The prominent landmarks in approaching Great Egg Inlet are: A black standpipe with white top and two iron chimneys close to it, showing over the buildings of Ocean City, 1½ miles southwestward of the inlet; a black water tank on a steel tower at Longport, on the north side; a broad black standpipe about 1 mile farther northward; and a slender black standpipe about ½ mile northward of the broad one.

Longport is a summer resort on the north side of Great Egg Inlet. It is connected with Ocean City in summer by a line of steamers, and with Atlantic City by an electric railway along the beach. The generally used channel from Longport to Ocean City follows the regular inside route through Risley Channel and Broad Thoroughfare. With local knowledge, small boats sometimes cross the flats from Longport southwestward, close southward of the marsh, which is good for a draft of 4 or 5 feet at high water.

Ocean City, a large summer resort on the south side of Great Egg Inlet, has railroad and electric-road connections with the mainland and southward along the beach to Stone Harbor. The wharves are on the northwest side, ½ to 1½ miles southwestward of the inlet, and have depths of 6 to 12 feet at the ends.

Great Egg Bay, extending 4 miles westward from Great Egg Inlet, is frequented by many boats of 5 feet or less draft bound to Somers Point and points in Great Egg and Tuckahoe Rivers. A highway and a railroad bridge cross the bay from Somers Point to Ocean City. There are draws in both bridges near Somers Point and in the channel along the Ocean City water front. The highway draws are single-lift openings and the railroad draws are center pier, both openings clear.

Somers Point, a summer resort on the north side of Great Egg Bay, is connected with Ocean City, Pleasantville, and Atlantic City by an electric railway. There is a depth of about 6 feet at the wharves.

Beesley Point is a small resort on the north side of the point between Great Egg and Peck Bays. There are landings with about 3 feet at the ends, and this depth can be carried to them from anywhere offshore. There is a prominent water tank and windmill near the eastern wharf.

The main channel in Great Egg Bay leads along the north side of the bay to the drawbridges at Somers Point, then ¼ mile east and ⅜ mile south of Ledge Island, then favors the southwest side of the

bay to the mouth of Middle River. It is marked from the inlet to the mouth of Tuckahoe River by perpendicularly striped buoys, and is easily followed by small boats.

A draft of 4 or 5 feet can be carried at low water between Rainbow Islands and the long narrow island southward of them, and into the main channel midway between Ledge Island and Beesley Point. It is not marked and the fixed bridges have a headroom of only about 4 feet at high water. At half tide or high water small boats can cross Peck Bay and enter Great Bay close around the end of Beesley Point, but it is seldom done.

Great Egg River, emptying into Great Egg Bay from northwestward, is said to be navigable with a draft of about 6 feet at low water to within ¼ mile of the town of **Mays Landing**, about 17 miles above the inlet. A fixed bridge crosses the river at Mays Landing, and the channel is shoal and difficult for about ¼ mile below. There is little business by boat in the upper end of the river; the lower end is frequented by small pleasure and truck boats and a few freight boats up to 5 feet draft.

Tuckahoe River, on the south side of Great Egg Bay, is said to have a depth of 3 feet to the town of **Tuckahoe**, 7 miles above the mouth. It is frequented only by small truck and pleasure boats.

Patcong Creek, northwest of Ledge Island, has a depth of about 2 feet at the mouth and deeper water inside for a long distance. It is principally used as a place to lay up boats in fresh water.

Middle River, 2 miles westward of Ledge Island, has a depth of 8 feet at the mouth, and is navigable for several miles, but is frequented only by small fishing boats.

OCEAN CITY TO ANGLESEA.

Peck Bay, south of Great Egg Bay, has a general depth of 1 to 2 feet. A channel 6 feet deep has been dredged across the southeast side, and forms a part of the inland waterway. A highway bridge crosses the channel at the south end of the bay; it has a center pier draw, both openings clear.

Corson Inlet, 6 miles southwestward of Ocean City, had a depth across the bar in 1914 of about 5 feet. It is not buoyed and is only used by a few local fishing and pleasure boats up to 4 or 5 feet draft. The appearance of the water is the best guide, but the channel is subject to rapid change, and is not recommended for a stranger.

Peck Beach is a small group of houses without prominent marks, about 1 mile northward of Corson Inlet. It can be reached only by small boats at high water from westward.

Corson Inlet (Strathmere post office) is a village and railroad station on the south side of Corson Inlet. A yellow water tank is prominent. The channel from Corson Inlet northward into Main Thoroughfare is bare at low water, and is crossed by a fixed bridge. It is seldom used. The main channel leads southwestward through two drawbridges at Strathmere, then southward of a marshy island and close along the south shore to the east side of Beach Thoroughfare; it then leads north-northwestward for the south point of the marsh, and follows it to Ben Hands and Upper Thoroughfares. A draft of about 5 feet can be carried from inside the inlet to this point.

There are several thoroughfares leading southwestward to Ludlam Bay, but Upper Thoroughfare, on the line of the inland waterway, is the one generally used.

Ludlam Bay, 2½ miles southwestward of Corson Inlet, is shoal, but a channel dredged to a depth of 6 feet leads from Upper Thoroughfare southward across the bay to Ludlam Thoroughfare.

Sea Isle City is a summer resort on the beach about midway between Corson and Townsend Inlets. The most prominent marks are a slender standpipe, a gray brick stack ¼ mile southward of it, and two church spires farther south. Ludlam Beach lighthouse, near the north end of the town, is not prominent by day.

The inland waterway leading along the west side of Sea Isle City has been dredged to a depth of 6 feet and is crossed by two drawbridges. There is a privately dredged basin just southward of the highway bridge, with a depth of 7 or 8 feet in the mouth and 12 feet inside.

Townsend Inlet had a depth across the bar in 1914 of about 4 feet. It is used by small fishing and pleasure boats and an occasional cruising yacht up to 5 feet draft, which only enter at high water and with a smooth sea. The channel and shore line are subject to considerable change and are moving southward at present. A railroad with a drawbridge on the south side crosses the inlet just inside the mouth. The channel is marked by perpendicularly striped buoys, but strangers generally take a pilot.

Townsend Inlet is a small resort just northward of the inlet. There are no prominent marks.

Avalon is a small resort on the south side of Townsend Inlet. A black water tank is the most prominent mark. A privately dredged channel leads from ⅓ mile westward of the bridge southeastward across the marsh to the town and is said to have a depth of 10 feet.

Townsend Sound is shoal and frequented only by small oyster and fishing boats. A draft of about 6 feet can be carried to it through Townsend Channel.

Stites Sound has a depth of 1 to 2 feet and is little used.

Leaming Bay has ruling depths of 1 to 3 feet, and extensive areas bare at low water. A channel has been dredged to a depth of 6 feet from Paddys Thoroughfare on the northeast side, south-southwestward to Gull Island Thoroughfare, and the traffic in the bay is along this channel, except for small oyster and fishing boats.

Peermont is a small resort on the beach 1½ miles southwestward of Townsend Inlet.

Stone Harbor is a summer resort on the beach about 3 miles northeastward of Hereford Inlet. It is marked by a slender standpipe with a railing around the top. Boats run from here to Anglesea in summer. There is a depth of 15 to 25 feet in the channel off the town, and there are several privately dredged basins for small boats. A drawbridge with a single lift opening crosses Great Channel just southwestward of Stone Harbor.

Jenkins Sound, 3 miles northwestward of Hereford Inlet, has ruling depths of 1 to 2 feet. A depth of about 6 feet can be carried through Dead Thoroughfare and to within ¼ mile of **Shell Landing,** on the northwest side of the bay, but it is bare at the landing at low water. Several small oyster and clam boats work from here. A depth of 5 feet can also be taken to the north end of the bay through Nicholas

Channel. The village of **Cape May Court House** is on the line of the railroad and main highway 1¼ miles northward of Shell Landing.

Hereford Inlet, 6 miles northeastward of Cold Spring Inlet, is subject to rapid change and the buoys can not always be depended upon to lead in the best water. In 1914 there was a depth of 4 feet in the buoyed channel. The deepest draft of the boats entering the inlet is 6 feet. In the entrance there are large areas bare at low water and usually having a sand ridge showing at high water. They are covered with marsh grass in summer. Breakers form across the inlet in heavy weather and on the shoals at all times, and the appearance of the water is the best guide in entering. The inlet is used by many fishing boats and some strange yachts. Pilots can usually be obtained from fishing boats outside. Stone Harbor Coast Guard station is the only mark on the north side of the inlet. There are buildings on the south side all the way from Hereford Inlet to Turtle Gut Inlet, and several prominent marks. Hereford Inlet lighthouse is a tower on a dwelling and is not prominent by day. There is a slender black standpipe ¼ mile westward of it.

Anglesea is a summer resort on the south side of Hereford Inlet, and is frequented by a large number of party fishing boats. There are several wharves along the water front northwestward of the Coast Guard station.

ANGLESEA TO COLD SPRING INLET.

Grassy Sound is the name of a summer settlement and post office at the railroad bridge crossing Grassy Sound Channel. Grassy Sound is generally shoal except in the slough connecting the two parts of Grassy Sound Channel.

North Wildwood, Wildwood, Holly Beach, and **Wildwood Crest** are summer resorts on Five Mile Beach between Hereford and Turtle Gut Inlets. There are a water tank and a slender standpipe close together at Wildwood. North Wildwood and Holly Beach can be reached through privately dredged canals, the former from the middle of Grassy Sound, and the latter from Grassy Sound Channel near the mouth of Post Creek. There are wharves at Holly Beach bridge and at Wildwood Crest. Boats from southward bound to the wharf at Wildwood Crest can pass close around the south end of Ephraim Island at high water, but at low water must pass northward and eastward of the island. Boats make regular trips from Holly Beach and Wildwood Crest to Cold Spring Inlet in summer.

Turtle Gut Inlet was nearly bare at low water in 1915, and a permit has been issued to a land development company to close the inlet with a jetty.

Cold Spring Inlet, 4½ miles eastward of Cape May lighthouse, has been improved by building two parallel stone jetties 850 feet apart, and dredging a channel 400 feet wide and 25 feet deep midway between them to Cold Spring Harbor inside. In November, 1915, there was a depth of 18 feet into the inlet. There is secure anchorage in the widening just above the casino and wharf, located at the inner end of the west jetty; but 10 feet is about the deepest draft that can be safely taken to the anchorage.

To enter Cold Spring Inlet, favor the end of the west jetty until just inside the end, then pass midway between the jetties, and pass not

over 300 feet off the wharf at the casino to avoid a shoal, bare at low water, which extends halfway across from the opposite side, just above the casino. Then pass in midchannel westward of a marshy islet, and anchor 200 yards northwestward of the islet and about ¼ mile from the casino, bearing about 173° true (S mag.).

Cold Spring Harbor has been improved by private enterprise under a project to create a basin of about 500 acres with a depth of 30 to 40 feet. In 1915 it had general depths of 15 to 35 feet, but there are several shoal spots left in the dredging, and some local knowledge is required to avoid them. Each is usually marked in summer by a row of bushes. A depth of about 4 feet can be taken to the landing at the bridge crossing Cape Island Creek. Gasoline and some provisions can be obtained here, and there is a railway for hauling out motor boats. There is an electric railway connecting the inlet and the landing on **Cape Island Creek** with Cape May and Cape May Point.

DELAWARE BAY AND RIVER

form the boundary between the State of New Jersey on the east, and the States of Delaware and Pennsylvania on the west. They are the approach to the cities of Wilmington, Chester, Philadelphia, Camden, and Trenton, and to many smaller cities and towns; and they have a large trade carried both in foreign and domestic vessels. Philadelphia, one of the important ports of the United States, and Trenton, the head of navigation, are 88 and 116 miles, respectively, above the entrance. The main entrance near Cape Henlopen is available for vessels of any draft. (See "Channels," following.) Vessels of 7 feet draft can pass from New York Bay to Delaware Bay through the Delaware and Raritan Canal, and vessels of 9 feet draft can pass from Chesapeake Bay to Delaware River through the Chesapeake and Delaware Canal. The route from New York Bay through Delaware River to Chesapeake Bay is described under the heading "Inside route, New York to Norfolk," on page 251.

Delaware Bay is, properly speaking, only an expansion of the lower part of the Delaware River. The dividing line is 44 miles above the entrance and extends from a monument lying 300 yards northwestward of Liston Point to a monument lying eastward of the south point at the entrance of Hope Creek.

Except at the entrance, Delaware Bay is bordered on both sides by wide areas of marsh, and there are no towns of any size on its shores. Detailed descriptions of the shores and tributaries are given under the headings "Delaware Bay, eastern side," and "Delaware Bay, western side."

Channels.—The main entrance to the bay, which is used by deep-draft vessels and strangers, has a clear width of over 2½ miles between Cape Henlopen and the shoals which extend 7 miles south-southwestward from Cape May Point.

The bay is shoal along its eastern and western sides, and there are extensive shoal areas close to the main channel through the center of the bay, but a channel with a depth of 35 feet or more leads from the entrance to the lower end of the dredged channel near the head of the bay. The least width (about ¼ mile between the 30-foot curves) is abreast Elbow of Cross Ledge lighthouse. The channel is

well marked by lighthouses and buoys, but strangers in deep-draft vessels should not attempt to enter by night.

Improvements are in progress to secure a channel 35 feet deep, from that depth in Delaware Bay to Allegheny Avenue (upper end of Port Richmond), Philadelphia, 800 feet wide in the straight reaches, 1,200 feet wide at Bulkhead Bar, 1,000 feet wide in the other bends, and 1,000 feet wide from abreast Gloucester to Allegheny Avenue. In 1915 a depth of 30 feet was being maintained from the sea to Philadelphia, and a depth of 35 feet had been obtained over some of the reaches of the river. The dredged channel is well marked by lighted ranges and buoys.

Anchorage.—Delaware Breakwater Harbor and Harbor of Refuge are among the important harbors of refuge on the Atlantic coast and are extensively used by all classes of vessels. For description, see page 76.

Deep-draft vessels sometimes anchor in the vicinity of the main channel above Fourteen Foot Bank lighthouse. **Bombay Hook Roads** is the widened part of the channel of the bay between Ship John Shoal lighthouse and the entrance to the dredged channel, which was formerly used as an achorage by sailing vessels while waiting for a favorable tide to cross Duck Creek Flats. Deep-draft vessels can anchor here, south of the Liston range, in 5 to 7 fathoms, soft bottom; the shoals rise abruptly in places on the sides of the channel, as shown on the chart.

In Delaware River there is good anchorage anywhere where the depth and bottom are suitable; in every case care must be taken not to anchor on or close to the ranges, nor in the dredged channels. The anchorages off Philadelphia are on the eastern side of the river from abreast Gloucester to Kaighn Point, and on the east side of the channel abreast Petty Island. (See Greenwich Point and Port Richmond anchorages.) Anchorage limits are prescribed by regulation, as follows:

Marcus Hook Anchorage is on the southeast side of Marcus Hook range, between Marcus Hook and the lower end of Raccoon Island.

Fort Mifflin Anchorage extends from the lower end of Fort Mifflin to a point south of the prolongation of the Horseshoe lower range, and lies westward of the Schuylkill River range and Fort Mifflin Bar range.

League Island Anchorage is east of the mouth of Schuylkill River and north of the channel marked by the Horseshoe west group lower range, and extends to a point opposite Broad Street (middle of League Island).

Greenwich Point Anchorage is east of lines drawn between three anchorage buoys (being white with a black anchor painted thereon), located opposite (1) the lower coal pier at Greenwich Point, to mark the lower limit of anchorage, (2) prolongation of Porter Street and about midway of the anchorage, and (3) Dickinson Street to mark the upper limit of anchorage; the latter buoy is off Kaighn Point.

Cooper Point Anchorage is in the channel between Cooper Point and Petty Island, so as not to interfere with vessels going to or from Cooper Creek.

Port Richmond Anchorage is east of the main ship channel, between the prolongation of lines drawn from the lower and upper ends of

Petty Island, as marked by two anchorage buoys (being white with a black anchor painted thereon). Buoy No. 1 is placed off the lower end of Petty Island. Buoy No. 2 is placed off Petty Island opposite Pier G, Port Richmond, about midway of the anchorage. The anchorage ground extends from the head of Petty Island to a point 900 yards below buoy No. 1 and northward of Cooper Point. The outer limit is a line drawn from a point ¼ mile outside the upper end of Petty Island to buoy No. 2, thence to buoy No. 1, thence a little more southward for 900 yards to a point 450 yards northward of the wharves at Cooper Point.

War vessels of the United States and of foreign nations and pleasure yachts, with permission of the commissioners of navigation, may anchor in such location as not to interfere with the navigation of the river.

Vessels must not anchor at any place in the River Schuylkill, nor lie at any wharf in that river more than two abreast, without the permission of the commissioners of navigation.

Harbor and anchorage regulations are enforced by the board of commissioners of navigation, and masters are required to report to them within 36 hours after arrival. The following are extracts from the regulations:

4. All vessels at anchor in the port of Philadelphia shall keep their sails furled during the night and regulation riding lights exhibited.

22. Vessels anchored in the harbor of the port of Philadelphia requiring the assistance of the police or fire boats shall display their national flag union down.

23. The signal for the commissioners of navigation's tender shall be the International Code letter "N" set in the rigging or hoisted in a conspicuous place, or three short blasts and one long blast of steam whistle, to be continued until answered.

Speed regulations.—1. Vessels shall not be worked or navigated in the Delaware River between the Point House Wharf and Pier "G," Port Richmond, at a greater rate of speed than eight (8) nautical miles an hour, and such vessels shall navigate as far as is practicable from the pierhead line. This rule will not apply to river craft when they are proceeding at more than three hundred (300) feet from the pierhead line.

2. Vessels shall not be worked or navigated in the Delaware River in front of the navy yard, between red buoy No. 44, off mouth of Schuylkill River, and red buoy No. 46, off Eagle Point, at a greater rate of speed than twelve (12) nautical miles an hour.

3. Vessels passing craft anchored in the stream between Marcus Hook and Bristol, loading, discharging, or bunkering, shall not navigate at a greater rate of speed than eight (8) nautical miles an hour.

4. Vessels shall not be worked or navigated in the Delaware River off Chester or Marcus Hook at a greater rate of speed than twelve (12) nautical miles an hour.

5. When vessels are moored to the ends of piers at Marcus Hook, lying parallel with the rivers, passing vessels shall not exceed a speed of eight (8) nautical miles an hour.

Regulations for passing dredges.—The following are extracts from regulations prescribed by the Secretary of War for Delaware River:

1. Steamers without tows passing the dredges shall not have a speed greater than 6 miles an hour, and their propelling machinery shall be stopped when immediately abreast of the dredges and while passing over the breast and quarter lines of the dredge.

Steamers with tows passing the dredges shall not have a speed greater than 6 miles an hour, and their propelling machinery shall be stopped while passing over the breast and quarter lines of the dredge; but they may start their propelling machinery if necessary between these lines.

3. Vessels drawing less than 12 feet of water must keep outside of the buoys marking the ends of mooring lines of dredges.
4. Vessels must not anchor on the ranges of stakes or other marks placed for the guidance of the dredges.
5. Vessels must not run over or disturb stakes or other marks placed for the guidance of dredges.
6. Dredges and operating plant in the prosecution of the work must not obstruct any part of the channel unnecessarily.
8. The breast and stern anchors of the dredges shall be marked or buoyed so as to be plainly visible to passing vessels.
9. While vessels in the channel are passing all lines running across the channel from the dredge on the passing side must be entirely slacked.

Pilotage is compulsory between Delaware Bay entrance and any point on Delaware Bay or River for all vessels except those employed in and licensed for the coasting trade or American vessels entirely loaded with coal mined in the United States, if spoken or offered the services of a pilot outside of a line drawn from Cape May lighthouse to Cape Henlopen lighthouse.

The fees for piloting between Delaware Bay entrance and the port of Philadelphia or any other place on Delaware River are as follows: Vessels of 12 feet or less draft, $2 per ½ foot; vessels of over 12 feet draft, $2.50 per ½ foot. An increase of 10 per cent over these fees is charged when a vessel is spoken east of Five Fathom Bank light vessel or north of Hereford Inlet lighthouse or south of Fenwick Island lighthouse, and a deduction of 10 per cent is made when a vessel is spoken inside of a line joining Cape May and Cape Henlopen lighthouses, but pilotage is not compulsory in the latter case.

Every ship or vessel bound to the Delaware Breakwater for orders shall be obliged to receive a pilot, provided she is spoken or a pilot offers his services outside of a straight line drawn from Cape Henlopen light to Cape May light, and every ship or vessel bound to the Delaware Breakwater for orders shall pay pilotage fees as follows: A sum equal to half the pilotage to the port of Philadelphia, and she shall be obliged to receive a pilot and pay the same pilotage fees when outward bound from the breakwater, and if such ship or vessel, without discharging her pilot, proceed to the port of Philadelphia, or any other port or place on the Bay or River Delaware, only one full pilotage fee shall be paid, in addition to the fee for detention: *Provided, however*, That the pilot bringing such ship or vessel to the breakwater be there discharged, and if the ship or vessel afterwards proceed to Philadelphia or any other port or place on the Bay or River Delaware, she shall make the usual signal for a pilot and continue to make such signal until reaching Brandywine light, and if spoken by or offered the services of a duly licensed Pennsylvania pilot, before reaching Brandywine light, shall be obliged to employ such pilot and pay him the regular rates in addition to the fee paid for bringing her into the breakwater, and for detention, if any.

Either Pennsylvania or Delaware pilots are taken to or from any point on Delaware Bay or River, and the fees in either case are the same. Both Pennsylvania and Delaware pilots will be found aboard one vessel, either a steamer or auxiliary schooner, which will be found cruising outside the entrance of the bay.

In case a pilot having charge of a vessel and whilst conducting said vessel be detained, either by order of the master, owner, or con-

signee, or by ice or any other unavoidable circumstance not personal to himself, he shall receive compensation for such detention at the rate of $3 per day for each and every day so detained, commencing at a period of 24 hours from the time the detention first occurred.

Vessels waiting in Delaware Breakwater for orders usually retain the pilot and pay him the detention fee.

Storm warnings of the United States Weather Bureau are displayed at Cape May Point Coast Guard station, Delaware Breakwater, Bivalve, Reedy Island, Philadelphia Navy Yard, and on the Bourse Building, Philadelphia. A branch office of the Weather Bureau is maintained at the Bourse Building, Philadelphia, to serve marine interests.

Reporting stations.—Vessels are reported to the Maritime Exchange at Philadelphia, during either day or night, from reporting stations at Delaware Breakwater and Marcus Hook, and by day from reporting stations at Reedy Island and New Castle. During the ice season an auxiliary station is placed in commission at Gloucester, N. J. Messages can be exchanged by International Code with any of the stations during the day and with the Delaware Breakwater station by night by means of a flashing lamp and the Morse Code. Vessels passing in or out of Delaware Bay should display their signals between Overfalls light vessel and Harbor of Refuge lighthouse. The station will answer all signals with pennant by day and by one long flash, followed by one short flash, at night. The following suggestions are made when signaling by means of a flashing lamp:

1. All other lights in the vicinity of the flashing lamp should be obscured.
2. The flashing lamp should be kept continually pointed directly toward the station or vessel.
3. Care should be taken that proper regularity is observed in the length of the flashes and spaces, and that the spaces between the words are considerably longer than those between the letters.
4. Vessels should, if possible, avoid coming within the rays of a lighthouse while signaling.
5. When "Morsing" a vessel's name, it is desirable that the name be spelled in full.

A United States Branch Hydrographic Office is established in the Bourse Building, Philadelphia. Bulletins are posted here giving information of value to seamen, who are also enabled to avail themselves of publications pertaining to navigation and to correct their charts from standards. No charge is made for this service.

A time ball is dropped daily at noon of the seventy-fifth meridian ($5^h\ 0^m$, Greenwich mean time) from a staff on the Bourse Building, Philadelphia.

Towboats will usually be found cruising in the river and bay or at Delaware Breakwater. Towboats to tow vessels or barges into the tributaries of Delaware River are usually engaged from Delaware City, Wilmington, or Philadelphia.

Vessels employing the city ice-breaker steamers for towing purposes when in the ice pay a fixed rate for such service.

Quarantine.—There are national quarantine stations at Delaware Breakwater and Reedy Island, and a State quarantine station at

Marcus Hook. At the Marcus Hook station, marked by a yellow flag, vessels are boarded by both National and State quarantine officers in order to avoid delay, and all vessels subject to inspection are required to stop there until given pratique. Vessels will be inspected, if desired, by the national quarantine officer at Delaware Breakwater. Vessels with sickness on board should anchor in Harbor of Refuge until inspected.

Supplies.—Coal for large vessels can best be obtained at Philadelphia and Wilmington, and for small steamers and tugs at these places and at Delaware City, Pigeon Point, and Chester. Water is obtainable at all of these places, and at half ebb tide the water in the river as far down as Chester is fresh enough for use in boilers. Gasoline and provisions are obtainable at all of the towns on the river and bay. Points near Delaware Bay where they are obtainable are Lewes, Bivalve, and Bowers, and at Bayside during the fishing season.

Repairs.—Repairs to the hulls and machinery of large vessels can be made at Philadelphia, Camden, and Wilmington, and to small vessels and motor boats at these places and at Essington, Pa., and Bivalve, Dorchester, and Greenwich Pier, N. J. Further information is given under the descriptions of these places.

A tide indicator, maintained by the Coast and Geodetic Survey, is established on the quarantine wharf at Reedy Island and faces up the river. On this indicator is shown the exact stage of the tide at Reedy Island, and whether the tide is rising or falling. The arrowhead in the middle of the semicircle when pointing upward indicates a rising tide and when pointing downward a falling tide. The pointer near the arrowhead points to the height of the tide (in feet), which is indicated in figures on the semicircle, the zero agreeing with mean low water.

Freshets are of rare occurrence, except in the vicinity of Trenton, and unless accompanied with ice do not interfere with navigation.

Ice.—In ordinary winters there is usually sufficient ice in the bay and river to make it a source of care to sailing vessels. Thin ice has been known to form early in December between Chester and Philadelphia, but the heavier ice does not usually begin to run before January. The tidal currents keep the ice in motion, except where it packs in the narrower parts of the river, when it often forms an obstruction that requires the services of steam, and the ice boats, of which there are a number at Philadelphia, are employed in keeping these parts of the river open. The greatest danger encountered from the ice is at Ship John Shoal, just above Fort Delaware, off Deep Water Point, and at the Horseshoe; at these places the ice usually packs heavier than elsewhere. After the first part of March ice is rarely met with.

In severe winters navigation above Chester has occasionally been interrupted, but with the powerful steamers now employed in the foreign and coasting trade to Philadelphia the channel is kept navigable for steamers during the most severe winters. The greatest danger is to wooden sailing vessels, which if caught in the pack ice are set on the shoals, and if in the thin ice are liable to be cut through on the water line.

Further information concerning freshets and ice above Philadelphia is given on page 102.

Tides.—The mean rise and fall of tides is 4.3 feet at Delaware Breakwater Harbor, 5.1 feet at Brandywine Shoal lighthouse, 5.8 feet at Elbow of Cross Ledge lighthouse, 6 feet at Ship John Shoal lighthouse, 5.9 feet at Reedy Island, 5.9 feet at Marcus Hook, and 5.3 feet at Philadelphia. Tidal information for the tributaries is given under their descriptions. Full tidal information, including daily predictions for Philadelphia, is given in the Tide Tables for the Atlantic Coast of the United States.

CURRENTS, DELAWARE BAY AND RIVER.

At Overfalls light vessel.—Slack water before the flood occurs 2 hours 20 minutes after time of low water at Sandy Hook, or 2 hours 10 minutes after time of high water at Philadelphia. Slack water before the ebb occurs 2 hours after time of high water at Sandy Hook, or 25 minutes after time of low water at Philadelphia. The mean velocity of the current at strength of flood is 2 knots in a 326° true (NNW ⅜ W mag.) direction, and of the ebb is 2.3 knots in a 136° true (SE ¾ S mag.) direction. A northwesterly gale will at times cause a very strong ebb current and will greatly diminish the flood current, which at times may be as low as 0.5 knot at maximum. During three months of observations in the winter of 1912–13 the greatest ebb current measured was 3.6 knots during a northwester, and the greatest flood measured was 3.2 knots during a southeaster.

Cape May Channel near Cape May.—The currents are about 1 hour earlier than in the middle of the main channel, slack water before the flood occurring about 1 hour 25 minutes after time of low water at Sandy Hook and slack water before the ebb occurring about 1 hour after time of high water at Sandy Hook. Along the shore, in the eastern angle of the bay, the currents are about 2 hours earlier than in the middle of the main ship channel, slack water before the flood and ebb, respectively, occurring at about the time of low and high water at Sandy Hook.

Main Ship Channel off Fourteen Foot Bank lighthouse.—Slack water before the flood occurs 2 hours 50 minutes after time of low water at Sandy Hook, or 2 hours 45 minutes after time of high water at Philadelphia. Slack water before the ebb occurs 2 hours 27 minutes after time of high water at Sandy Hook or 1 hour after time of low water at Philadelphia.

Channel off Ship John Shoal.—Slack water before the flood occurs 3 hours 45 minutes after time of high water at Philadelphia, and slack water before the ebb 2 hours 10 minutes after time of low water at Philadelphia.

Channel off Reedy Island.—Slack water before the flood occurs 2 hours 30 minutes before time of low water at Philadelphia, and slack water before the ebb occurs 1 hour 25 minutes before time of high water at Philadelphia.

Channel off New Castle.—Slack water before the flood occurs 1 hour 40 minutes before time of low water at Philadelphia, and slack water before the ebb occurs 40 minutes before the time of high water at Philadelphia. The mean velocity of the current at strength of flood is 1.8 knots and at strength of ebb is 1.9 knots, setting fair with the channel.

At Chester.—Slack water before the flood occurs 30 minutes before time of low water at Philadelphia, and slack water before the ebb occurs 10 minutes after time of high water at Philadelphia.

At Philadelphia.—In mid-channel opposite Chestnut Street slack water before the flood occurs 40 minutes after the time of low water at Philadelphia, and slack water before the ebb occurs 1 hour 5 minutes after the time of high water at Philadelphia. The mean velocity at strength of flood or ebb is about 1.4 knots, setting fair with the channel. Close to the docks, both on the Philadelphia and the Camden sides of the channel, slack water occurs 20 to 30 minutes earlier than in midstream.

Above Philadelphia and for several miles below the city.—The time of slack water and the strength of the currents are influenced considerably by freshets, delaying the time of slack water before the flood, advancing the time of slack water before the ebb, and increasing the strength of the ebb current. In the lower bay the currents are influenced similarly by winds and freshets, although to a much less extent.

GENERAL REMARKS, APPROACHES TO DELAWARE BAY.

Between the parallels of 38° 15′ N and 39° 15′ N the 100-fathom curve is from 75 to 90 miles offshore and the 30-fathom curve is about 25 miles closer in toward the shore, both having a general northeasterly and southwesterly trend. Inside the 30-fathom curve the water shoals gradually westward to the 20-fathom curve, but inside the latter curve the depths are somewhat irregular, and if uncertain of her position, especially in thick weather, a vessel, when inside of the 20-fathom curve, should approach the coast with care and in no case approach closer than in 12 fathoms until sure of her position. On a clear night the lights of the light vessels and lighthouses should be made in time to prevent too close approach to the shore.

Vessels coming **from southward and seaward** in clear weather should shape a course so as to cross the meridian of 74° 30′ W in latitude 38° 45′ N; this will lead them within 5 miles of Five Fathom Bank light vessel. If uncertain of the longitude, soundings should be taken frequently and the water not shoaled to less than 20 fathoms until between the parallels of 38° 40′ N and 38° 50′ N, and the entrance then be approached between those parallels.

In approaching the entrance **from northward and seaward**, when between the parallels of 39° 15′ N and 38° 40′ N, soundings of 20 fathoms indicate a distance of 25 to 30 miles from shore. In clear weather a vessel standing westward on the parallel of 38° 45′ N should make Five Fathom Bank light vessel before the depth is lessened to 15 fathoms.

There are least found depths of 35 to 38 feet between latitude 38° 39′ N and 38° 42′ N, and longitude 74° 43′ W and 74° 49′ W.

Entering from northward, the passage inside of Five Fathom Bank, eastward or westward of McCrie Shoal, is used by most of the coasting vessels of less than 24 feet draft. In a heavy sea vessels of a greater draft than 18 feet are advised to pass eastward of Five Fathom Bank, and this is the safest course at all times for strangers in vessels of a greater draft than 18 feet.

Entering from southward, coasting vessels of the deepest draft keep outside Fenwick Island Shoal light vessel. Vessels of 15 feet draft usually pass inside of Fenwick Island Shoal in good weather, but strangers should use this passage with caution.

DIRECTIONS, DELAWARE BAY AND RIVER TO PHILADELPHIA.

Directions for the outside coast and courses to Overfalls light vessel from northward and southward are given on page 37. Directions for Delaware Breakwater are given on page 76.

The channel is well marked by lighthouses and buoys to the entrance of the dredged channel and by lighted ranges and buoys above that point. The dredged channels are generally 800 feet wide in the straight reaches and 1,000 feet wide in the bends. The buoys marking the dredged channels are usually maintained on or close to the edge, and vessels on the ranges will usually pass them at a distance of 100 to 200 yards. Buoys marking each range are numbered separately, and each buoy bears the first letter of the range which it marks. The ranges do not all show well as daymarks, but vessels will ordinarily have no trouble in running by the buoys except when ice is running, at which times the buoys may be dragged from their positions.

Shoaling is liable to take place at any time where the channel has been improved, but the channels are usually redredged as soon as the shoaling is found. In general, the bottom is soft and vessels, if on or close on the ranges, do not sustain damage from grounding, except near the intersection of the Marcus Hook and Chester ranges and near the intersection of the Chester and Tinicum ranges, where the bottom is rocky. At the shoalest places deep-draft vessels take advantage of the tide, which has a mean rise and fall of 5 to 6 feet between the entrance of the river and the wharves at Philadelphia, but during strong northerly winds the high and low waters may be as much as 2.5 to 3.5 feet lower than the mean.

It must be remembered that the channel in the river is being improved and that dredges may be found at work on or near any of the range lines. Directions for passing dredges are given on page 67.

At night a stranger may be confused by the lights of vessels at anchor near the channels, and strangers in deep-draft vessels are advised not to run. Red sectors are established in the lighthouses to cover the dangers on both sides of the channel from Overfalls light vessel to the entrance of the dredged channel and should be observed closely if running at night.

The following table gives the courses and distances from Overfalls light vessel to Philadelphia. They lead in a least depth of about 29 feet to the entrance of the dredged channel and in the dredged channels (least depth 30 feet in 1915) to Philadelphia. Local knowledge or a pilot is required to carry a greater depth than 29 feet through Delaware Bay at low water. Many cut-offs are possible for light-draft vessels, but strangers are advised to follow the main channel.

	Course. True.	Course. Magnetic.	Distance in nautical miles.
1. Overfalls light vessel to ¾ mile east-northeastward of Fourteen Foot Bank lighthouse	° 336	N by W ½ W	16¾
This course leads for Miah Maull Shoal lighthouse, and passes ¾ mile eastward of Brown Shoal gas and bell buoy and ¾ mile westward of Brandywine Shoal lighthouse.			
2. To ½ mile west-southwestward of Miah Maull Shoal lighthouse	330	NNW	4¾
3. To 200 yards westward of Elbow of Cross Ledge lighthouse	325	NNW ⅜ W	4⅜
4. To 300 yards eastward of gas and bell buoy 11C	332	N by W ¾ W	1½
5. With Elbow of Cross Ledge lighthouse astern to 300 yards westward of Ben Davis Point Shoal gas and bell buoy	329	NNW ⅛ W	2⅞
6. To gas and bell buoys 1B	318	NW by N	17
This course leads ⅜ mile southwestward of Ship John Shoal lighthouse and along the dredged channel on Liston range ahead.			
7. On Baker range ahead to buoy 1R	355	N ¼ E	1⅝
8. On Reedy Island range astern to gas and bell buoys 2N	15	NNE	4¼
9. On New Castle range ahead to position ¼ mile southwestward of gas buoy 2D	334	N by W ⅝ W	4½
10. To position on Deepwater Point range and ¼ mile about N by W (mag.) from gas buoy 2D	9	N by E ½ E	⅜
11. On Deepwater Point range ahead to gas and bell buoys 2C	42	NE ½ E	3⅞
12. On Cherry Island range ahead to buoy 2B	17	NNE ¼ E	4⅜
13. On Bellevue range astern to gas buoy 2M	35	NE ⅛ N	3
14. On Marcus Hook range astern to gas buoy 2C	57	NE by E ¾ E	4¼
15. On Chester range ahead to gas buoy 2T	50	NE by E ⅛ E	2½
In 1915 Schooner Ledge range was in position, but the channel was being dredged 35 feet deep and 800 feet wide with Marcus Hook and Chester ranges as center lines.			
16. On Tinicum range ahead to buoy 6T	92	E ⅞ S	3½
17. Past Lincoln Park and Billingsport to buoy 1F	70	E by N	1⅛
18. On Fort Mifflin Bar range astern to the red buoy opposite the lower end of League Island	54	NE by E ½ E	2¾
19. On Horseshoe West Group lower range astern until on Eagle Point range	94	ESE ⅞ E	1⅞
20. On Eagle Point range astern until on Horseshoe East Group upper range	60	ENE ⅛ E	½
31. On Horseshoe East Group upper range to abreast Gloucester	26	NE by N	⅞
The mid-channel is clear above Gloucester, but the best water favors the western side. Anchorages are described on p. 66.			

DELAWARE BAY, WESTERN SIDE.

The western shore of Delaware Bay is low and marshy, with few prominent marks northward of Delaware Breakwater. The principal marks visible from the western channel are as follows: Delaware Breakwater range rear light; a small group of houses at Waterloo, just above Broadkill River entrance; a group of houses at Slaughter Beach, just below Cedar Beach; the lighthouse and fish factory in the mouth of Mispillion River; a large group of houses at Bowers; a small group at Kitts Hummock; the lighthouse and a few houses at Mahon River; and the ranges at Leipsic River.

The rivers on the western side of Delaware Bay are very narrow and crooked and vessels have considerable difficulty in making some of the turns. They are frequented by freight and passenger steamers and schooners carrying produce, fertilizer, and canned goods to or from the towns at their heads and the farm landings below, the usual draft of boats engaged in this trade being 6 to 8 feet. Oyster and fishing boats also seek anchorage in the mouths of many of them. Towboats are not often used, and strangers seldom enter.

Most of the business from the rivers is northward to Chester and Philadelphia. Local vessels usually take advantage of the tide up and down the Delaware River, leaving the mouths of the creeks bound northward at a little after low water, and leaving Philadelphia bound southward at high water or a little before. In entering or leaving the creeks allowance should be made for the current in the bay, which sets across the dredged channels and has considerable velocity at times.

There are many detached shoal spots with depths of 2 to 6 feet along the western side of Delaware Bay from Delaware Breakwater northward to Bombay Hook Point. They are generally unmarked, except in the vicinity of the main ship channel, and are subject to some change, both in depth and position. Strangers using any of the channels westward of the main ship channel should proceed with caution.

There is a channel along the western side of Delaware Bay, which is marked by a line of perpendicularly striped buoys from off the mouth of St. Jones River southward to below Old Bare Shoal. It is used by most of the vessels frequenting the tributaries on the western side of the bay. It is said to lead clear of dangers if the buoys are followed closely, but leads close to the shoals in places.

Vessels entering the channel from northward usually leave the main channel of Delaware River at buoy No. 13, 2½ miles southward of Ship John Shoal lighthouse, pass close eastward of buoy No. 3, at the north end of Blake Channel, and steer 183° true (S ⅞ W mag.) to the buoy off the entrance of St. Jones and Murderkill Rivers. The least depth crossed on this course is 7 or 8 feet.

Cape Henlopen, on the southwest side of the entrance to Delaware Bay, is a high white sand hill, bare of vegetation. The point of the cape, from a comparison of the surveys, is moving northward at a slow but uniform rate; by the last survey (1914) the point had advanced nearly to the line of the **Delaware Breakwater range,** and vessels should keep well northward of the range when passing the cape. The most prominent mark is Cape Henlopen lighthouse, on the

highest part of the hill. A shoal with little depth, as shown on the chart, extends nearly 3/8 mile eastward from the end of Cape Henlopen, and is marked at its easterly end by a black bell buoy.

Cape Henlopen lighthouse is a white octagonal tower. The light is fixed white with a fixed red sector between 128° true (SE mag.) and 173° true (S mag.), 126 feet above the water, and visible 17 miles.

Delaware Breakwater (chart 379) is the name generally applied to the entire anchorage in the vicinity of Cape Henlopen, including the inner anchorage (Breakwater Harbor) and the outer anchorage (Harbor of Refuge).

Breakwater Harbor, on the west side of Cape Henlopen, southward of the inner breakwater, is easy of access both day and night and is a safe harbor for light draft vessels in all but heavy northwesterly gales, and affords considerable protection even in such weather. Under the most favorable conditions a vessel of as much as 15 feet draft can select anchorage with sufficient swinging room in the easterly part of the harbor, but the harbor is generally crowded in heavy weather, and vessels of a greater draft than about 10 feet should preferably anchor westward or northwestward of the inner breakwater or in Harbor of Refuge.

Breakwater Harbor has depths of 13 to about 30 feet in its easterly part, eastward of a line joining the reporting station on the breakwater and the easternmost fish-oil works. The angle in the westerly part of the breakwater is shoal, depths of 9 to 10 feet extend nearly 3/8 mile south-southwestward from the westerly half of the breakwater, and depths of 12 to 13 feet extend to the shore southwestward. The shoals with depths less than 12 feet on the south side of the harbor lie southward of a line joining the end of Cape Hanlopen and the end of the Government pier, and inside the ends of the piers westward.

Pilots.—See page 68.

Tides.—The mean rise and fall of tides is about 4.3 feet.

Currents.—The tidal currents have considerable velocity behind the breakwater in the inner harbor, especially near its eastern end. The flood sets westward and the ebb eastward, and at strength have estimated velocities of 1½ to 2 knots. Slack water before the flood occurs about 2 hours 20 minutes after time of low water at Sandy Hook and slack water before the ebb occurs about 2 hours after time of high water at Sandy Hook.

In the outer harbor the tidal currents have an average estimated velocity of 1 to 1½ knots at strength. The general direction of tidal curents is about parallel with the breakwater, with a considerable set toward the lower end on the ebb and toward the upper end on the flood.

Directions, Breakwater Harbor.—From Overfalls light vessel steer 279° true (WNW ½ W mag.) until Delaware Breakwater front lighthouse bears about 240° true (WSW mag.). Then steer this course for that lighthouse and pass about 100 yards southeastward of it in entering the harbor. The entrance is about ¼ mile wide between the lighthouse and the edge of the shoal southeastward. Caution is necessary at night during heavy weather on account of the large number of vessels which will usually be found at anchor in the harbor. Vessels should keep well northward of the Delaware Breakwater range when passing Cape Henlopen.

Coming down Delaware Bay, pass eastward of Brown Shoal gas and bell buoy, and steer 174° true (S ⅛ W mag.) for Cape Henlopen lighthouse with Brandywine Shoal lighthouse astern, which will lead to a position 350 yards eastward of Harbor of Refuge lighthouse. A 203° true (SSW ¾ W mag.) course will then lead 100 yards eastward of Delaware Breakwater front lighthouse.

Wharves.—The easterly wharf on the south side of Breakwater Harbor is the property of the Government, and has a depth of 16 feet at its end. Westward of it are wharves of fish-oil works, with about 12 feet at the ends, some of them in ruins, and 1¼ miles westward is a railroad wharf with 12 feet at its end. Lying 500 feet westward of the latter are the submerged ruins of a wharf, which extend out nearly as far as the railroad wharf, and which should be carefully avoided.

Lewes is a town with railroad communication lying ½ mile southwestward of the railroad wharf. Provisions, gasoline, ice, and some ship chandlery are obtainable, and some coal in case of necessity.

The inner breakwater is nearly 1 mile long in a west-northwesterly direction, and is marked at its east end by Delaware Breakwater range front lighthouse, and at its west end by a red light. A telegraph and **reporting station**, from which vessels are reported to the Maritime Exchange at Philadelphia, is located near the middle of the breakwater, and storm warnings are displayed.

Delaware Breakwater range front lighthouse, on the east end of the inner breakwater, is a brown conical tower. The light is occulting white (light 2.5 seconds, eclipse 2.5 seconds), with an occulting red sector southward of 262° true (W mag.) and 101° true (ESE ⅜ E mag.), 61 feet above the water, and visible 13 miles. The fog signal is a horn, blast 2 seconds, silent 13 seconds. If the horn is disabled, a bell will be struck by hand 1 stroke every 10 seconds.

Delaware Breakwater range rear lighthouse, on the shore 3¼ miles 262° true (W mag.) from the front light, is a brown skeleton tower. The light is fixed white, visible southward of the bearing 249° true (WSW ¾ W mag.), 104 feet above the water, and visible 16 miles.

Lying westward and northwestward of the inner breakwater is an extensive anchorage with depths of 16 to 25 feet, muddy bottom, where vessels are sheltered from southeasterly and northeasterly winds, and this anchorage is much used by coasting vessels. The anchorage is easy of access, the least depths in the approach being 23 to 30 feet between the inner breakwater and Marshall Shoal buoy.

Harbor of Refuge, lying 1 to 2 miles north-northwestward of Cape Henlopen, is formed by a breakwater which extends 1¼ miles south-southeastward from the southeast end of the **Shears**, and by a row of ice breakers on the Shears. The breakwater is marked 100 feet northward of its south end by Harbor of Refuge lighthouse, and at its north end by a red light. The harbor, except in its northern part, has depths of 4 to 7 fathoms, muddy bottom, for a distance of nearly 1 mile west-southwestward from the breakwater. It affords a harbor in easterly gales for deep-draft vessels. The entrance from southward is deep and clear, while that from northward across the Shears has depths of 9 to 12 feet. The deepest water, depths 5 to 7 fathoms, will be found ⅜ mile westward of the south half of the breakwater. During seasons of ice, drifting ice often forms a danger.

A ridge, having lumps with depths of 12 to 18 feet, extends 145° true (SSE ½ E mag.) from the south end of the Shears toward Delaware Breakwater range front lighthouse. The south end of the shoaler part of the ridge is marked by a horizontally striped buoy which lies 1⅛ miles 274° true (W by N mag.) from Harbor of Refuge lighthouse. **Marshall Shoal**, on the south part of the ridge, is marked by a horizontally striped buoy which lies ⅜ mile north-northeastward of the angle in the inner breakwater. Depths of 23 feet have been found on the ridge for a distance of 600 yards south-southeastward from the latter buoy.

Directions, Harbor of Refuge.—From Overfalls light vessel a 282° true (WNW ¼ W mag.) course for 3¼ miles will lead nearly ¼ mile southward of Harbor of Refuge lighthouse. Coming down Delaware Bay, pass eastward of Brown Shoal gas and bell buoy and steer 174° true (S ⅛ W mag.) for Cape Henlopen lighthouse with Brandywine Shoal lighthouse astern, which will lead to a position 350 yards eastward of Harbor of Refuge lighthouse. Pass 200 yards or more southward of the lighthouse when rounding it.

Harbor of Refuge lighthouse, on the breakwater, 100 feet from its south end, is a white dwelling on a brown pier. The light is flashing white (light 1 second, eclipse 11 seconds), with a flashing red sector between 330° true (NNW mag.) and 341° true (N by W mag.), and some red tint on either side to 326° true (NNW ⅜ W mag.) and 347° true (N ½ W mag.), covering **Hen and Chickens Shoal.** The light is 61 feet above the water, and visible 13 miles. The fog signal is a siren, giving a group of three blasts, each of 2 seconds duration, every 60 seconds, silent interval 38 seconds. If siren be disabled, a bell will sound 1 stroke every 15 seconds.

Broadkill River empties into the Delaware River 1¾ miles northwestward of Delaware Breakwater range rear lighthouse. A channel has been dredged 6 feet deep and 150 feet wide in the entrance, and the same depth and 40 feet wide to the town of **Milton**, the head of navigation, 10 miles above the mouth. A jetty, marked at its end by a beacon, has been constructed on the northwest side at the mouth. The entrance is subject to rapid change. In 1915 there was a depth of 2½ feet on the bar outside the entrance and about 4 feet to Milton. A drawbridge crosses the creek about 5 miles above the mouth. The draw has a clear width of 35 feet, a headroom at high water of about 4 feet when closed, and a depth of 6 feet in the opening.

Shoals extend about 300 yards offshore to the 6-foot curve, and are subject to change. The channel leads close to the jetty, and thence to the head the mid-channel is the best water, except for a middle ground, bare at a little below high water, which lies 1 mile above the mouth. The middle ground shows discolored water at all times, is usually marked by bush stakes, and the best water is on its south side.

The entrance to the canal which will connect Delaware Bay with Rehoboth Bay is about ½ mile inside the entrance of Broadkill River, and is described under the heading, "Inside waters, Cape Henlopen to Cape Charles."

Tides.—The mean rise and fall of tides is 4.6 feet at the entrance and 3.5 feet at Milton. High and low water at Milton occur 2 hours and 15 minutes later than at the entrance.

There are several **drainage canals** between Broadkill and Mispillion Rivers, which are used to some extent for purposes of navigation by small local boats, but they are of little interest to a stranger.

Mispillion River, 15 miles northwestward of Cape Henlopen lighthouse, is marked by Mispillion River lighthouse (a white tower on a dwelling), and by a fish factory just inside the mouth. A channel 4 feet deep and 150 feet wide has been dredged into the entrance, and 6 feet deep and 60 to 75 feet wide to the town of **Milford,** at the head of navigation 12 miles above the entrance. A long jetty has been constructed on the south side at the mouth and a short jetty on the north side. In 1915 there was a depth of about 4 feet across the bar at the entrance and thence 6 feet to Milford. The river is used by freight steamers, some schooners, and motor boats, the deepest draft being 7 feet.

Vessels **bound into Mispillion River** from northward steer southwestward from the gas buoy at the north end of Old Bare Shoal until off the dredged cut, and then follow the south jetty at a distance of 100 feet through the cut on a 310° true (NW ¼ N mag.) course for **Mispillion River lighthouse.** From the inner end of the jetty the channel follows closely the south and west sides until above the lighthouse wharf, and then follows a general mid-channel course to Milford, passing southward of the island lying 1 mile above the mouth. The channel is very crooked, and steamers have difficulty in making some of the turns.

Tides.—The mean rise and fall of tides is 5.1 feet at the entrance and 3.5 feet at Milford. High and low water at Milford occur 2 hours and 15 minutes later than at the entrance.

Murderkill River is 22½ miles northwestward of Cape Henlopen lighthouse and 245° true (WSW ½ W mag.) from Miah Maull Shoal lighthouse. A channel 7 feet deep and 100 feet wide has been dredged across the flats into the entrance, and 7 feet deep and 60 feet wide to the town of **Frederica,** at the head of navigation, 7 miles above the mouth. The deepest draft ordinarily going to Frederica is about 7 feet. The river is extensively used by steamers and schooners to Frederica, and by fishing and oyster boats at the entrance. A passenger steamer runs to Philadelphia.

There is a lighted range for entering Murderkill River. The front range is a white post just above the steamer wharf, and shows against a low gray building with higher buildings on either side. There is a low iron chimney showing about 100 feet to the right of it. The back range is a black post 60 feet high with box on top, and shows well above the buildings at Bowers.

There is a mud bank along the south side of the entrance cut, which is bare for a considerable distance at low water, and was marked by bush stakes in 1914. There is a can buoy off the entrance, maintained at the intersection of the Murderkill and St. Jones River ranges.

To enter Murderkill River, from the can buoy head in on the range, course 247° true (WSW ⅝ W mag.), passing 40 feet northward of the bushes marking the mud bank. From the wharf at Bowers, the best water generally favors the ebb-tide bends to the head. The river has been straightened by cuts across the sharper bends, the old bed of the stream having been filled by the dredged material near the cuts.

Bowers is a post village and summer resort on the point of land between Murderkill and St. Jones Rivers, and is prominent from offshore. Gasoline and provisions are obtainable.

Tides.—The mean rise and fall of tides is 5.4 feet at the entrance and 2.7 feet at Frederica.

St. Jones River is 23 miles northwestward of Cape Henlopen lighthouse and ½ mile northward of the entrance to Murderkill River. Improvements are authorized to dredge a channel 7 feet deep to the city of **Dover**, 15 miles above the mouth, to have a width of 100 feet in the entrance and 40 to 50 feet above. In 1915 there was a depth of about 5 feet at the entrance and 6 feet to **Lebanon**, a village about 9½ miles above the mouth. No work has been done above Lebanon; in 1915 it was good for a depth of about 3 feet to Dover and was little used above Lebanon. The deepest draft entering the river is about 8 feet.

A drawbridge with a clear width of 31 feet crosses the river at **Barker Landing**, 6 miles above the mouth, and 1 mile westward of the bridge is the village of **Magnolia**. A drawbridge crosses the river at Lebanon, width of opening 37 feet. Dover has railroad communication, and Lebanon and the landings below have communication with Philadelphia by a passenger steamer.

There is a lighted range for entering St. Jones River, each a white post, which shows about 100 yards to the right of a white house on the wharf at Bowers Landing. A mud bank on the south side of the entrance is bare at the inner end at half tide and at the outer end at extreme low water, and is usually marked by bush stakes.

To enter St. Jones River, from the can buoy off the entrance head in on the range, course 266° true (W ¼ N mag.), passing 40 feet northward of the bushes marking the mud bank. From **Bowers Landing**, just inside the mouth, the best water favors the southwest side for about ½ mile, and then a general mid-channel course in the straight reaches and the ebb-tide bends in the curves is the best to the head.

Tides.—The mean range of tides is 5.4 feet at the entrance, 2.5 feet at Lebanon, and 1 foot at Dover.

Little Creek, 1½ miles southward of Mahon River lighthouse, is navigable to the village of Little Creek, 2½ miles above the mouth. A channel has been dredged to a depth of 5 feet to Little Creek, 60 feet wide across the bar and 40 feet wide in the creek. The deepest draft entering is 7 feet. There is a lighted range for entering, course 310° true (NW ¼ N mag.), plainly visible by day. The best water follows the northeast side around the bend from the north point at the entrance until past the front light, and then the mid-channel to the head. The mean rise and fall of tides is 5 feet at the entrance and 4.5 feet at Little Creek. High and low water at Little Creek occur 30 minutes and 50 minutes, respectively, later than at the entrance. Small boats can go a short distance above a drawbridge at Little Creek.

Mahon River is marked by Mahon River lighthouse (a light on white house) and three smaller houses around it. There is a depth of about 5 feet across the bar at the mouth and 10 to 15 feet inside, and it is extensively used as an anchorage by oyster and fishing boats. The point of marsh on the east side at the entrance is wearing away, and a shoal extends southward from it. There is a black bell buoy ⅜ mile southward of the entrance, eastward of the base of an old

lighthouse, which is covered at high water. To enter the river, pass anywhere northeastward of the bell buoy, giving the point on the east side of the entrance a good berth. Small boats can pass through Mahon River into Dona River, but there is little business above the mouth.

Dona River, 2¼ miles northward of Mahon River lighthouse, has a depth of about 3 or 4 feet across the flats at the mouth and 6 to 12 feet inside. It is used to some extent as an anchorage. The entrance is not marked. Small boats can, with difficulty, pass through into Leipsic River, but it is not often done.

Leipsic River, 3½ miles northward of Mahon River lighthouse and 3¾ miles south-southwestward of Ship John Shoal lighthouse, is the approach to the town of **Leipsic,** about 8½ miles above the mouth. A channel 6 feet deep and 50 feet wide, with several cut-offs, has been dredged to Leipsic, and 5 feet deep and 40 feet wide to the head of navigation about 4½ miles above Leipsic, with a turning basin at the head. A drawbridge with a draw opening 35 feet wide crosses the river at Leipsic. The south opening has the best water.

There is a lighted range for **entering Leipsic River,** each a post with slatted daymark, plainly visible by day. The course on the range is 285° true (WNW mag.), and it should be closely followed to avoid shoals close to it on the south side. Above the entrance a general mid-channel course is the best.

Tides.—The mean rise and fall of tides is 5.9 feet at the entrance, 3 feet at Leipsic, and 2.5 feet at the head of navigation.

Duck Creek, extending from Leipsic River to Smyrna River, is navigable at high water throughout most of its length from Leipsic River, but has a dam at the northern end which prevents entrance from Smyrna River. It is used only by boats with hunting parties and schooners carrying marsh hay. A fixed bridge crosses the creek just back of Woodland Beach.

Smyrna River, 5¾ miles southward of Stony Point Shoal, is navigable to **Smyrna Landing,** about 9 miles above the mouth and 1 mile from the town of **Smyrna.** The deepest draft entering is about 7½ feet, and this draft is taken to the head at high water. Improvements are authorized to construct jetties at the entrance and obtain a channel 7 feet deep to Smyrna Landing, 100 feet wide across the bar at the entrance and 60 feet wide inside, and there are to be several cut-offs across the sharper bends; in 1915 there was a depth of 4 feet to Smyrna Landing. There is a lighted range for entering, front light on a white post and rear light on a brown skeleton structure, both plainly visible by day. A white dwelling shows 250 yards to the left of the range.

There is a spoil bank, bare at low water, on the south side of the entrance of Smyrna River. The range leads across a shoal bar about ½ mile outside the entrance. Local steamers usually enter at near high water, when the bar can be crossed on the range, but if entering at low water, must pass well southward of it and then steer northwestward inside the bar until on the range, but some local knowledge is required to carry the best water. From inside the entrance to the head the best water generally follows a mid-channel course or favors the ebb-tide bends. A drawbridge crosses the river

at Flemings Landing, 3 miles above the mouth. It is a center-pier draw, each opening 38 feet wide; the north opening is generally used.

Tides.—The mean rise and fall of tides is 6 feet at the entrance and 3.5 feet at Smyrna Landing. High and low water at Smyrna Landing occur 2 hours and 13 minutes later than at the entrance.

DELAWARE BAY, EASTERN SIDE.

The eastern side of Delaware Bay is low and has few prominent marks except the lighthouses. There are many small creeks, frequented mostly by fishing and oyster boats and a few truck boats, and two large tributaries, Maurice and Cohansey Rivers, which have considerable trade, the deepest draft being about 11 feet.

The ruling depth on the eastern side of Delaware Bay is 7 to 15 feet, with many spots of less than 6 feet. These shoals are generally unmarked and some local knowledge is required to avoid them. There are bars at the mouths of the creeks and deeper water inside.

Cape May, on the eastern side of the entrance to Delaware Bay, is marked by the large hotels at the town of Cape May and by Cape May lighthouse at the town of **Cape May Point**. Storm warnings are displayed at Cape May Point Coast Guard station, southward of the lighthouse.

The shoals and channels on the northeast side of Delaware Bay entrance, southward and westward of Cape May, are subject to change both in depth and position, the general direction of movement being southward. **Cape May Channel** is the principal one of several buoyed channels, and by the latest survey, made in 1914, had a least depth of 15 to 18 feet at its inner end between **North Shoal** and **Crow Shoal**. For the latest information concerning the channels and the positions of the buoys reference is made to the chart. The channels have strong tidal currents. Strangers should enter the bay by the main channel along the southwest side, which is broad and deep.

There are several unimportant creeks northward of Cape May, but the first one open to navigation is **Goshen Creek**, 13½ miles north-northeastward of Cape May lighthouse. There is a depth of about 1 foot across the flats at the mouth and 2 feet to **Goshen Landing**, 1 mile above the mouth and 1 mile below the village of **Goshen**. It is only entered by small local boats.

Dennis Creek, 6⅜ miles eastward of East Point lighthouse, has a depth of 2 feet across the flats at the mouth and 6 to 12 feet inside. It is navigable for a considerable distance, but is principally used as an anchorage by oyster boats. The entrance is marked by range lights, which lead in the best water across the flat in the approach.

West Creek, 1 mile northwestward of the entrance to Dennis Creek, is nearly bare at low water at the mouth and has a depth of about 3 feet inside. It is little used.

Deadman Shoal, lying 5⅜ to 7 miles southward of East Point lighthouse, had a least depth of 3 feet in 1914. It is marked on the northeast side by a light and at the north end by a horizontally striped buoy. Depths of 6 feet or less extend about 1 mile south-southeastward ⅝ mile north-northwestward, and 1½ miles westward from the light. Extending southward (true) from the west end of the shoal is a ridge with 6 to 7 feet over it, the south end of which lies 3 miles southwestward from the light.

East Point lighthouse, a white dwelling on the point on the east side of Maurice River Cove, is the most prominent mark in the vicinity.

Maurice River is navigable to the city of Millville, 21 miles above the mouth. The landings near the mouth are the center of a large oystering and fishing industry, and there is considerable trade in the upper river, mostly in towed sand barges. The deepest draft entering the river is 11 feet, and this draft is taken to Millville at high water.

The river is under improvement to obtain a channel 100 feet wide and 7 feet deep to Millville. In 1915 there was a depth of 6 feet and width of 100 feet in a dredged channel across the flats outside the mouth. From inside the mouth to within 4 miles of Millville there is a natural channel with a least depth of about 10 feet, and from there to the mill dam ½ mile above the lower bridge at Millville there is a depth of 7 feet, most of the way through a dredged channel.

Bivalve is a railroad terminus and important oyster-shipping point on the west bank of Maurice River, 2½ miles above the mouth. Gasoline and provisions are obtainable and there is water on the wharves. There is a railway capable of hauling out vessels of 150 tons and 6 or 7 feet draft, and a machine shop for ordinary repairs to motors. Storm warnings are displayed.

Maurice River, a post office opposite Bivalve, is also the terminus of a railroad and a shipping point for sea food.

Port Norris is a town about ¾ mile from the river and northward of Bivalve.

Between Port Norris and Millville are the villages of **Leesburg**, **Dorchester**, and **Port Elizabeth** on the east bank, all on the railroad, and **Mauricetown** on the west bank. There are railways at Dorchester capable of hauling out vessels of about 100 tons and 6 feet draft, and a machine shop for ordinary repairs to motors. A highway drawbridge crosses the river at Mauricetown. It has a center pier draw, width of openings 58 feet. Either opening is clear, but the eastern opening is the one generally used, as there is a westerly set on both ebb and flood tide.

Millville is an important town at the head of navigation on Maurice River. It has railroad communication and several factories. A drawbridge having a draw opening 36 feet wide crosses the river at the lower end of the wharves.

Tides.—The mean rise and fall of the tide is 5.8 feet at the entrance and 4.7 feet at Millville; it is high water at the latter place about 2¾ hours later than at the mouth of the river. The tidal currents change at the entrance 1 hour and at Mauricetown ½ hour after high and low waters. At Millville the flood current changes to ebb a little before high water, and the ebb changes to flood about ¾ hour after low water; this applies to the river in summer, when there are no freshets.

Directions, Maurice River.—There are numerous oyster stakes off the entrance, but no difficulty will be experienced if guided by the fixed aids until sure of the buoys. The following courses will lead in a depth of 9 feet or more until approaching the entrance:

A 358° true (N ½ E mag.) course from a position ½ mile westward of the western end of Cape May Point will lead to a position with

Deadman Shoal light bearing 318° true (NW by N mag) distance 1¾ miles. Then a 335° true (N by W ½ W mag.) course, passing ½ mile eastward of Deadman Shoal light, will lead to a position ¼ mile southwestward of the entrance to the dredged channel.

Or a 14° true (NNE mag.) course with Brandywine Shoal lighthouse astern will lead to the above position off the entrance.

Coming down Delaware Bay the safest course for a stranger is to pass southward of the buoy at the south end of Miah Maull Shoal, steer 82° true (E mag.) for 4½ miles, until East Point lighthouse bears 35° true (NE ¼ N mag.), then steer 31° true (NE ½ N mag.) for 4¾ miles to the entrance of the dredged channel.

The channel across the bar and into Maurice River is marked by buoys and a lighted range, each light on a white post with slatted daymark. There is a dwelling a little to the right of the range. The center line of the dredged channel follows the northern edge of the white sector in East Point lighthouse on a 47° true (NE ⅞ E mag.) course until on the range, then a 346° true (N ½ W mag.) course on the range until inside the mouth. On the flood, vessels should guard against a northwesterly set. For a distance of 16 miles above the entrance the channel has ample width and is easily followed; in the absence of local knowledge it is safer to take it on a rising tide and proceed with caution. In the upper 5 miles to Millville the channel is narrow and some local knowledge is required to follow the dredged channels. Towboats bound to or from the upper part of the river usually run with the current.

There is a narrow cut through the marsh leading into Maurice River about ⅜ mile eastward of the main entrance. It has a depth of about 2½ feet and is much used by motor boats.

Dividing Creek, 2½ miles northeastward of Egg Island lighthouse, has a depth of about 2½ feet across the flats at the mouth and 5 to 15 feet inside. A draft of about 4 feet at high water can be carried through a very narrow crooked channel to the town of Dividing Creek, about 8 miles above the mouth. It is used only by a few oyster boats.

Oranoaken Creek, ½ mile westward of Dividing Creek, has a depth of about 2½ feet across the flats at the entrance and deeper water inside. It is little used.

Egg Island lighthouse, a white dwelling, is the most prominent mark in its vicinity. There are shoals southward of the point and an unmarked slough, good for a depth of about 7 feet, close along the point inside the shoals. The slough is used by local vessels, but strangers should pass southward of the shoals.

Fortescue Beach is a post village and small summer settlement on the shore about 4 miles north-northwestward of Egg Island lighthouse.

Nantuxent Creek, 6¼ miles east-southeastward of Ship John Shoal lighthouse, has a depth of about 5 feet in the entrance, and is navigable at high water to within about 1 mile of the village of **Newport**. It is used only by local oyster boats.

Shoal spots with a least depth of about 5 feet extend about 1 mile south-southwestward of **Nantuxent Point**, and are marked off the west side by a gas buoy. Boats bound alongshore should keep outside of

the buoy and well eastward of **Ben Davis Point Shoal**, which has a depth of 5 feet and borders the main channel of Delaware Bay.

Cedar Creek, 1¾ miles eastward of Ben Davis Point, has a depth of 4 feet across the flats at the mouth, 4½ feet for a distance of about 3 miles above the mouth, and about 3½ feet at high water for a further distance of 2½ miles to the village of **Cedarville**. The mouth is used as an anchorage for small boats and there is little traffic above.

Back Creek, on the east side of Ben Davis Point, has a depth of about 5 feet across the flats at the entrance, and is navigable with a good depth of water for about 3 miles. It is used only as an anchorage by local boats.

Cohansey River, marked by Cohansey lighthouse (a white dwelling), is navigable to the city of Bridgeton, 17½ miles above the entrance. It has considerable trade, carried mostly in barges to the upper end, and small schooners and motor boats in the lower end. The deepest draft entering the river is about 11 feet, and this draft is taken to Bridgeton at high water.

A new mouth 100 feet wide and 7 feet deep has been dredged into the river 500 yards northwestward of Cohansey lighthouse, and the channel has been improved above to secure a width of 100 feet and depth of 7 feet to the lower drawbridge at Bridgeton, and a width of 60 to 75 feet and depth of 7 feet for a further distance of about ¼ mile to the head of navigation.

Greenwich Pier, a railroad terminus and shipping point for sea food, is on the west bank of Cohansey River, about 4 miles above the entrance. Gasoline, provisions, and water are obtainable. There is a railway capable of hauling out small vessels up to 8 feet draft, and machine shop for ordinary repairs to motors. **Greenwich** is a town about 1 mile from the wharves.

Fairton is a village on the east bank of Cohansey River, 3½ miles below Bridgeton.

Bridgeton is an important manufacturing town and railroad center at the head of navigation on Cohansey River. There are two drawbridges at Bridgeton, each a center pier draw, both openings clear. The clear width of openings of the lower bridge is 42.5 feet and of the upper bridge about 40 feet.

Tides.—The mean rise and fall of the tide is 5.5 feet at the entrance and 7 feet at Bridgeton. It is high water at the latter place about 2 hours later than at the entrance.

Directions, Cohansey River.—Vessels approaching the river from northward usually leave the main channel of Delaware Bay southward of the red buoy at the south end of Arnold Point Shoal, steer east-southeastward with Cohansey lighthouse well on the port bow until off the new entrance, and then head in on the axis of the cut.

Or, continue the course to the old entrance, ¾ mile eastward of Cohansey lighthouse, which has a depth of about 6 feet. It is used by some vessels approaching from southward, also by some local vessels approaching from northward at night. A shoal extends east-southeastward and east-northeastward from the lighthouse, and the point should be given a good berth.

From inside the entrance to about 1 mile below Bridgeton there is a natural channel with ample width and depth and easily followed; in the absence of local knowledge it is safer to take it on a rising tide

and proceed with caution. Thence to Bridgeton the channel has been obtained by dredging, and some local knowledge is required to follow it. Vessels bound to or from the upper part of the river usually run with the current.

Stow Creek, 3 miles northwestward of Cohansey lighthouse, has a depth of about 4 feet in the entrance and deeper water inside. It is said to be navigable at high water to within about 1 mile of the village of **Canton**, about 10 miles above the entrance. There are farm landings near the head from which some produce is shipped, the deepest draft being 6 feet. The best water in entering lies close along shore southward of the entrance, then eastward and northward of the island in the mouth.

Bayside, at the mouth of Stow Creek, is a railroad terminus and important shipping point for sea food. There is a depth of 3 feet at the wharf. Gasoline and some provisions are obtainable during the fishing season.

Mad Horse Creek, 6 miles northwestward of Cohansey lighthouse, has a depth of about 5 feet in the entrance. It is navigable for several miles but is entered only by an occasional truck boat.

DELAWARE RIVER BELOW CHRISTIANA RIVER.

Hope Creek, on the east side, 1¾ miles southeastward of Stony Point Shoal, has a depth of about 2 feet at the mouth and is navigable for several miles, but is little used.

Blackbird Creek, on the west side, ⅜ mile southward of Reedy Island range front light, can be entered with a draft of about 3 feet at low water by following the shore from well southward of the entrance, as mentioned in the description of Appoquinimink Creek, and this draft can be carried several miles above the mouth. It is frequented only by small produce boats. The creek is crossed by a drawbridge about 4 miles above the mouth, but it is seldom opened.

Appoquinimink Creek, marked at the mouth by range lights (posts with slatted daymarks), is navigable at high water for vessels of 8 feet draft to the village of **Odessa**, 6 miles above the mouth, and for small boats a farther distance of about 2 miles.

The channel in Appoquinimink Creek has been improved by dredging and by cut-offs across the bends. In 1915 there was a depth of 8 feet from inside the bar at the mouth to Odessa; no work has been done outside the mouth. There is a least depth of about 2 feet on the axis of the range between the mouth and deep water in Delaware River.

A depth of about 3 feet at low water can be taken into the entrance of Appoquinimink Creek by running close inshore from abreast **Rays Ditch**, about 1½ miles below the entrance. The best water leads close to the end of a jetty, submerged at high water and unmarked, lying about 1 mile below the entrance; from here pass about 150 yards off the marsh on the north side of Blackbird Creek and 350 yards off the marsh on the south side of Appoquinimink Creek until on the range. From inside the mouth to Odessa the best water follows a general mid-channel course.

A drawbridge crosses Appoquinimink Creek about 3 miles above the mouth. The bridge is a center-pier draw, each opening 39 feet

wide, with a headroom of 5 feet at high water. There is a drawbridge just above the wharves at Odessa with a single clear opening 44 feet wide and a headroom of 4½ feet at high water.

Tides.—The mean rise and fall of the tides is 5.2 feet at the mouth and 3.3 feet at Odessa. At Odessa high and low water occur about one hour after high and low water at the mouth.

The shoalest part of **Stony Point Shoal** has been surrounded by a bulkhead and raised to above high water by dumping, forming an artificial island about 2½ miles long. A dike, visible at all stages of the tide, connects the south end with **Stony Point.**

Alloway Creek, eastward of the north end of the artificial island on Stony Point Shoal, is navigable for vessels to the village of **Quinton,** 7 miles above the mouth, and with some difficulty for small boats at high water for a further distance of 4 miles to the village of **Alloway.** A channel 6 feet deep and 60 to 75 feet wide has been dredged to Quinton. Two cut-offs have been made across sharp bends, one 1¼ miles above the entrance and the other above Hancocks Bridge; also two short dikes have been constructed 2½ and 5½ miles above the entrance.

A drawbridge crosses the creek at the post village of **Hancocks Bridge,** 4 miles above the mouth. The bridge has a center pier draw, each opening about 40 feet wide, with the best water in the north opening.

Upper Hancocks Bridge crosses the river 5½ miles above the entrance; width of opening, 42 feet. There is a drawbridge at Quinton, width of opening 35 feet.

Boats **entering Alloway Creek** must pass northward of the artificial island on Stony Point Shoal, and should enter the creek on a northeasterly course to avoid shoals off the points on either side. Above the entrance the best water does not always follow midstream, and some local knowledge is required to keep in the best water. Strangers should take it on a rising tide and proceed with caution.

Tides.—The mean rise and fall of tides is 6 feet at the entrance, 4 feet at Quinton, and 2.5 feet at Alloway.

Reedy Island is the site of a national quarantine station, and storm warnings are displayed. A dike extends 2½ miles southward from the south end of the island. The lower end is submerged at high water and is marked by a red buoy at the end. There is no navigation around the south end of the jetty except in small motor boats. **Old Reedy Island lighthouse,** a white tower on a dwelling, is on the dike ¼ mile southward of Reedy Island. About midway between the lighthouse and the south end of Reedy Island is an opening in the dike 150 feet wide, with a depth of 5 feet at low water, used by boats up to 7 feet draft bound to Port Penn. The opening is not marked, but the dike on each side is visible at high water.

Port Penn is a village on the west bank westward of Reedy Island. It can be approached from southward, through the opening in the dike at the south end of Reedy Island, and from northward with a depth of about 7 feet by passing westward of **Reedy Island Bar.** The anchorage off the town, known as **Reedy Island Harbor,** has a depth of about 20 feet, but is little used except during the fishing season. There are depths of 1 to 2½ feet at the wharves at Port Penn, and 10 feet at the pier, about ½ mile southward of the town.

Salem River, emptying into **Salem Cove**, 3 miles southeastward of Pea Patch Island, is the approach to the city of **Salem**, at the junction of Salem and **Little Salem Rivers**, 3 miles above the mouth. There is considerable trade to Salem in steamers, barges, and many smaller boats. The deepest draft entering is about 10 feet. Improvements are in progress to obtain a channel 9 feet deep and 100 feet wide from Delaware River to a fixed bridge crossing Little Salem River a little over ½ mile above its junction with Salem River. In 1915 a draft of 7 feet at low water could be carried across Salem Cove into the river and 9 feet inside to Salem.

The channel across Salem Cove follows the southeast side and is marked by buoys and by a set of range lights. The front range is a post on a white house with black base, and the back range is a tall white mast with slatted daymark.

To enter Salem River, pass southward of the gas and bell buoys at the intersection of the New Castle and Reedy Island ranges, and steer southeastward for ¼ mile until past the black buoy at the entrance. Then steer 28° true (NE ⅞ N mag.) on the range for about 1¼ miles to buoy No. 2, then 73° true (E ⅞ N mag.) for 400 yards to buoy No. 4, and then haul gradually southward, passing 150 yards off the point on the south side. There is a red buoy off the point. The best water then favors the north side until around the first bend and about ¾ mile above the north point at the entrance, and then follows a general mid-river course to the lower wharves at Salem. There is a drawbridge crossing Salem River just below the mouth of Little Salem River. It is a center pier draw, south opening 49.5 feet wide and north opening 46.5 feet wide and having 6.5 feet headroom above high water; both openings are used.

Coal in limited quantities can be obtained at Salem and there is water on the wharves. In summer a passenger steamer runs from Salem and landings on the eastern side of Delaware River to Philadelphia.

The mean rise and fall of tides is 5.9 feet at the entrance and 6.4 feet at Salem.

Salem River was originally navigable to **Courses Landing**, 15 miles above Salem and 2½ miles below the village of **Sharptown**. A dam has been placed across the river about 9 miles above Salem, and the river above the dam is connected with Delaware River by Salem Canal. In 1915 the river from Salem to the dam was navigable for small boats at low water, and small launches could cross the dam at high water into the upper part of the river.

Salem Canal and Salem River above the dam are said to be navigable with a draft of 4 or 5 feet at high water to Courses Landing. They are used only by a few truck boats. The entrance to Salem Canal is marked on the north side by **Deepwater Point range front light** (black and white tower with slatted daymark).

Pea Patch Island is low, and shoals extend for a long distance northward and southward of it.

Delaware City is on the west bank of Delaware River, southwestward of Pea Patch Island. The eastern entrance to the **Chesapeake & Delaware Canal** is located here. The city has little trade except that passing through the canal. There is a depth of about 12 feet at the wharves, and provisions, water, and coal in limited quantities can be obtained. A description of the Chesapeake & Delaware

Canal is included with "Inside route, New York to Norfolk," on page 255.

Bulkhead Shoal Channel. westward of Pea Patch Island and Bulkhead Shoal, is used only by boats of 9 feet or less draft, bound through the canal.

A curved jetty extends 5/8 mile westward from the eastern bank of Delaware River, 2 miles above Pea Patch Island, and is marked at its end by a light. A pile of rocks with 4 feet over them, lying 3/8 mile southwestward of the light, is marked off its west side by gas buoy No. 2D.

New Castle is a town on the west bank of Delaware River, 4 miles below the entrance of Christiana River. It has little trade. The main wharf has a depth of 4 feet at its end, and the other wharves are in bad repair. There is a foundry 3/4 mile northward of the town, with a wharf in front of it having a depth of 12 feet at the end. A small harbor, protected from drifting ice by ice breakers, is located at New Castle.

Pennsville is a village on the east bank, 3½ miles below the entrance to Christiana River. There are depths of 7 to 8 feet at the wharves.

There is a railroad wharf, with a depth of 9 feet at the end, on the end of **Pigeon Point**, 1 mile southward of the entrance to Christiana River. It is used as a shipping point for coal and other freight, principally in car floats and barges. Coal and water are obtainable.

CHRISTIANA RIVER,

on the west side of Delaware River about 64 miles above Cape Henlopen and 26 miles below Philadelphia, is the approach to the city of Wilmington, 2½ miles above the mouth, and the villages of Newport and Christiana.

Wilmington has large manufacturing interests and considerable trade by water. The deepest draft entering is about 20 feet, and the usual draft about 10 feet. The city is connected with Chester and Philadelphia by passenger and freight steamers, and with Penngrove by ferry.

Channel.—Improvements are in progress to obtain a channel 21 feet deep for a distance of 3½ miles above the entrance, to within 300 yards of the first bridge above Mill Creek, 10 feet deep to the bridge, and 7 feet deep for a further distance of 4¼ miles to the village of **Newport.** The project width is 250 feet from the entrance to the mouth of Brandywine Creek, 200 feet to the upper limit of the 10-foot project, and 100 feet to Newport. The project has been completed, but the channel is subject to considerable shoaling. In 1915 there was a depth of about 15 feet to the head of the 21-foot project and a depth of 6 feet to Newport.

Two parallel **jetties** have been constructed at the entrance. The north jetty is visible at all stages of the tide and has a light (post on white house) and fog bell on the end. The **Bellevue range rear light** (black skeleton tower) is near the inner end of the jetty, and is prominent. The south jetty is submerged at extreme high water, and is marked at the outer end by a white skeleton tower on a house.

Christiana is a village at the head of navigation on Christiana River, about 12 miles above the entrance. A draft of 2 feet at low water

and about 5 feet at high water can be taken to the town. There is some trade in motor boats and barges up to 4 feet draft.

Brandywine Creek, emptying into Christiana River 1¼ miles above the entrance, is good for a depth of about 4 feet at low water to the railroad bridge 1 mile above the mouth, and a draft of about 6 feet at high water can be taken a farther distance of about ¾ mile to a fixed bridge at the head of navigation. There is considerable traffic, mostly in barges of 4 to 6 feet draft. The channel is rocky above the railroad bridge.

Bridges.—The following are the drawbridges crossing Christiana River, the distance in nautical miles above the outer ends of the jetties at the entrance, the least width of the two draw openings, and the clear height above high water:

Pennsylvania Railroad (lower), 1.2 miles, 90 feet, 7.3 feet.
Third Street (highway), 2 miles, 99 feet (north), 95 feet (south), 6 feet.
Market Street (highway), 2.7 miles, 97 feet, 5.7 feet.
Baltimore & Ohio Railroad, 3.1 miles, 70 feet, 6 feet.
Pennsylvania Railroad (middle), 3.6 miles, 70 feet (east), 62 feet (west), 7 feet.
Philadelphia & Reading Railroad, 3.7 miles, 66.5 feet (east), 57.3 feet (west), 4 feet.
Pennsylvania Railroad (upper), 4.8 miles, 40 feet, 4 feet.
Newport (highway), 8 miles, 32.5 feet (south), 6.1 feet.
Churchmans (highway), 10.3 miles, 27 feet, 5 feet.

Four bridges cross Brandywine Creek between the mouth and the head of navigation, and all have draw openings.

Bridge regulations prescribed for the highway bridges crossing Christiana River and Brandywine Creek require that the draws shall be opened immediately at all times of the day or night upon a signal of three blasts of a whistle or horn, if no person or vehicle passing over the bridge is then in the way. The answer from the bridge is three blasts of a whistle or horn if the bridge can be opened immediately, and two blasts if the bridge can not be opened immediately.

Regulations prescribed for the railroad bridges crossing Christiana River and Brandywine Creek require that the draws shall be opened immediately at all times of the day or night upon a signal of three blasts of a whistle or horn, unless a train is due to arrive within 5 minutes of the time of giving the signal. But in no case shall there be a delay of more than 10 minutes in opening the draws. The signal shall be answered from the bridge by three blasts of a whistle or horn if the bridge can be opened immediately, and two blasts if the bridge can not be opened immediately.

Channel regulations.—1. Vessels over 20 tons propelled by machinery shall not proceed at any time within the limits of these waters at a greater speed than 8 statute miles per hour.

2. Vessels over 15 tons, propelled by machinery, passing any plant employed in the improvement of said waters, shall not proceed at a speed greater than 4 statute miles per hour, and the propelling machinery of vessels passing any such plant shall be stopped at a distance of 300 feet from said plant and not started in motion until said vessel shall have passed abreast of such plant, except where it may become necessary to avoid an accident, or in the case of a vessel with heavy tow. When it becomes necessary for a vessel to pass between any such plant and any buoys indicating the position of the mooring anchors of such plant, such vessel shall give the following

warning signal to said plant to lower the mooring lines: Four short blasts of a whistle or horn in quick succession, said warning signal to be given when said vessel is about ½ a mile away from the plant.

Paragraphs 3 to 9 of the regulations for Delaware River, given on page 68, apply to Christiana River.

Supplies.—Water, provisions, ship chandlery, and coal in any amount can be obtained at Wilmington.

Repairs.—There are good facilities for the construction and repair of hulls and machinery. There are a dry dock and several marine railways, the dry dock having a length on blocks of 343 feet, depth on sill of 13 feet, and a capacity of 4,000 tons, and the largest railway having a length on blocks of 180 feet, a depth of 8 feet forward and 12 feet aft, and a capacity of 900 tons.

Tides.—The mean range of tides is 5.8 feet at Wilmington, 5.5 feet at Newport, and 3.5 feet at Christiana. High and low water at Newport occur 1 hour 10 minutes and 1 hour 40 minutes, respectively, later than at Wilmington, and at Christiana 2 hours 30 minutes and 3 hours, respectively, later than at Wilmington.

DIRECTIONS, CHRISTIANA RIVER.

The following directions are available for small vessels of 10 feet or less draft; vessels of deeper draft should take a pilot:

Enter the river on a course about 335° true (N by W ½ W mag.), heading 40 yards to the right of Bellevue range rear lighthouse and 50 yards to the left of the light on the end of the north jetty. Pass close to the end of the north jetty and follow it at a distance of 100 to 200 feet to its inner end. Then steer 267° true (W ½ N mag.) for 500 yards, and then favor slightly the southwest bank at a distance of about 100 yards to the first bridge. From this point to 200 yards above the third bridge the mid-channel is the best water, and from there to the first bridge above Mill Creek the channel leads along the north and west sides. From that point to Newport the best water is about in mid-river.

DELAWARE RIVER, CHRISTIANA RIVER TO PHILADELPHIA.

There is a powder factory on **Carney Point**, on the south side of **Helms Cove**, eastward of the entrance to Christiana River. A tank and several chimneys are prominent.

Penngrove is a town on the east side of Delaware River, 2 miles northeastward of the entrance to Christiana River. It is a railroad terminus, and has communication by ferry with Wilmington and by steamer in summer with Philadelphia and Salem. There is a depth of 7 feet at the steamboat wharf.

Edgemoor is a village on the west side of Delaware River, 2 miles northward of the entrance to Christiana River. A rolling mill and a buoy depot of the Lighthouse Service are located here.

A dike, marked at its end by a red buoy, extends 580 yards off **Oldmans Point**, on the east bank, between **Marcus Hook Bar** and **Cherry Island Flats**.

Oldmans Creek, on the east side of Delaware River, 4 miles above Christiana River, is the approach to the villages of **Pedricktown** and

Auburn, 4½ and 9½ miles, respectively, above the mouth. Considerable produce is shipped from the creek, the deepest draft of vessels being 8 feet. A channel 6 feet deep and 100 feet wide has been dredged across the bar at the mouth, 6 feet deep and 75 feet wide to Pedricktown, and 5 feet deep and 40 feet wide to Auburn, and nine cut-offs have been made between the mouth and Auburn.

To enter Oldmans Creek steer about 73° true (E ¾ N mag.) with **Cherry Island range rear light** (black circular daymark on mast above white tower) astern to buoy No. 3, then steer northeastward into the mouth of the creek to buoy No. 5. Above the entrance the best water follows a general mid-creek course to the head.

Three drawbridges cross Oldmans Creek below Auburn. The highway bridge 2½ miles above the entrance has a draw opening 34 feet wide, the railroad bridge ¾ mile above has a draw opening 32 feet wide, and the highway bridge at Pedricktown has a draw opening 30 feet wide. There is a fixed bridge at Auburn under which small boats can pass.

Tides.—The mean rise and fall of tides is 6 feet at the entrance, 2.5 feet at Pedricktown, and 1 foot at Auburn. At Pedricktown high and low water occur 35 minutes and 25 minutes, respectively, after high and low water at the entrance, and at Auburn high and low water occur 2 hours and 45 minutes after high and low water at the entrance.

Marcus Hook, on the west side of Delaware River, 2 miles below Chester, has oil refineries and is an important oil-shipping point. There is a depth of 25 feet at the public wharf and 20 to 30 feet at the oil wharves. Rocky patches with a least depth of 24 feet have been found off the lower oil wharf. The State quarantine station is located here (see p. 69), and also a small harbor, protected from drifting ice by ice breakers.

Raccoon Creek, on the southeast side of Delaware River, 1 mile southward of the lower end of Chester, is the approach to the towns of **Bridgeport** and **Swedesboro,** 1½ and 8 miles, respectively, above the entrance. It has considerable trade in vessels up to 6½ feet draft and this draft is taken to Swedesboro.

A channel has been dredged 7 feet deep and 75 feet wide from the entrance to Bridgeport, 7 feet deep and 60 feet wide to Springer Wharf, 2½ miles above Bridgeport, and 5 feet deep and 50 feet wide to Swedesboro.

There is a bar off the entrance with a least depth of 2 feet on it, and a channel eastward of it to the mouth of the creek, with a least depth of 7 feet from northward and 8 feet from southward. A channel 7 feet deep has been dredged from the mouth of Raccoon Creek west-northwestward through the bar to the Delaware River channel. It is marked by buoys and a lighted range, but is subject to rapid shoaling, and most of the vessels entering the creek use the natural channel eastward of the bar. There are no marks for the natural channel, and local knowledge is required to carry the best water into the entrance. There is a pile of rocks, bare at extreme low water and unmarked, on the south side 300 yards westward of the entrance and 100 yards eastward of the channel from southward.

Two bridges, each having a draw opening 32 feet wide, cross Raccoon Creek at Bridgeport. Three bridges cross the creek at Swedesboro. The lower bridge has an opening 60 feet wide; the second is

fixed and has a headroom of 21 feet at high water; the third, at the head of the dredged channel, is fixed and has a headroom of 7 feet at high water.

Tides.—The mean rise and fall of tides is 6 feet at the entrance and 5 feet at Swedesboro. At Swedesboro high and low water occur 1 hour and 30 minutes after high and low water at the entrance.

A **rocky area** having a depth of about 27 feet lies near the intersection of the Marcus Hook and Chester ranges, and between the new 35-foot channel marked by these ranges and the old Schooner Ledge dredged channel. It is marked by a horizontally striped gas buoy.

Chester is an important manufacturing city 73½ miles above the entrance to Delaware Bay and 14½ miles below Philadelphia. It has considerable trade in vessels up to 25 feet draft. There is a depth of 22 feet at the long factory wharf ½ mile southwestward of Ridley Creek, 5 to 12 feet at the public wharves between there and Chester Creek, and 8 to 25 feet at the principal wharves of the industrial plants southwestward. Water and limited quantities of coal can be obtained at Chester. There are several machine shops at Chester and marine railways at Essington, 3 miles eastward.

Chester Island, in mid river off the upper wharves at Chester, is marshy and has no prominent mark. A dike visible at high water extends from the upper end of the island to the eastern shore of the river. The channel from the dike to the southwest end of the island has been used as a dumping ground and shoaled to a depth of 6 feet.

Chester Creek has a depth of 5½ feet for a distance of 300 yards above the mouth to the second bridge, and about 3 feet for 2 miles to the village of **Upland.** There is a railroad drawbridge just inside the mouth, with a single draw opening 52 feet wide and a headroom of 1½ feet at high water, and there are numerous fixed bridges between this point and Upland, having a least headroom of 6 feet at high water. Most of the business in the creek is in barges of about 6 feet draft carrying coal to industrial plants. The mean rise and fall of tides is 5.8 feet at the entrance and about 5 feet at Upland.

Ridley Creek has a depth of about 5 feet at high water to a dam 2 miles above the mouth. The shoalest places are at the mouth and at the head of navigation. The creek is crossed by numerous fixed bridges having a least headroom of 8 feet at high water. There is little business by water.

Eddystone, a town just above Chester, has a large factory and a wharf with a depth of 17 feet at the end.

Crum Creek, just westward of Schooner Ledge range front light, is bare in places at low water, and has a depth of 5 feet at high water to the fixed railroad bridge about 1 mile above the entrance. It is crossed by two drawbridges ½ mile above the entrance, having a least width of 28 feet and a least headroom of 4 feet at high water.

Darby Creek, ½ mile northeastward of Schooner Ledge range front light, has a depth of about 7 feet for 4 miles above the mouth and 3 feet for a further distance of about 2 miles to the fork, ½ mile from the town of **Darby.** It is used only by small pleasure boats. Three bridges cross the river below the fork. Two of them have draw openings and the third is fixed, but has a high arched span with

sufficient headroom for any of the boats using the creek. The mean rise and fall of tides is about 6 feet at the mouth, 5 feet at the fork, and nothing at Darby.

Essington is a town on the north side of Delaware River northward of Tinicum Island. There is a depth of 14 feet at the shipyard wharf and 3 to 4 feet at the clubhouse wharves. Vessels bound to the town, unless of light draft, must pass around the western end of Tinicum Island. The largest marine railway has a capacity of 100 tons, and can take out vessels 120 feet long, draft 6 feet forward and 14 feet aft.

Tinicum Island, 11 miles below Philadelphia, is a long, marshy island with bushes on its western end.

Mifflin Bar dike extends from the first point above Tinicum Island west-southwestward for a little over 1 mile to within 800 yards of the eastern end of Tinicum Island. It was submerged at high water in 1915, but is to be raised above high water. There is an opening 150 yards wide near the eastern end, marked by spar buoys on each side, through which a depth of about 2 feet at low water can be taken to the channel northward of Tinicum Island.

There are several large factory buildings between **Thomson** and **Crab Points**, and two wharves, the upper one having a depth of 20 feet at the end and the lower one 11 feet.

Billingsport is a village on the southeast side of Delaware River, 1 mile above the upper end of Tinicum Island. It has communication by steamer with Philadelphia and other points on the Delaware River. There is a depth of 6 feet at the main wharf.

Mantua Creek, on the southeast side of Delaware River, ½ mile above Billingsport, is the approach to the villages of **Paulsboro**, **Mount Royal**, and **Mantua**, 1½, 4, and 7½ miles, respectively, above the entrance. A channel has been dredged 12 feet deep and 100 feet wide from the Delaware River to the fertilizer factory 700 yards above the entrance, 8 feet deep and 80 feet wide to Paulsboro, and 7 feet deep and 60 feet wide to the wharf near Mount Royal. There is a depth of about 1 foot to the head of navigation at Mantua. There are jetties on both sides at the entrance, and the channel is buoyed to the fertilizer factory. Vessels of 12 feet draft go to the fertilizer factory, 7 feet to Mount Royal, and about 4 feet to Mantua.

A railroad and a highway drawbridge, having clear openings 44 feet and 41 feet wide, respectively, cross the creek at Paulsboro. There are two fixed bridges about ¾ mile above the wharf at Mount Royal. The clear width and height above high water of the lower bridge are 70 feet and 10 feet, and of the upper bridge 26 feet and 9 feet. There are two fixed bridges close together at Mantua, with a least headroom of 13 feet at high water, but boats seldom go above them.

Tides.—The mean rise and fall of tides is 5.6 feet at the entrance, 4.5 feet at Paulsboro, 4 feet at Mount Royal, and 2.5 feet at Mantua. High and low water occur later than at the entrance, as follows: Paulsboro, 20 minutes; Mount Royal, 50 minutes; Mantua, 2 hours and 5 minutes.

Woodbury Creek, on the southeast side of Delaware River, 1 mile southward of the entrance to Schuylkill River, has been improved by dredging a channel 6 feet deep and 60 feet wide from Delaware River

to a highway bridge 1 mile above the entrance, and 6 feet deep and 40 feet wide to the town of **Woodbury**, 3½ miles above the mouth, with two cut-offs near the mouth and one near the head. Two drawbridges cross the creek below the head. The lower bridge is a center pier draw with one clear opening 40 feet wide and a headroom of 6 feet at high water when closed; the south opening is the better. The second bridge, ¾ mile above the lower one, is a center pier draw with one clear opening 32 feet wide and a headroom of 5 feet at high water when closed. There is a fixed highway bridge at Woodbury with a headroom of 10 feet at high water. The dredged channel stops at this bridge and there is little navigation above. The mean rise and fall of tides is 5.5 feet at the entrance and 4 feet at Woodbury. High and low water at Woodbury occur 40 minutes and 50 minutes, respectively, later than at the mouth.

There is a middle ground in Delaware River northwestward of the entrance to Woodbury Creek, which is marked on the southwest end by a broken-down pier (**Block Island**) with a white slatted beacon on it. Vessels bound into Woodbury Creek can pass on either side of the middle ground. The channel at the entrance is buoyed, but some local knowledge is necessary to enter with the best water.

Vessels **approaching Woodbury Creek** from southwestward should pass 400 yards southwestward and southward of Block Island. Approaching from northward, eastward of the middle ground, pass 100 to 200 yards off the wharf at Philadelphia Sanitarium, 250 yards offshore abreast the white monument at **Red Bank**, and 600 yards off the mouth of the creek. The course in the channel into the entrance is 112° true (SE by E ¼ E mag.), heading for a shanty and landing on the northeast side at the entrance until about 100 yards from it, and then keeping in mid-creek. At low water the channel is well defined in the creek.

Schuylkill River, emptying into Delaware River at the lower end of the city of Philadelphia and at the western end of League Island, is navigable to the entrance of the Schuylkill Navigation Canal, near the **Fairmount Dam**, 7½ miles above the entrance, and by canal for a farther distance of 80 miles. It is an important outlet for a part of the commerce of Philadelphia. There are large storage elevators at **Girard Point**, oil-refinery wharves opposite **Point Breeze** and at **Gibsons Point**, and other industrial wharves, besides several yacht clubs. The river has a large trade in vessels up to 30 feet draft to Girard Point, 29 feet to Point Breeze, 20 feet to Walnut Street Bridge, and in tugboats and barges to Fairmount Dam.

Dredging is being done by the city of Philadelphia to maintain a channel with a depth of 30 feet to Girard Point, 28 feet to Penrose Ferry Bridge, 26 feet to Point Breeze, 24 feet to Gibsons Point, and 21 feet to **Walnut Street Bridge**, 6½ miles above the mouth, and dredging is also done at times between Walnut Street Bridge and Fairmount Dam. The project width to Walnut Street Bridge is 200 feet, but parts of the channel are often dredged to a width of only 100 feet. The project has been completed, but the channel is subject to considerable shoaling and is redredged in sections at irregular intervals. In December, 1915, there was a depth of 30 feet to Girard Point, 26 feet to Point Breeze, 23 feet to Gibsons Point, 20 feet to Walnut Street Bridge, and 12 feet to Fairmount Dam.

Bridges.—The following are the drawbridges crossing Schuylkill River, the distance in nautical miles above the entrance, the least width of the two draw openings, and the clear height above high water:

Penrose Ferry (highway), 1.2 miles, 183 feet, 18 feet.
Passyunk Avenue (highway), 3.1 miles, 200 feet, 33 feet.
Baltimore & Ohio Railroad, 4.6 miles, 75 feet, 18.5 feet.
Greys Ferry (railroad), 4.9 miles, 75 feet, 22.8 feet.
Greys Ferry (highway), 4.9 miles, 75 feet, 22 feet.
Pennsylvania Railroad, 5.7 miles, 65 feet, 25.5 feet.
South Street (highway), 6 miles, 75 feet, 30.7 feet.

Walnut Street Bridge, 6.5 miles above the entrance, and the bridges above as far as Fairmount Dam, are fixed and have sufficient headroom for the passage of small tugboats and barges. The least headroom at high water is 21 feet.

Bridge regulations prescribed for the Penrose Ferry Bridge require that it shall be opened at all times during the day or night to all vessels that can not pass underneath it, if no person or vehicle passing over the bridge is then in the way. The signal is three blasts of a whistle or horn, to be answered from the bridge by three blasts if the bridge can be opened immediately, or two blasts if the bridge can not be opened immediately. The draw need not be opened for the passage of a tug or other craft equipped with a smokestack which can be lowered so as to permit passage under the closed draw.

The **channel** in Schuylkill River is narrow and crooked, and is marked by range beacons from the entrance to **Yankee Point**, numbered consecutively from the mouth. **Schuylkill River range lights** (triangular slatted daymarks), although not numbered, are considered to be range No. 1, and range No. 5, leading through Penrose Ferry Bridge, is omitted. All ranges except range No. 1 are maintained by the city of Philadelphia and are posts with diamond-shaped marks 4 or 5 feet square. In addition the channel as far as the Baltimore & Ohio Railroad bridge is marked in places by buoys. Above this point chart 381 is the best guide. A black buoy off the mouth of **Mingo Creek** marks a rock with 8 feet over it. The bridges and the sharp bends in the river make it necessary for sailing and large vessels to employ towboats. **Anchorage** in Schuylkill River is prohibited except by permission of the commissioners of navigation.

Schuylkill Navigation is a succession of short canals and slack-water pools following the course of the Schuylkill River from a point near Fairmount Dam, 7½ miles above the entrance, to **Port Clinton**, a distance of about 80 miles. It is used mostly by canal boats, but is also frequented by many yachts and motor boats. The available depth throughout at low stage is about 4½ feet. It has 55 locks, each 18 feet wide and 110 feet long. All of the bridges crossing the canal are fixed, the lowest being a bridge at **Norristown**, 21 miles above the mouth, which has a headroom of 13 feet at mean summer stage and 1 foot at flood stage. The canal is closed for about 4 months in winter.

League Island, at the junction of the Delaware and Schuylkill Rivers, is the site of a **United States navy yard**. The basin on the north side of the island and its entrance from Schuylkill River have been dredged to a depth of 30 feet, and are not open to general navigation. The channel northward of the island having its en-

trance from Delaware River has a depth of 6 feet and is used only by boats engaged in dredging operations. Storm warnings are displayed at the navy yard.

Big Timber Creek, on the southeast side of Delaware River southward of Gloucester, has a depth of about 3 feet on the flats at the mouth and deeper water inside. Tugboats and barges of 6 feet draft go to the wharves at **Westville.** There is a drawbridge at the mouth and two fixed bridges at Westville with a least headroom of 4 feet at high water, under which small motor boats and barges can pass. The river is navigable at high water for several miles.

Gloucester is a city on the eastern side of Delaware River opposite the lower end of Philadelphia. The depths at the wharves are 8 feet or less, the principal traffic being coal and building materials. A ferry runs to Philadelphia.

Newton Creek, on the eastern side of Delaware River between Camden and Gloucester, is crossed by three fixed bridges near the mouth and can be entered only by small boats.

Camden is an important manufacturing city on the eastern side of Delaware River, opposite Philadelphia; the two cities are connected by several lines of ferries.

Petty Island, eastward of the main channel at the northern end of the city of Camden, is 1½ miles long, low, and sparsely wooded. The channel eastward of Petty Island is principally used by the traffic to and from Cooper Creek, and has a least depth of 12 to 15 feet at the westerly entrance, which is generally used and is easy of access with the aid of the chart. The easterly entrance is a dredged cut 300 feet wide, with a least depth of about 11 feet, between two buoys which mark the ends of spits bare at low water extending from Fisher Point Dike and the northeast end of Petty Island. There is generally little depth at the wharves on the south side of the channel.

Fisher Point Dike, extending nearly ¾ mile west-southwestward from Fisher Point, shows well above high water and is sparsely wooded to the end.

Cooper Creek, southward of Petty Island, has been improved by dredging a channel 12 feet deep and 70 feet wide across the flats at the mouth and 1¼ miles above the entrance. There is a depth of about 6 feet for a further distance of about 1 mile, and a depth of 2 feet at low water and 4 feet at high water to **Stoys Landing,** at the head of navigation 7¼ miles above the entrance. Vessels using the creek are tugboats and barges up to 12 feet draft to the industrial plants in the lower part, and small truck and pleasure boats in the upper part. There is a black buoy on the eastern side of the dredged channel at the entrance. Above the entrance the best water follows a general mid-creek course.

Cooper Creek is crossed by seven bridges between the entrance and the head of navigation. The first four, all within a distance of 3 miles from the mouth, are drawbridges, having a least draw width of 37 feet and a least headroom of 4 feet at high water when closed. The others are fixed bridges with a least width of 52 feet and a least headroom of 7 feet at high water.

Tides.—The mean rise and fall of tides is 5.3 feet at Cooper Point, just outside the entrance, and 2 feet at Stoys Landing. High and low water at Stoys Landing occur 2 hours and 15 minutes after high and low water at Cooper Point.

Regulations prescribed for Cooper Creek require that vessels propelled by machinery shall not proceed at a greater speed than 4 statute miles per hour while passing a plant engaged in dredging operations, and that the engine must be stopped while passing. The signal to the plant to lower the mooring lines is four short blasts in quick succession, given when about ½ mile or about 5 minutes in time from the plant.

Philadelphia, foot of Chestnut Street, is 88 miles above Cape Henlopen. General information relating to the port is given on pages 65–72.

Wharves.—The wharves and piers on the Philadelphia side of Delaware River are numbered consecutively from the foot of Market Street northward to Port Richmond and southward to Greenwich Point. The wharves at Port Richmond are numbered independently. The principal wharves have ample depth, many having depths of over 40 feet at the ends and over 30 feet alongside. The Pennsylvania Railroad coal terminals are at **Greenwich Point,** where there are depths of 20 to 30 feet at the wharves and facilities for rapid coaling. The Philadelphia & Reading Railroad terminal is at **Port Richmond,** where there are depths of 18 to 30 feet at the principal wharves. Cramps shipbuilding plant is just below Port Richmond.

The wharves on the Camden side are numbered consecutively from **Pavonia** southward to Newton Creek, except for the Pennsylvania Railroad wharves, which are numbered independently. The principal wharves have depths at the ends of 13 to 36 feet at Piers 46 to 51 in the southerly part of Camden, 12 to 21 feet in the vicinity of **Kaighn Point,** and 10 feet in the vicinity of **Cooper Point.**

DELAWARE RIVER ABOVE PHILADELPHIA.

The Delaware River is navigable for a distance of 24½ miles above the Pennsylvania Railroad bridge at Philadelphia to the city of Trenton. It is crooked and has many bars and shoals, but has been improved by dredging a channel 200 feet wide and 12 feet deep from Philadelphia to Trenton. It is marked by buoys and by lighted ranges in the upper end and is easily followed with the aid of the chart. Day ranges have been established by the United States engineers in connection with the dredging operations to mark the channel between Torresdale and Bordentown; in 1915 only part of them were in position. When bound up the river the day ranges ahead are square and those astern are diamond shaped.

Steamers of 6 to 9 feet draft make regular trips to all of the towns on the river between Philadelphia and Trenton, and there is also considerable trade on the river in steamers, schooners, and barges up to 14 feet draft to the industrial plants along the shores. Schooners take a tow at Philadelphia or below. The river is also the approach to the Delaware & Raritan Canal, which has its entrance at Bordentown. **Directions** for the river from Bordentown to Philadelphia are given on page 258, under "Inside route, New York to Norfolk."

The Pennsylvania Railroad bridge, crossing the river 1 mile above Petty Island, has a center pier draw, each opening 120 feet wide,

with a headroom of 50 feet at high water under either the draw when closed or the fixed spans.

Pensauken Creek, on the eastern side, ¾ mile above the railroad bridge, has a depth of about 3 feet at low water for a distance of 5 miles above the mouth, but is crossed by six fixed bridges, which limit the navigation to barges and motor boats. The first three bridges have a headroom of about 10 feet at high water and the others a least headroom of about 3 feet at high water.

Riverton is a town on the eastern side, 3¼ miles above the railroad bridge. There is a depth of 7 feet at the steamboat wharf.

Bridesburg, Tacony, and **Torresdale** are parts of the city of Philadelphia, 1, 2½, and 6 miles, respectively, above the railroad bridge.

Frankford Creek, on the western side, 1½ miles above the railroad bridge, has been dredged to a depth of 6 feet and width of 60 feet for ⅜ mile above the mouth, and has a depth of 5 feet at high water for a further distance of about 2 miles. It is crossed by three drawbridges within a distance of 1 mile from the mouth and by several fixed bridges between the upper drawbridge and the head of navigation. Navigation is confined almost exclusively to the lower ½ mile, and the deepest draft entering is about 6 feet.

Pennypack Creek, on the western side, 4½ miles above the railroad bridge, has a depth of about 6 feet at high water to a fixed bridge 1 mile above the entrance. It is used by tugboats and barges of 6 feet draft. The **Philadelphia House of Correction** is on the south side.

The **Philadelphia filter plant** is on the western side of the river, ⅜ mile above the mouth of Pennypack Creek. A very tall chimney and a white cylindrical tower are prominent.

Rancocas River, on the eastern side of the Delaware River, 5½ miles above the railroad bridge, has a depth of 7 feet for a distance of 4½ miles above the mouth and 5 feet to the junction of the Lumberton and Mount Holly branches, 7¾ miles above the mouth. It is used by many tugboats and barges up to 10 feet draft and by one freight steamer of 7 feet draft, which goes as far as Hainesport, on the Lumberton Branch. The Lumberton Branch above Hainesport and the Mount Holly Branch are used only by small pleasure boats. **The channel** of Rancocas River, above Bridgeboro especially, is very narrow and crooked, follows generally the ebb-tide bends back and forth between shoals and is difficult, even with local knowledge. The drawbridges crossing the river below the fork are described with Delanco, Bridgeboro, and Bougher.

The channel from the fork to the town of **Mount Holly,** a distance of 4½ miles, is nearly bare in places at low water and has a depth of about 3 feet at high water. A drawbridge with an opening 30 feet wide, and two fixed bridges with a least headroom of 8 feet at high water, cross the river at Mount Holly.

There is a depth of 3 feet at low water in the **Lumberton Branch** to the town of **Hainesport,** 2½ miles above the fork, and about 4 feet at high water for a further distance of 2¼ miles to the town of **Lumberton.** Two bridges cross the Lumberton Branch at Hainesport. The highway bridge has a draw opening and the railroad bridge is fixed, but has sufficient headroom for small unmasted boats

Riverside is a town on the south side of Rancocas River, 1¼ miles above the entrance. It has several factories and considerable business by water.

Delanco is a town on the north side of Rancocas River, 1½ miles above the entrance. There are wharves on both the Delaware and Rancocas River water fronts. There is a railway here capable of hauling out boats of 50 feet length and 5 feet draft. Two center pier drawbridges cross Rancocas River between Delanco and Riverside. Each opening in the highway bridge is 41 feet wide and in the railroad bridge 43 feet.

Bridgeboro is a village on the south side of Rancocas River, 3 miles above the mouth. A drawbridge with openings 45 and 50 feet wide crosses the river at this point.

Bougher is a village on the south side of Rancocas River, 7 miles above the mouth. A bridge having a center pier draw with a width of 50½ feet in the south opening crosses the river at this point. The north opening is shoal.

Hawk Island is a marshy island, wooded in the center, at the junction of Delaware and Rancocas Rivers.

Mud Island, ¾ mile northward of Hawk Island, is a mud flat covered with marsh grass in summer and is partially submerged at high water. A channel used only by motor boats leads around the northwest side.

Beverly is a city on the eastern side, 9 miles above the railroad bridge at Philadelphia. The principal business by water is by the regular river steamers and a few coal barges. There is a depth of 9 feet at the steamboat wharf. A black standpipe is prominent.

Edgewater Park is a settlement of summer residences along the high bank eastward of Beverly. There are no wharves except for small motor boats.

Neshaminy Creek, on the northern side, ¾ mile east-northeastward of the standpipe at Beverly, has a depth of about 3 feet at the mouth and is used at high water by barges of 8 feet draft and by pleasure boats to the second bridge, 1¼ miles above the mouth. It is crossed by two fixed bridges under which barges and motor boats can pass.

Burlington is a city on the southern side of Delaware River, 12 miles above the railroad bridge at Philadelphia. It has several industrial plants and considerable trade by water in steamers, schooners, and barges, the deepest draft being 15 feet. There is a depth of 12 feet at the public wharf, 400 yards westward of a broad standpipe. Water and coal can be obtained at the wharves. The city is connected with Bristol by a ferry, which in summer also makes landings at Burlington Island.

Burlington Island, just north of the city of Burlington, is high and sparsely wooded. The center of the island is occupied by a pleasure park (Burlington Island Park). There is a wharf on the northwest side with a depth of 8 feet at the end, at which river steamers and motor boats land. The channel southeastward of the island has a depth of 7 feet, being shoalest at the upper end. Vessels of 12 to 15 feet draft use the lower end as far as a pipe foundry, ¾ mile above the entrance, but the upper end is used only by motor boats.

Bristol is a town on the northwest side of the river, 13 miles above the railroad bridge at Philadelphia. It is the terminus of the Delaware & Lehigh Canal. The principal trade by water is by the regular steamer line. There is a depth of 12 feet at the wharves. Just above the town is a pipe foundry, at which schooners and barges load to a draft of 14 feet.

The entrance to the **Delaware & Lehigh Canal** is at the south end of the town of Bristol. It is navigable to **Easton** and **Mauch Chunk**, distant 52 and 94 miles, respectively, above the entrance, and is used principally by coal barges and an occasional motor boat and yacht. The locks are 90 feet long, 11 feet wide, and 6 feet deep.

Florence is a town on the south side of the river, 16 miles above the railroad bridge at Philadelphia. There is a large pipe foundry on the point at the bend of the river, at which schooners and barges load to a draft of 14 feet. The steamboat wharf, ¾ mile eastward of the bend, has a depth of 12 feet at the end.

Money Island, abreast the eastern end of Florence, is a wooded marsh. The channel northward of the island is bare at low water. **Roebling** is a town established in connection with a large wireworks 17½ miles above the railroad bridge at Philadelphia. There is a depth of 10 feet at the clubhouse wharf and 12 feet at the wireworks wharf 400 yards above.

Newbold Island, 18½ miles above the railroad bridge at Philadelphia, is high and sparsely wooded, and has a house on the northwest side. A dike extends 300 yards westward from the lower end. The channel eastward of the island is nearly bare at low water.

Fieldsboro is a town on the high bank on the east side of the river, ¾ mile above the upper end of Newbold Island. There are factories and a railroad yard close alongshore at the foot of the bank. The steamboat wharf has a depth of 10 feet at the end.

Bordentown is a town on the high bank on the east side of the river, 21 miles above the railroad bridge at Philadelphia. The principal trade by water is by the regular river steamers, and it is important as the outlet of the Delaware & Raritan Canal, which is described on page 253. There is a depth of 7½ feet to the entrance of the canal. The channel is buoyed and leads eastward of the shoal extending ⅜ mile south-southwestward of the point on the west side of the canal entrance. There is a depth of 9 feet at the steamboat wharf. Gasoline and provisions are obtainable. Directions are given on page 258.

Crosswick Creek, at the north end of Bordentown, has a depth of about 3 feet for 3 miles above the mouth, but the channel is crooked and difficult. A fixed bridge, under which small boats can pass, crosses the creek at the mouth.

The **dredged channel** from Bordentown to Trenton is well marked by buoys and range lights, and is easily followed. A railroad bridge with a center pier draw, each opening 120 feet wide, with a headroom of about 50 feet above high water, crosses the river 1 mile below the wharves at Trenton.

Trenton, at the head of navigation, 24½ miles above the railroad bridge at Philadelphia, has two wharves at the lower end of the city, with a depth of 12 feet at the ends. The dredged channel terminates at present at these wharves, but in 1915 work was in progress to dredge a channel along the Trenton side 12 feet deep and 200 feet wide for a further distance of ¾ mile to the Pennsylvania Railroad bridge, with a turning basin below the bridge. The mid-river between the wharves and the railroad bridge has a depth of 3 to 4 feet and is used only as an anchorage for motor boats. There is no navigation above the bridge. The deepest draft of vessels going to the wharves are tugboats and coal barges drawing 10 feet.

Tides.—The mean rise and fall of the tides is 5.3 feet at Philadelphia, 5.4 feet at Burlington, 4.7 feet at Bordentown, and 4.2 feet at Trenton. Daily predictions for Philadelphia are given in the tide tables published annually by the Coast and Geodetic Survey.

Ice.—The river above Philadelphia is generally closed to navigation by ice for extended periods during January and February, and during severe winters navigation is practically suspended during these months. Ice seldom forms before January.

Freshets.—During March and April freshets of from 10 to 20 feet in height above mean low water may be expected at Trenton. The highest water level is reached during the breaking up of the ice in the spring, and rain freshets do not ordinarily cause a height of over 9 feet above mean low water. Unless accompanied by ice, freshets are not ordinarily dangerous to shipping. The highest freshet on record, occurring in 1903, reached a height above low water of 21.6 feet at Trenton, 19.6 feet at Bordentown, and 12.8 feet at Bristol.

Directions for Delaware River from Bordentown to Delaware City are given on pages 258–261, under the heading "Inside route, New York to Norfolk."

COAST FROM CAPE HENLOPEN TO CAPE CHARLES.

From Cape Henlopen the coast trends southward for 21 miles to Fenwick Island lighthouse and then trends south-southwestward for 96 miles to Cape Charles. The coast southward of Cape Henlopen is a chain of low sand beaches, backed by woods, and presents few characteristic features from offshore. There are few towns along the outer beach, and the most prominent marks are the lighthouses and Coast Guard stations. The only harbor of refuge between Delaware and Chesapeake Bays is Assateague Anchorage, 61 miles southward of Cape Henlopen. The inlets and interior waters are described under "Inside waters, Cape Henlopen to Cape Charles," following.

The only towns visible from offshore between Cape Henlopen and Cape Charles are the summer resorts of **Rehoboth, Bethany Beach,** and **Ocean City,** 4, 15, and 28 miles, respectively, southward of Cape Henlopen lighthouse. Rehoboth is distinguished by a standpipe, Bethany Beach is a small group of houses without prominent marks, and Ocean City is marked by a water tank and several other prominent objects.

The coast between Cape Henlopen and Cape Charles is fringed with broken ground, on which lumps with depths up to 6 fathoms are found for distances of 8 to 11 miles from shore. The latest information from the old surveys respecting the outlying shoals is shown on the charts. The principal ones to which names have been applied are mentioned in the following description. There are light vessels off the outer edge of the broken ground and deep-draft vessels keep outside of them.

Hen and Chickens Shoal, close inshore off Cape Henlopen, by the last survey, had a least depth of 5 feet, and there was a channel westward of it with a least depth of 22 feet, seldom used except by small boats. Strangers should pass outside of it. At night a red sector in Harbor of Refuge lighthouse covers the shoal. A black buoy, lying nearly 3 miles south-southeastward of Cape Henlopen light-

house, marks the south end of the shoaler part, but a bank with 4 to 5 fathoms extends 3 miles southeastward from the buoy.

Fenwick Island lighthouse is a white tower. The light is occulting white (light 50 seconds, eclipse 10 seconds), 83 feet above the water, and visible 15 miles.

Shoals with depths of 5 fathoms or less extend 8 miles offshore eastward of Fenwick Island lighthouse. **Fenwick Island Shoal** had a least depth of 11 feet by the last survey and is marked on the west side by a black whistling buoy. A wreck with 5 fathoms over it and marked by a gas and whistling buoy lies 10½ miles, 92° true (E ⅞ S mag.) from Fenwick Island lighthouse.

Fenwick Island Shoal light vessel, 13¾ miles 92° true (E ⅞ S mag.) from Fenwick Island lighthouse, has a red hull with a white band covering bulwarks and "Fenwick" on each side and two masts with a black lantern gallery at each masthead. The lights are 56 feet above the water, fixed white on the foremast, visible 11 miles; and fixed red on the mainmast, visible 8 miles. The fog signal is a siren, blast 3 seconds, silent 17 seconds. If the siren is disabled a steam whistle will sound the same characteristic. The submarine bell strikes "3" every 6⅔ seconds.

Isle of Wight Shoal, 7 miles 120° true (SE ¾ E mag.) from Fenwick Island lighthouse, had a least depth of 16 feet by the last survey and is marked on the western side by a horizontally striped buoy. A shoal with 3½ fathoms on it lies about midway between Isle of Wight Shoal and Fenwick Island Shoal.

Little Gull Bank, 2½ miles southeastward of Ocean City, had a least depth of 12 feet by the last survey. It is marked on the east side by a gas and whistling buoy and at the southwest end by a horizontally striped buoy.

Great Gull Bank, 2½ miles southward of Little Gull Bank, had a least depth by the last survey of 16 feet at the southwest end and is unmarked.

Numerous unmarked spots with less than 5 fathoms lie offshore between Great Gull Bank and Winter Quarter Shoal, as shown on the chart.

Winter Quarter Shoal, 11 miles 72° true (E by N mag.) from Assateague lighthouse, had a least depth of 12 feet by the last survey, and is marked on the southwest end by a horizontally striped buoy. There is a gas and whistling buoy 3¼ miles southeastward of the shoal.

Winter Quarter Shoal light vessel, 20 miles 88° true (E ½ S mag.) from Assateague lighthouse, has a straw-colored hull with "Winter-Quarter" on the sides, and two masts with a lantern gallery at the foremast head. The light (shown from the foremast) is group flashing white (flash 2 seconds, eclipse 3 seconds, flash 2 seconds, eclipse 13 seconds), 50 feet above the water, and visible 13 miles. The fog signal is a chime whistle, blast 3 seconds, silent 57 seconds. If whistle is disabled, a bell will be struck by hand. The submarine bell strikes "45" every 24⅓ seconds.

Assateague lighthouse is a red tower. The light is fixed white, with a fixed red sector between 28° true (NE ⅞ N mag.) and 61° true (ENE mag.), 154 feet above the water, and visible 19 miles. The tower shows well above the trees surrounding it, and is the most prominent mark in the vicinity.

Assateague Anchorage, about midway between the entrances to Delaware and Chesapeake Bays, is extensively used as an anchorage by schooners, tows, and other small vessels, usually in heavy northerly weather. There are depths of 20 to 24 feet close southwestward of the western end of Fishing Point, sheltered from northerly and northeasterly winds, and depths of 9 to 18 feet inside the bight formed by Fishing Point, sheltered from all but southwesterly winds. A limited number of small vessels can find anchorage in the eastern part, sheltered from all winds, but this part is generally crowded in heavy weather.

Fishing Point is a bare sand spit and is extending rapidly northwestward. From 1908 to 1911 the rate of movement was 200 yards per year, and from 1911 to 1915 it was about 100 yards per year. Most of the point westward of Fishing Point light shows but little above high water, and this, together with the movement of the point northwestward, should be kept in mind by strangers at night. The shoaling is abrupt at the northwest end of the point. **Fishing Point light** (fixed white, with red sector) is ¾ mile from the end of the point and **Fishing Point outer light** (flashing white) was 200 yards southeastward from the end of the point as located in September, 1915.

A prominent **fish factory** with iron stacks is located on the point on the north side of Fishing Point, north-northeastward of Fishing Point light. There is a depth of about 11 feet at the wharves, where coal in limited quantities and water of inferior quality can usually be obtained. Shoals, usually marked by bush stakes, extend northward on either side of the fish factory, and the best water in approaching the wharf is from northward, passing northward and well eastward of buoy No. 6.

The shoals southeastward and eastward of Fishing Point are subject to some change both in depth and position, and strangers should proceed with caution when in this vicinity. The off-lying shoals are fairly stable, and those southward of Fishing Point are moving slowly southward. The routes usually followed by coasting vessels in approaching and leaving Assateague Anchorage are given on page 40.

Vessels bound to Assateague Anchorage **from Winter Quarter Shoal light vessel** in heavy weather should shape a course to lead southward of the shoals with 4 to 5 fathom depths between the light vessel and Black Fish Bank, and keep in a depth of at least 5 fathoms until south-southwestward of the entrance.

From Winter Quarter Shoal gas and whistling buoy vessels can head for Black Fish Bank gas and whistling buoy, but should pass ¼ mile southward of it to avoid the south end of the shoal. Vessels entering around the south side of Turners Lump should pass at least ½ mile south of the black bell buoy at its eastern end, and southward and at least 200 yards westward of the red buoy at its western end. In the daytime vessels can then steer northward to a position 100 yards eastward of the black bell buoy westward of Fishing Point, then head northeastward and round the point at a distance of 200 yards.

There is a very narrow channel, good for a depth of about 16 feet in 1915, between the eastern end of Turners Lump and the southern

end of Chincoteague Shoals, which is used by local fishing steamers, but strangers should not attempt to use it.

The channel leading **westward of Chincoteague Shoals** and about ¼ mile southward of the red buoys marking the south side of Ship Shoal is considerably used, and had a least depth of about 16 feet in 1915.

Approaching Assateague Anchorage from southward, the shore should be given a berth of at least 3 miles to clear areas of possible fish traps. A 28° true (NE ⅞ N mag.) course heading for Assateague lighthouse will lead to the black bell buoy westward of Fishing Point outer light. At night this course leads along the eastern edge of the red sector in Assateague lighthouse. Pass 100 yards eastward of the bell buoy and steer northeastward, giving the end of the point a berth of 200 yards and selecting anchorage according to draft, the water shoaling gradually from 18 feet near the end of Fishing Point to 12 feet northwestward of Assateague Anchorage light.

Porpoise Banks, 10 miles southward of Assateague Anchorage and the same distance offshore, is a broken area on which the least depths found were 5½ to 6 fathoms, as shown on the chart. The banks have not been closely developed and should be avoided by deep-draft vessels.

Parramore Banks, extending 8 miles from shore off Wachapreague Inlet, is a broken area on which the least depths found are 3½ to 4 fathoms, as shown on the chart. The banks have not been closely developed.

Hog Island lighthouse is a black skeleton tower. The light is flashing white (flash 3.5 seconds, eclipse 41.5 seconds), 180 feet above the water and visible 20 miles. There is a white unused lighthouse tower ½ mile southward of the lighthouse.

Smith Island Shoal has a least found depth of 17 feet, lying 7¾ miles 101° true (ESE ½ E mag.) from Cape Charles lighthouse. Depths less than 30 feet extend 2 miles, and broken ground with least found depths of 5½ to 6 fathoms extends 11½ miles, northeastward from Smith Island Shoal, as shown on the chart.

Cape Charles light vessel, 1¼ miles southeastward of Smith Island Shoal and 9 miles 103° true (ESE ¼ E mag.) from Cape Charles lighthouse, has a red hull with "Charles" on the sides, and two masts with a grating at the head of each. There is a fixed white light on each mast, 45 feet above the water, and visible 12 miles. The fog signal is an air siren, blast 3 seconds, silent 17 seconds. If siren is disabled, a bell will be struck by hand. The submarine bell strikes "49" every 25 seconds.

Cape Charles lighthouse is a white skeleton tower. The light is group flashing white, 180 feet above the water, and visible 20 miles. The light flashes 9 times every 60 seconds, thus: Four flashes, eclipse 6.5 seconds, five flashes, eclipse 25 seconds; each flash 1.2 seconds duration.

Smith Island, upon which the lighthouse is located, is low and sparsely wooded, and the lighthouse shows well above the trees surrounding it. There is a white unused lighthouse tower with a red band around the center, ⅝ mile east-southeastward of Cape Charles lighthouse.

The shoals and channels on the northeast side of the entrance to Chesapeake Bay are described on page 127.

Fish weirs along the outside coast between Cape Henlopen and Cape Charles are limited by regulation to certain areas. The inner limit of the areas for the entire distance is approximately ½ mile from shore. From just southward of Cape Henlopen lighthouse to abreast Rehoboth Beach Coast Guard station the distance of the outer limit from shore increases gradually from ½ mile to 2½ miles, is approximately 2½ miles offshore from abreast Rehoboth Beach Coast Guard station to Little Gull Bank, and 2 miles from shore from this point to a position eastward of Fishing Point light, with a clear opening abreast Indian River Inlet, 1¾ miles wide at the inner end and 2¼ miles wide at the outer end.

Between Chincoteague Inlet and Sand Shoal Inlet the outer limit is approximately 3 miles offshore, varying somewhat with the topography, with open areas about 1¾ miles wide at the inner ends and wider at the outer ends in front of each inlet. Between Sand Shoal Inlet and Cape Charles, the only area in which fish wiers are allowed, is an area approximately 1½ miles long and ⅝ mile wide close inshore just southward of Sand Shoal Inlet.

Tides.—The mean rise and fall of tides on the outside coast is about 4 feet, and high and low waters occur at approximately the same time as at Sandy Hook.

INLAND WATERS, CAPE HENLOPEN TO CAPE CHARLES.

The bays and connecting channels on the coast of Delaware, Maryland, and Virginia form a continuous inland waterway from Rehoboth, Del., southward to Cape Charles. There is at present no navigable entrance to the interior waters from outside between Cape Henlopen and Chincoteague Inlet, a distance of 61 miles, but southward of Chincoteague Inlet there are several inlets through which the inside waters can be reached. All of the inlets have shifting entrances, in some cases marked by buoys.

The inlets and interior waters give access to the villages and summer resorts on the beaches and the adjacent mainland. They are used by a large number of small craft engaged in the oyster and clam industry and inside and outside fishing, and by some pleasure boats. There is considerable freight business between points inside, and some coasting trade in sea food, wood, and lumber.

Improvements are in progress to connect the north end of Rehoboth Bay with Delaware Bay by a canal 6 feet deep and 50 feet wide, except in the deep cuts, where it will be 40 feet wide. This will lead from just inside the mouth of Broadkill Creek (5 miles northwestward of Cape Henlopen) southeastward in Lewes Creek to Lewes, then by a canal southeastward to Gordon Pond, then southward through **Rehoboth Canal** to Rehoboth Bay. In November, 1915, the canal had been completed from the north end southward to within ¾ mile of the north end of Rehoboth Canal.

Supplies.—Gasoline, provisions, and water can be obtained at Lewes, Rehoboth, Ocean View, Ocean City, Franklin City, Chincoteague, Wachapreague, Broadwater, Willis Wharf, and Oyster. Coal can be had in limited quantities at Ocean City, Chincoteague, and at the

fish factory on Assateague Anchorage. There is communication by telephone at all villages and by telegraph at the railroad stations.

Repairs.—There is a railway at Chincoteague capable of hauling out vessels of 180 tons, 90 feet length, and 7 feet draft, and shops for ordinary repairs to hulls and motors. There are also smaller railways at Ocean View, Ocean City, Accomac, Wachapreague, and Willis Wharf, capable of hauling out most of the boats frequenting those places.

Pilots.—There are no regular pilots for the inside passages or the inlets, but all of the local boatmen are competent pilots. In good weather there are often fishing boats outside the inlets, and strangers can obtain a fisherman for a pilot. There are no towns at the inlets from which a pilot may be obtained on signal, but a member from the Coast Guard station nearest the inlet will usually go out if a signal is set.

Bridges.—There are three fixed bridges crossing the canal between Indian River Bay and Little Assawoman Bay, with a least headroom of 8½ feet. All of the other bridges have draw openings with sufficient width for any of the boats using the inside waters.

Communication.—Lewes, Rehoboth, Ocean City, and Franklin City have railroad communication. Points on the beaches from Ocean City southward can be reached only by boat. Points on the mainland adjacent to the interior waters can be reached from the railroad a few miles westward of them.

Ice.—The inside waters northward of Chincoteague Bay are usually closed to navigation by ice during ordinary winters. From Chincoteague Bay southward the waters tributary to the inlets are closed by ice during severe winters, but remain so for only short periods of time. The principal inlets are rarely closed by ice, and are used by local boats throughout the winter.

Tides.—In the inland waterways the tides are greatly affected by winds, both in time and height, westerly winds producing low water and easterly winds high water. In Assawoman, Isle of Wight, Sinepuxent, and Chincoteague Bays northerly and southerly winds drive the water to the ends of the bays. With strong winds of long duration the change in depth may be as much as 3 feet above or below the normal high or low water, respectively, and the time of high or low water may be accelerated or retarded by more than an hour.

There is no tidal range in the inside waters from Rehoboth southward to the north end of Chincoteague Bay, the only variation in water level being due to winds; this usually ranges from ½ to 1 foot, with a maximum variation of several feet after strong winds of long duration.

Under the following stations in Chincoteague Bay and Inlet are given the mean rise and fall, and the time of high or low water after high or low water at Assateague Anchorage; Snow Hill Landing, 0.4 foot, 5 hours 30 minutes; Assacorkin Island, 0.4 foot, 3 hours 55 minutes; Franklin City, 1 foot, 2 hours 25 minutes; Chincoteague, 1.9 feet, 55 minutes; Chincoteague Point, 3 feet, 0 minutes.

The mean rise and fall at Assateague Anchorage and at the entrances of the inlets southward is about 4 feet, and high and low waters occur at approximately the same time as at Sandy Hook. Along the inside waters between Chincoteague Inlet and Cape

Charles the mean rise and fall is about 4 feet and high and low waters occur from 30 minutes to 1 hour, depending on the distance from the nearest inlet, after high and low waters at the inlets.

Currents.—The currents have considerable velocity in the inlets and the narrow channels connecting the inlets with the adjacent bays and sounds. No observations are available, but it is estimated that current velocities of as much as 3 knots may be experienced at times in places of maximum velocities. In the inland waters from Rehoboth southward to the north end of Chincoteague Bay there are no tidal currents, the only currents being due to winds.

Aids to navigation.—The more important of the navigable inlets are marked by buoys, but the channels are shifting and the buoys can not always be depended upon. Breakers form on the shoal areas even in ordinary weather and are often a good guide.

Some of the more important interior channels are marked by beacons and lights, but most of them are marked only by bush stakes maintained by local authorities, which are of little use to a stranger. The sloughs leading through mud flats can best be followed at low water, when the shoals are visible. Strangers drawing near the limit of draft for the interior channels should take a pilot.

DIRECTIONS, INSIDE ROUTE REHOBOTH TO CAPE CHARLES.

The directions and description following are written for use with charts 1219, 1220, 1221, and 1222, published by the Coast and Geodetic Survey.

Rehoboth to Ocean View, distance 10½ miles, least depth 4 feet.—From the head of the canal 1 mile westward of **Rehoboth**, the waterway follows the canal southward for 1¾ miles to Rehoboth Bay. The south end of the canal leads between two stone jetties and is marked by a light on the east side and a prominent white shanty on the west side.

From here the best water slightly favors the west side of **Rehoboth Bay**, passes about ½ mile eastward of **Piney Island**, about 300 yards northeastward of **Bluff Point** (marshy and not marked), and close eastward and southward of the large island southeastward of it (marked by an old house in the center and a cedar thicket on the east end). The channel then passes through **Big Ditch**, the thoroughfare westward of **Middle Islet**, which lies between **Burton Islands** and **Indian River Neck**. Middle Islet is marked by a single tree and shanty.

From Big Ditch the waterway trends southwestward for 1 mile in **Indian River Bay** to avoid the shoals in its eastern part, then leads south-southeastward to **White Creek**, and then follows White Creek for 1½ miles to the mouth of the canal at Ocean View. There are shoals, usually marked by bush stakes, making off many of the points in White Creek.

Ocean View to Ocean City, distance 15 miles.—The least depth through the canal from Ocean View to Little Assawoman Bay is 16 inches, and from there to Ocean City is about 2 feet.

The waterway leads from Ocean View southward through the canal to Little Assawoman Bay, then southward across the mouth of **Miller Creek**, passing westward of two grassy islets and eastward

of a string of islets, and then close along the marsh on the west and south sides to the Narrows.

It favors the west side through **the Narrows**, keeping out of the bight, then leads southward, favoring the west side of **Little Assawoman Bay** to the thoroughfare connecting it with Assawoman Bay, passes through this thoroughfare and the eastern fork at its south end, and then favors the west side of **Assawoman** and **Isle of Wight Bays**. Close to the south side of Isle of Wight Bay and 1¼ miles southeastward of **Keyser Point** there are two low, grassy islands; the best water, about 2 or 2½ feet, leads about ¼ mile northwestward of them, and then follows the shore through the narrow slough southward of them, and then favors the western side of **Sinepuxent Bay** to the drawbridge at **Ocean City**.

Ocean City to Chincoteague, distance 30 miles.—The least depth from Ocean City to the north end of Chincoteague Bay is 2½ feet, and from there to Chincoteague is 5 feet.

From the drawbridge at Ocean City the best water favors the east side of Sinepuxent Bay for 400 yards, and then the west side for about 1½ miles, until near the ruins of a pile jetty crossing the bay from **Coffin Point**. It leads through the eastern opening in the jetty, then in mid-channel until just northward of **Sandy Point**, and then favors the western side to South Point. For a distance of ¾ mile southward from Sandy Point the channel is narrow and lies about ¼ mile from the west shore.

The waterway rounds **South Point** at a distance of about 200 yards and follows the marsh northwestward at a distance of about 300 yards. There is a house and barn ¼ mile eastward of **Island Point**; pass about 150 yards southward of Island Point, and bring the house and barn astern on a westerly course until about ½ mile from Island Point. Then head for **Robins Marsh** (covered by bushes) and pass ¼ mile eastward of it. Then head a little westward of **Big Bay Point** until about 1 mile from it, and then pass ¼ mile eastward of it. Pass about 250 yards off the southeast end of Big Bay Point, about ¼ mile westward of **White Rock** (bare at extreme low water and usually marked by bush stakes), and about ¼ mile eastward of **Assacorkin Island**. Pass about 200 yards eastward of the southeast end of **Mills Island**, and between the two largest islets southeastward of that point on a southwesterly course; shoals extending a short distance southward from these islets were marked by bush stakes in 1914.

Pass ¼ mile eastward of the island off Long Point, steer southwestward for ¾ mile, and then bring the railroad wharf at **Franklin City** astern and pass 200 to 300 yards westward of light No. 4. Then head for light No. 5, pass close eastward of it, and head for a position about 200 yards northwestward of **Killick Shoal lighthouse** (white dwelling on piles). Pass 75 yards southwestward of the lighthouse and follow the curve of the channel, passing southwestward of light No. 2 and eastward of lights Nos. 3 and 1, to the wharves at **Chincoteague**.

Chincoteague to Wachapreague Inlet, distance 33 miles.—The least depth is not more than 1 foot at mean low water, and it often goes bare in places. There is 3 or 4 feet at mean high water, and it is only used at half tide or higher. The deepest draft using it is 4 feet and

usual draft 2 or 3 feet. Navigation is difficult, and local knowledge is necessary. The shoalest places are found in Kegotank, Metomkin, Cross Broad Water, and Floyds Bays. Boats from Chincoteague southward can carry the best water by leaving on the last of the ebb tide, and from Wachapreague northward by leaving about 2 hours after the beginning of the flood. A little deeper draft can be carried northward than southward on a single tide.

From the wharves at Chincoteague the waterway follows **Chincoteague Channel** southwestward until about 3/8 mile southward of the point of marsh on the east side of Queen Sound, then north-northwestward across the middle ground with a shanty on Chincoteague Island astern, then follows the western channel southwestward as shown on the chart to **Ballast Narrows.** It leads westward through Ballast Narrows, through **Island Hole Narrows,** and then in a dredged channel across **Bogues Bay** and through **Cat Creek**; the dredged channel is marked by spoil banks. At the south end of Cat Creek the waterway follows the easternmost narrow slough to **Hog Creek,** and down the latter to **Assawaman Inlet.**

From Assawaman Inlet the waterway leads northwestward in **Assawaman Creek** for 1/2 mile, then westward through a short cut-off, and then follows the most westerly thoroughfare, as shown on the chart, to the northwest end of Kegotank Bay. It passes westward of an islet on the west side of **Kegotank Bay,** and then leads southeastward across the bay to the easternmost narrow slough at its south end. It then follows this slough and **North Gargathy Creek** southward to **Gargathy Inlet,** and **South Gargathy Creek** westward and southwestward to Metomkin Bay. There is a shanty on the west side of the thoroughfare at its outlet into Metomkin Bay.

The best water leads westward of two islets just after entering **Metomkin Bay,** then southeastward for about 1/4 mile, then favors the east side of the bay and passes through the eastern slough in its southern part, as shown on the chart, to **Metomkin Inlet.** From here it leads westward through **Longboat Creek,** through the middle of **Cross Broad Water** to its south end, westward through **Teagles Ditch,** southwestward near the middle of the north part of **Floyds Bay** for 1 mile, and then in the slough near its west side, as shown on the chart, to the north end of **Hummock Channel,** and then southward in the latter to the entrance of **Finney Creek,** which leads to **Wachapreague.** The waterway continues southward through **Black Rock Reach,** then eastward for 3/4 mile, and then southward across **Wachapreague Inlet,** following the marsh on its west side to avoid the middle ground shown on the chart.

Wachapreague Inlet to Great Machipongo River, distance 15 miles, least depth 3 feet at low water and about 6 feet at high water.—The shoalest place is at the south end of Drawing Channel, and the deepest draft will be carried across this point by leaving Wachapreague Inlet at high water. The channels are difficult, and local knowledge is required to avoid the shoals.

From Wachapreague Inlet the waterway leads southward along **Horseshoe Lead** and **Drawing Channel,** then westward and southward through the **Swash** and **Little Sloop Channel** to Sandy Island Channel.

From here the more direct route, good for a depth of about 2 1/2 feet, leads southwestward along **Sloop Channel** and southeastward

along **Cunjer Channel** to **North Channel**; but the deeper and more generally used passage leads southeastward along **Sandy Island Channel** to **Little Machipongo Inlet**, then southwestward and westward along **North Inlet** and North Channel to Great Machipongo River.

Great Machipongo River to the southwest end of Smith Island, distance 30 miles, least depth about 6 feet.—The shoalest part is through the Ramshorn, which is very narrow and difficult and can be followed only at low water when the flats show above water. All of the channels are more easily followed at low water.

From the intersection of North Channel and **Great Machipongo River** the waterway leads southward for 3½ miles to the western branch, and then westward through this branch and **the Deeps** to the Outlet. From here a draft of 2½ feet can be carried southwestward through **the Outlet** and into the Thoroughfare, as shown on the chart; but the deeper and more generally used channel leads westward along the Deeps, then northwestward, northward, and southwestward into **the Thoroughfare**, following the channel lying nearest to the mainland. This part of the waterway is known as **the Ramshorn**.

From here the waterway leads southward through the Thoroughfare and the channel in **Magothy Bay** to the southwest end of **Smith Island**, as shown on the chart. There is a light at the intersection of **Sand Shoal Channel** and the Thoroughfare, and posts with arms pointing to the best water at frequent intervals between there and Smith Island.

In 1915 boats could leave the waterway through **Smith Island Inlet**, which had a depth of 4 feet at low water and about 7 feet at high water, or through **Fisherman Inlet**, which had a depth of about 4 feet at high water. Further information is given on page 118.

REHOBOTH TO CHINCOTEAGUE BAY.

Rehoboth is a summer resort with railroad communication, on the beach 3½ miles southward of Cape Henlopen lighthouse. In summer motor boats run to Ocean View and Bethany Beach. A black standpipe is the most prominent mark.

Rehoboth Bay has a depth of 4 to 7 feet and is much frequented by boats of 3 or 4 feet draft running produce and wood products from the tributaries of Rehoboth and Indian River Bays to Rehoboth for shipment. There is a landing, to which a depth of 4 feet can be carried, at the northeast end, westward of Rehoboth Beach Coast Guard station. The tidal effect is not felt more than 1 mile from Indian River Inlet, but the water level is changed from ½ to 1½ feet by winds.

Love Creek, at the northwest end of Rehoboth Bay, is navigable for small boats to a milldam near the village of **Robinsonville**, 3½ miles above the mouth. It is crossed by a fixed bridge, under which motor boats without houses can pass.

Herring Creek, at the southwest end of Rehoboth Bay, is navigable with a draft of about 2½ feet to the fork, about 2 miles above the mouth, and with a less draft for a short distance up either fork. It is little used. **Angola** is a post village near the head of navigation.

Indian River Inlet, 9½ miles southward of Cape Henlopen lighthouse, had a depth in 1914 of about 1 foot and is very changeable.

It is used only by an occasional local boat of 2 or 3 feet draft, and then only when the conditions as to wind and tide are of the best. Strangers should not attempt to enter.

Indian River Bay has general depths of 6 or 7 feet, except along the eastern end, which is shoal. It is used by boats bound north or south along the waterway and by local boats carrying produce and wood products to Rehoboth or Millsboro. The usual draft of boats is 2 to 4 feet.

Indian River, at the west end of Indian River Bay, has a depth of 3½ feet in mid-channel to the milldam at Millsboro, the upper 1½ miles being a privately dredged channel. **Millsboro** is a town on the railroad 5½ miles above the mouth.

Pepper Creek and **Vine Creek,** on the south side at the western end of Indian River Bay, have a depth of 3 feet for about 1½ miles above their junction; they have several farm and mill landings.

White Creek, on the south side of Indian River Bay, has a depth of about 4 feet to **Ocean View,** a village at its head 2 miles above the mouth. It forms a part of the inland waterway.

A canal, dredged to a width of 20 feet and depth of 4 feet, but shoaled in 1915 to 16 inches, connects White Creek with the north end of Little Assawoman Bay.

Bethany Beach is a small summer resort on the beach, 2 miles southeastward of Ocean View and 4½ miles northward of Fenwick Island lighthouse. A privately dredged channel, marked by spoil banks, leads from the canal eastward through **Salt Pond** to near the beach. It had a depth of 2 feet in 1914 and this depth could be brought to it from Indian River Bay. In summer motor boats run to Ocean View, Millsboro, and Rehoboth.

Little Assawoman Bay has depths of 2 to 4 feet and is little used. It is covered with grass in summer, which is an obstruction to navigation for boats not equipped with special propellers which free themselves of the grass. **Miller Creek** and **Derickson Creek,** on the west side of the bay, have a depth of 1½ feet for about 1½ miles above their mouths and are little used. Little Assawoman Bay and Assawoman Bay are connected by a narrow thoroughfare having a least depth of about 7 feet; it is crossed by a highway drawbridge. **Bayville** is a post village 1½ miles northwestward of the bridge.

Assawoman and Isle of Wight Bays have general depths of 4 to 6 feet along their western sides, but only 2 feet can be brought to them from north or south. They are frequented by pleasure boats from Ocean City and by boats engaged in traffic between points on the tributaries.

Roy Creek and **Grey Creek** have depths of 3 feet nearly to their heads but are little used.

St. Martin River, on the northwest side of Isle of Wight Bay, has a depth of about 3 feet to the fork, 3½ miles above the mouth, and 2 feet to the post village of **Bishopville,** at the head of navigation on the north branch (**Bishopville Prong**) 2½ miles above the fork. It is crossed by a drawbridge about 1 mile below Bishopville. The west branch, called **Shingle Landing Prong,** is said to be navigable for small boats for 1½ miles.

Sinepuxent Bay has depths of 3 to 5 feet; it can be entered from northward with a draft of 2 feet and from southward with a draft

of 2½ feet. It is frequented by fishing and pleasure boats and boats bound north or south along the inland waterway. The ruins of a pile jetty cross the bay 1¾ miles southward of Ocean City; the eastern opening is the best.

Bridges.—A combined railroad and highway center-pier drawbridge crosses Sinepuxent Bay at Ocean City; width of openings 38 feet, height above high water 5 feet. The following are regulations prescribed for the bridge:

1. Between 6 a. m. and 10 p. m. daily the drawbridge shall be opened within 5 minutes after any boat entitled to opening has signaled, except as provided below. At other times the drawbridge shall be opened as soon as practicable.
2. Signal for opening shall be given by three blasts on a horn or steam whistle and shall be recognized by the bridge tender by the waving of a red flag by day or a red lantern by night.
3. The drawbridge shall be opened for the passage of all boats that can not pass under the bridge. Boats that can pass under the bridge by unstepping masts of 4 inches or less diameter shall not be entitled to have the drawbridge opened, unless the mast is permanently stepped in the boat or permanently attached thereto by stays or guys.
4. Boats unprovided with proper horns for signaling shall notify the bridge tender in any convenient manner, and the draw shall be opened as soon as practicable after the notification is received.
5. The drawbridge shall not be opened or allowed to remain open for passage of boats within 10 minutes of expected arrival of scheduled trains.

Ocean City is a summer resort with railroad communication, 7½ miles southward of Fenwick Island lighthouse. It is frequented by many small boats in summer, and is the shipping point for a large amount of sea food and produce. A water tank is prominent.

CHINCOTEAGUE BAY AND INLET.

Chincoteague Bay, about 20 miles long, has depths of 5 to 7 feet along its western side and is shoal along its eastern side. There are depths of 2 to 3 feet at its junction with Sinepuxent Bay. It is frequented by a large number of boats up to 6 feet draft, engaged in the oyster, clam, and fishing industry. There is also considerable freight business between points on the bay and adjacent waters. There are several small landings on the western side of the bay northward of Franklin City.

Newport Creek, at the north end of Chincoteague Bay, is said to be navigable with a draft of 2 feet for about 6 miles to within 1½ miles of the town of **Berlin**.

Franklin City is a village and railroad terminal on the west side of Chincoteague Bay, 3½ miles northward of Killick Shoal lighthouse. It is the shipping point for the sea food and produce of this vicinity. A draft of 4½ feet can be carried to the wharves from southward. Boats run regularly to Chincoteague. Two white church spires are prominent.

Chincoteague is a town on the west side of **Chincoteague Island**, southeastward of **Killick Shoal lighthouse**. It is the center of most of the oystering and fishing industry in this vicinity, and has boat connection with the railroad at Franklin City. There are depths of 5 to 8 feet at the wharves, where all kinds of supplies are obtainable.

Chincoteague Inlet, the first navigable inlet southward of Cape Henlopen, had a depth in 1914 of about 6 feet in the buoyed channel,

as shown on the chart. It is used by many boats, the largest being schooners and barges of 8 feet draft carrying oysters and coal. The shore line and channels in the vicinity of the inlet are subject to rapid change, and the outer buoys do not always mark the best water. Assateague lighthouse and the fish factory on the southeast side of Assateague Anchorage are the prominent marks in approaching the inlet. Pilots for the inlet can usually be obtained at the fish factory or from one of the Coast Guard stations in the vicinity. There is good anchorage anywhere in the channel inside of Chincoteague Point.

Assateague Anchorage is described on page 104.

Assateague Inlet, the channel eastward of Chincoteague Island, has a depth of 2½ feet at its south entrance and deeper water inside. The north entrance is shoal and not used.

Wire Narrows, Queen Sound, and **Cockle Creek** have good depths into them from southward, but are shoal at their outlets into Chincoteague Bay. They are used only by small oyster boats.

CHINCOTEAGUE INLET TO GREAT MACHIPONGO INLET.

Watts, Powells, and **Bogues Bays** are shoal; a draft of 4 or 5 feet can be carried to them through **Roots, Ballast,** and Island Hole Narrows.

Wishart Point is a landing and post office on the mainland between Powells and Bogues Bays. A draft of about 4 feet can be carried to the wharf at low water through Ballast Narrows. It is connected with Chincoteague by daily mail boat.

A channel, dredged to a depth of 4 feet and marked by spoil banks, leads from the south end of **Island Hole Narrows** across **Bogues Bay** and through **Cat Creek**.

Assawaman Inlet, 5 miles southwestward of Chincoteague Inlet, had a depth across the bar in 1914 of about 2 feet. The channel is unmarked, is changeable in depth and position, and is seldom used; there are usually breakers across the entrance.

Assawaman Creek, leading northwestward from the inlet, is navigable for small boats for about 3½ miles.

Kegotank Bay has a depth of about 1 foot at low water and frequently goes bare over most of its area at extreme low water. There is about 4 feet at high water.

Gargathy Inlet, 9 miles southwestward of Chincoteague Inlet, had a depth across the bar in 1914 of about 2 feet. It is not marked, is changeable, and used only by an occasional small local boat. The appearance of the water is the best guide.

Kegotank Creek, leading northwestward from Gargathy Inlet, is navigable for small boats at high water for about 4 miles to within about 1 mile of the village of Modest Town.

Metomkin Inlet, 15 miles southwestward of Chincoteague Inlet, had a depth across the bar in 1914 of about 5 feet. It is used by some local fishing and oyster boats up to 6 feet draft. The channel is marked by buoys, but is changeable and strangers should not attempt to enter without a pilot. The Coast Guard station on the north side of the inlet is the only mark in approaching.

Metomkin Bay has several sloughs with depths of 6 to 10 feet leading northward from the inlet, but the north end has a general depth

of only 1 to 2 feet. The best water in the north end of the bay leads along its eastern side.

Folly Creek, leading westward from the south end of Metomkin Bay, is said to have a depth of 3 feet at low water to the landing at its head, 3 miles above the mouth and 1 mile from **Accomac,** a town on the main highway.

Longboat Creek, leading westward from Metomkin Inlet, has a least depth of about 9 feet.

Cross Broad Water, 2 miles southwestward of Metomkin Inlet, can be crossed with a least depth of 1½ feet at low water and about 5 feet at high water. It is connected with the north end of Floyds Bay by **Teagles Ditch,** which has a least depth of 12 feet.

Floyds Bay, extending northward from Wachapreague Inlet, has several sloughs with good water leading northward from the south end, terminating in shoals at the north end. **Hummock Channel,** marked on the east side by a row of oyster houses on small grassy islets, is the most important. It has a depth of 20 feet at its south end, gradually shoaling to a general depth of about 1 foot in the north end of the bay.

Wachapreague is a post village on the west bank of **Finney Creek,** 4 miles west-northwestward of Wachapreague Inlet. It is the center of most of the oystering and fishing industry in this vicinity and is frequented by some pleasure boats in summer. A draft of about 10 feet can be carried from Wachapreague Inlet through **Black Rock Reach** and Finney Creek to abreast the wharves. A white church spire is prominent from eastward with the sun on it.

Wachapreague Inlet, 20 miles south-southwestward of Chincoteague Inlet and 12 miles north-northeastward of Hog Island lighthouse, had a depth in 1914 of 7 feet in the main buoyed channel, which led northward and westward, as shown on the chart. It is used by many local fishing and oyster boats and a few boats entering for shelter. The deepest draft entering is 10 feet, and the usual draft 3 to 6 feet. Strangers should take a pilot, as the channel is shifting and the buoys do not always mark the best water.

The old and new Coast Guard stations, a hotel, and several houses, all on the north side of Wachapreague Inlet, are the most prominent marks in approaching. A clubhouse and windmill on the point of marsh 1 mile northwestward of the entrance are also prominent. There is a wharf at the Coast Guard station just inside the entrance.

The best anchorage is in Horseshoe Lead, southwestward of the entrance, where there is a depth of 20 to 36 feet along the east side of the channel. There is a middle ground inside the inlet and northwestward of the entrance; the best water leads eastward and northward of it.

The open waters northwestward of the beach between Wachapreague Inlet and Little Machipongo Inlet are mud flats bare at low water, with sloughs leading through them, and are used only by local fishing and oyster boats. A channel has been dredged by private enterprise to a depth of 3 feet along the south end of **Drawing Channel to the Swash,** and forms a part of the inside route.

Little Machipongo Inlet, 4½ miles north-northeastward of Hog Island lighthouse, had a depth across the bar in 1914 of about 10 feet. It is not marked and is used only by local boats of 5 or 6 feet draft. A house on the point of beach on the south side of the inlet.

and a windmill and clubhouse on the southeast side of Revel Island are the only marks visible in approaching the inlet. The appearance of the water is the best guide in entering, but strangers should not enter without a pilot.

Quinby is a small post village on the mainland about 5½ miles north-northwestward of Little Machipongo Inlet. A draft of 6 feet can be carried to within 1½ miles of it, and the remaining distance is navigable only for small boats at high water.

Broadwater is a post village of oystermen and fishermen on **Hog Island** near the lighthouse. A draft of about 6 feet at low water can be carried to abreast the village from southward through **Heather Channel**, and about 4 feet at high water from northward through a crooked unmarked slough leading southward from **North Inlet**, 2 miles southwestward of Little Machipongo Inlet. There is a privately dredged basin for small boats west-southwestward of Hog Island lighthouse, on which all of the landings are located; the depth is about 3 feet. Broadwater is connected by boat with Willis Wharf.

GREAT MACHIPONGO INLET TO CAPE CHARLES.

Great Machipongo Inlet, 2 miles southward of Hog Island lighthouse, had a depth across the bar in 1914 of about 15 feet in the buoyed channel, which led westward into the inlet approximately as shown on the chart. Breakers form on the bar only in heavy weather, but form on the shoals on each side at all times. While the inlet is not subject to radical change with every gale, it has a slow but steady change from year to year and no permanent directions can be given. The usual draft of boats using the inlet is 5 or 6 feet, and the deepest draft 14 feet. The prominent marks in approaching the inlet are **Hog Island lighthouse** and the old tower ½ mile southward of it.

Great Machipongo River, leading westward and northward from Great Machipongo Inlet, has a least depth of about 17 feet for 12 miles above the inlet to the mouth of Parting Creek, about 6 feet for a further distance of 5 miles, and is navigable by small boats at high water for a considerable distance farther. For a distance of 9½ miles from the inlet it leads through mud flats bare at low water. It is marked by buoys and lights, as shown on the chart, but can best be navigated at low water, when the flats show above water. The best water leads eastward of the large island just after entering the mainland. There is little business above the mouth of Parting Creek.

Willis Wharf is a village on the west side of **Parting Creek**, 1 mile above its junction with Great Machipongo River and 13 miles by water from Great Machipongo Inlet. It is 1½ miles from the railroad station of **Exmore**, and is the shipping point for most of the sea food taken in this vicinity. A draft of 3 feet can be brought to the wharves at low water, and schooners loaded to 8 feet leave at high water. In entering the mouth of Parting Creek favor the north side to avoid a shoal area about in midstream. The best water leads southward and westward of the island ½ mile above the mouth, then favors the west side to the wharves.

There are several sloughs leading from Great Machipongo River southwestward to Sand Shoal Channel. A draft of about 3½ feet

at high water can be carried from Great Machipongo Inlet southwestward in **Rowes Hole Channel**, then south-southwestward between two large islands and through **Loon Channel** to Sand Shoal Inlet. It is unmarked and local knowledge is required to follow it.

A draft of about 2 feet at low water and 5 feet at high water can also be carried up **Gould Marsh Channel**, through a narrow slough into **Eckichy Channel**, and down this to Sand Shoal Channel.

The best and most generally used channel is the most westerly one, leading through the **Deeps** and the **Ramshorn** to the north end of **the Thoroughfare**, as described in the directions for the inside route preceding.

Sand Shoal Inlet, 7½ miles southwestward of Hog Island lighthouse and 11½ miles northeastward of Cape Charles lighthouse, had a depth in 1914 of about 13 feet through the northeast channel, which is marked by buoys and a lighted range. While the inlet is not subject to radical changes with every gale, it has a slow but steady change from year to year and no permanent directions can be given. The southeast and south channels are used to some extent by local boats, but are unmarked and should not be attempted by a stranger. The usual draft of boats using the inlet is 5 or 6 feet and the deepest draft about 14 feet. The Coast Guard station and a hotel on the south end of **Cobb Island**, and two houses on the north end of **Wreck Island**, are the only marks visible in approaching the inlet.

Loon Channel, leading northward from Sand Shoal Inlet close to Cobb Island, can be entered with a draft of about 8 feet. It has a depth of about 20 feet off the Coast Guard station and is a good boat anchorage.

Sand Shoal Channel, leading westward from Sand Shoal Inlet, has a least width of ¼ mile and a least depth of 30 feet in mid-channel for 5 miles westward from the inlet to its junction with the Thoroughfare. It is marked by buoys, lights, and beacons, as shown on the chart, and is easily followed.

Oyster is a post village on the mainland 1 mile westward of the intersection of Sand Shoal Channel and the Thoroughfare. It is 2 miles from the railroad station of **Cheriton**, and is the shipping point for a large amount of sea food. It can be reached through a narrow crooked slough, bare at low water and having a depth of about 4½ feet at high water. The entrance is about ½ mile northwestward of the light at the intersection of Sand Shoal Channel and the Thoroughfare.

New Inlet, 9 miles northeastward of Cape Charles lighthouse, is shoal and unmarked, is very changeable, and is seldom used even by local boats. A draft of about 6 feet at high water can be carried from the inlet southwestward and southward into Ship Shoal Channel; small boats can also pass westward along **Great Drum Drain** and northward along **Man and Boy Channel** to Sand Shoal Channel.

Ship Shoal Inlet, 7 miles northeastward of Cape Charles lighthouse, had a depth across the bar in 1914 of about 8 feet. It is unmarked and is used only by local oyster boats of 3 to 5 feet draft. There is deep water inside but no connection with the main waterways, except for small boats. A draft of about 2 feet at low water can be carried along **Ship Shoal Channel** and through a very crooked

slough through the flats to the **Thoroughfare**, westward of Cape Charles lighthouse.

Little Inlet, 5½ miles northeastward of Cape Charles lighthouse, had a depth of about 3 feet in 1914; it is unmarked and is used only by a few local boats of 2 or 3 feet draft. Small boats can pass from Little Inlet to Ship Shoal and Smith Island Inlets at high water only.

Smith Island Inlet, entering 2 miles south-southwestward of Cape Charles lighthouse, had a depth in 1915 of about 4 feet. The channel is buoyed, but is narrow, is subject to rapid change, and the buoys can not always be depended upon. It is the southern outlet to the inside waters, and is used by many local boats of about 3 to 6 feet draft, carrying sea food to Norfolk, Cape Charles, and other points.

Fisherman Inlet, entering westward of Cape Charles lighthouse, has a depth of about 1 foot at low water and 4 feet at high water; it is used by many boats of 2 or 3 feet draft, and is preferred to Smith Island Inlet when the depth is sufficient, as it has ample width and is protected from heavy seas. There is a perpendicularly striped buoy at the western entrance. From here the best water follows the channel northeastward close along the south point of the mainland, then east-southeastward across the flats to the channel of Smith Island Inlet.

Magothy Bay, extending 7 miles northward from Smith Island Inlet, is shoal except in the main channel, which has a least depth of about 9 feet from Smith Island northward to Sand Shoal Channel. The channel is marked at frequent intervals by posts with arms, but can best be navigated by a stranger at low water, when the flats show above water.

Magotha is a post village on the mainland about 3 miles northwestward of Cape Charles lighthouse. A draft of about 3 feet at high water can be carried to the wharf through a narrow slough, leaving the main channel just northward of Long Point Island.

There is a long wharf on the northwest side of **Smith Island** abreast the lighthouse, to which a depth of 6 feet can be carried from southward.

CHESAPEAKE BAY.

Chesapeake Bay is 170 miles long from the entrance to the mouth of Susquehanna River at the head. It is the approach to the seaports of Baltimore, Norfolk, Newport News, and many other important cities, and has a large trade carried in foreign and domestic vessels. It is also the center of a large oystering and fishing industry.

The main entrance is between Cape Charles on the north and Cape Henry on the south. It can also be entered from Delaware River by vessels of 9 feet draft through the Chesapeake & Delaware Canal, at the north end of the bay; and from Albemarle Sound by vessels of 9 feet draft through the Dismal Swamp Canal, and 8½ feet draft (in 1915) through the Albemarle & Chesapeake Canal, both connecting the inside waters southward with the Chesapeake Bay at Norfolk.

The shores of the bay from the south end northward to Patuxent River entrance on the western side and to Chester River entrance on the eastern side are generally low and present no prominent

features. Above these points they are hilly and generally wooded, rising to a considerable height in the vicinity of Northeast and Susquehanna Rivers.

The most important tributaries on the western side are generally broad and deep at their entrances, are navigable for long distances, and have a large general trade. Those on the eastern side are generally shoal at the mouths and have little coasting trade, but are frequented by many vessels engaged in the bay trade.

Channels.—The main channel of Chesapeake Bay has a least depth of 35 feet from the entrance to Baltimore, a distance of 149 miles. It follows the natural channel of the bay from the entrance to Sandy Point, 21 miles below Baltimore, except through **York Spit Channel**, which is a dredged cut 35 feet deep and 1,000 feet wide, but is not used except by deep-draft vessels. From Sandy Point to Baltimore it leads through a dredged channel. The channel in the bay has ample width, is well marked, and easy of navigation either by day or night. It leads close to middle grounds just inside the entrance, but above the mid-channel is clear, though shoals make off for a long distance from many of the points.

Pilots.—Pilotage is compulsory between Chesapeake Bay entrance and Smith Point, Yorktown, Newport News, Norfolk, or any intermediate point, for all vessels other than vessels exclusively engaged in the coastwise trade and those made exempt by United States statutes, if spoken outside of a line with Cape Henry bearing south. Pilotage is also compulsory for foreign vessels and vessels from a foreign port and all vessels sailing under register, bound to and from Baltimore, except vessels employed in and licensed for the coasting trade and American vessels laden either in whole or in part with coal or coke mined in the United States.

Virginia pilots are taken to any port in Virginia and Maryland pilots to any port in Maryland. Two pilot steamers will usually be found cruising outside the entrance of the bay, except when one goes in for supplies, at which time both Virginia and Maryland pilots are aboard one steamer. The night signal for a Virginia pilot is one long and one short blast of whistle, and for a Maryland pilot three long and one short blasts. Vessels bound up the Potomac usually take a Maryland pilot, if any, who on reaching the river turns the vessel over to a river pilot or takes the vessel up himself. The pilotage fees in either case are the same to Washington as to the port of Baltimore. Pilots for the smaller tributaries of the bay are oystermen or fishermen living in the vicinity, and can be obtained from boats at work near the entrances or on signal from shore.

The fees for piloting to or from Smith Point, Yorktown, Newport News, or Norfolk or intermediate points are as follows. For every vessel drawing—

	Per foot.
Under 8 feet	$2.00
8 feet and under 10 feet	2.50
10 feet and under 13 feet	3.50
13 feet and under 16 feet	4.00
16 feet and under 20 feet	4.50
20 feet or over	5.00

If any vessel be boarded or spoken 20 miles eastward of Cape Henry, $0.25 per foot shall be added to the foregoing rates.

All vessels coming into Hampton Roads seeking, in ballast, shall pay the same rate of pilotage as vessels calling for the sole purpose of coaling; provided, however, that if such vessel coming to Hampton Roads, seeking, if afterward chartered to load in any port or place in this State, she shall pay the usual pilotage in and out as though she had come to a direct port. All steamers calling at any port or place in this State for the sole purpose of coaling shall pay $1 less per foot than the regular rates under 10 feet, and all vessels drawing 10 feet and under 20 feet shall pay $1.50 per foot less than regular rates; and all such vessels drawing 20 feet and over shall pay $2 less per foot than the regular rates. All vessels having paid inward pilotage that go from Norfolk to Newport News or from Newport News to Norfolk, to load or finish loading, shall, if they take a pilot (which shall be optional with the master), pay a fee of $10 to the pilot for transporting such vessel between said ports.

Vessels coming from sea to Hampton Roads and thence to any port in Maryland shall be subject to the same rate of pilotage as vessels bound from Newport News to sea.

The pilotage fee between Newport News and any point on James River is $1.50 per foot, but pilotage is not compulsory.

Pilotage fees to and from Baltimore are as follows: For every vessel of 15 feet or over draft, $5 per foot; for every vessel of 12 feet and under 15 feet draft, $4 per foot; for every vessel of less than 12 feet draft, $3.50 per foot.

Any vessel bound from Baltimore to sea, subject to pilotage, and going into Hampton Roads for any cause except distress of weather, shall pay a fee of $12 for inward pilotage and $10 for outward pilotage in addition to the regular fee.

Towboats.—Towboats will sometimes be found cruising in the lower part of the bay near the entrance, and they will sometimes be found in the bay between the entrance and the mouth of Patapsco River. At Old Point Comfort tugs may be ordered by telegraph to Hampton Roads from Norfolk and Baltimore. Towboats from Baltimore seldom cruise below Sandy Point lighthouse unless previously notified.

Anchorages.—The following anchorages are the principal ones available for vessels bound up and down Chesapeake Bay: Lynnhaven Roads, just westward of Cape Henry, affords shelter against southerly winds in depths of 20 to 28 feet; Hampton Roads is a secure anchorage in all weather for vessels of any draft, and is reached through a dredged channel 35 feet deep; York River above Tue Marshes lighthouse affords good anchorage in 6 to 11 fathoms, protected from all but easterly winds; Mobjack Bay has secure anchorage westward of New Point Comfort in depths of 10 to 24 feet; Rappahannock River has anchorage within its mouth in depths of 3 to 10 fathoms; Great Wicomico River affords secure anchorage in depths of 15 to 20 feet; anchorage secure from northerly winds can be had in depths of 15 to 30 feet in Cornfield Harbor inside of Point Lookout, and secure anchorage in any weather in St. Marys River, 5 miles northwestward; Patuxent River entrance affords secure anchorage for the largest ships, well sheltered and with good holding ground. There are several good anchorages on the eastern side of the bay, but they are seldom used by strangers.

Regulations prescribed for York Spit dredged channel require that it be restricted to vessels or other water craft passing up or down the bay, and that it shall be unlawful for any vessel or other water craft to cross the said channel, or to enter it at any other point than at the ends, and in the direction of its axis, after which the course of the channel must be followed for its entire length.

Speed trial course.—A speed trial course 1 nautical mile long has been established on the western side of Kent Island, 5 miles northward of Bloody Point Bar lighthouse. The ranges are masts with white daymarks. A line joining Bloody Point Bar and Sandy Point lighthouses leads at right angles to the ranges. Buoys have been established northward and southward of the course to mark the approach.

Supplies.—Baltimore, Norfolk, and Newport News are available as coaling ports for large vessels and have wharves equipped for rapid coaling. Water and ship-chandlers' supplies are obtainable at these places. As mentioned under the different headings, supplies can be obtained at many other places, but the quantity is apt to be limited and the facilities are not always good. Small vessels and motor boats bound up and down Chesapeake Bay and desiring supplies can best obtain them at Cape Charles, Reedville, Solomons Island, or Annapolis.

Repairs.—Repairs to the hulls and machinery of large vessels can be made at Baltimore, Newport News, and Norfolk. Places near Chesapeake Bay where repairs to small vessels can be made are Hampton, Solomons Island, Annapolis, and Crisfield. Further information is given under the different headings, and a table of largest dry docks and marine railways is given on page 24.

A list of **storm warning** display stations of the United States Weather Bureau is given on page 26.

Fog.—See page 24.

The **reporting station** for vessels entering Chesapeake Bay is at Cape Henry, from which vessels are reported to Norfolk and Baltimore either day or night, and with which vessels can communicate by use of the International code by day or a flashing lamp and the Morse code by night. Messages to or from vessels will be forwarded to destination. Vessels bound to Baltimore are also reported from Cove Point and Sparrows Point.

Quarantine.—Quarantine for all ports on Chesapeake Bay and tributaries, except Baltimore, is conducted by the United States Public Health Service. The boarding station for vessels entering Hampton Roads is a vessel moored off Hotel Chamberlin in Hampton Roads, and vessels are boarded when off Old Point Comfort.

Vessels bound to Washington should preferably stop at the boarding station in Hampton Roads. Otherwise the boarding station is at Alexandria, where the facilities are not as good and some delay may be experienced.

Vessels bound to Baltimore are not required to stop at Hampton Roads, but are inspected at the quarantine station at Leading Point, Patapsco River, where the laws of the State of Maryland and the quarantine regulations of the city of Baltimore are in force; in general, the minimum requirements are in accordance with the United States Public Health Service.

Fish weirs are numerous in Chesapeake Bay and tributaries in season, the fishing season usually lasting from about March to July and from October to December; and many of them will be found in position throughout the year. They are thickest on the western side of the bay from Hampton Roads to Potomac River, but will be found throughout the bay and for a considerable distance above the entrances to the tributaries. Areas of possible fish traps should be avoided by small craft, especially at night, on account of the danger from stakes which may have been broken off and not removed.

Regulations governing the establishment of fish-net stakes in Chesapeake Bay and tributaries are prescribed by the Secretary of War. The general supervision of fishing structures is controlled by the Chief of Engineers, United States Army, Washington, D. C., from whom copies of the regulations and additional information may be obtained. Lines showing the limits of possible fish traps in Chesapeake Bay will be shown on certain Coast and Geodetic Survey charts.

Fish stakes are prohibited within the regularly established or followed boat routes, such channels to have a width in the approach to the mouth of any tributary of not less than one-third the width of the mouth. In the tributaries they are prohibited at a greater distance from shore than one-third the distance across the stream from point to point in the wide portions, and from shore to shore elsewhere.

The outer end of each trap must have a bush or other suitable daymark, and a white light at night. When navigation is possible between the trap and shore, the inner end must have a red light at night. There must be a clear space of at least 200 feet between adjoining traps.

Black and white horizontally striped buoys are established in many places in Chesapeake Bay and tributaries to mark the outer limits of possible fish traps.

Ice.—In severe winters ice forms in the head of the bay and in many of its tributaries. Under the influence of wind and tide ice will sometimes be met as far down the bay as Cove Point, very seldom below this. The weather shore is generally free from ice. Large steam vessels can always pass up and down the bay, but some of the tributaries may be closed to navigation for a period of a month or more during the winter. To vessels bound to and from Baltimore, ice sufficient to interfere with navigation of vessels is most often found in the vicinity of Seven Foot Knoll lighthouse, where ice packs are of frequent occurrence. The ice-breaker steamers from Baltimore attempt to keep the channel open, but navigation is sometimes blocked for limited periods, and none but the largest vessels enter or leave at night when ice may be expected.

In the tributaries north of Pocomoke Sound entrance on the eastern side and York River on the western side ice sufficient to interfere with navigation of small vessels and motor boats may be met with at any time between January 1 and April 1, and north of Patapsco River entrance ice is sometimes found a little before and after these dates.

The ice from Tangier and Pocomoke Sounds does not interfere with the larger vessels in the bay, but small vessels engaged in oystering and fishing are frequently held up by the ice, especially in

Kedges and Hooper Straits, and are forced to employ towboats to assist them.

Tides.—A table of tides is given on page 32. Further information is given under the different tributaries. Full tidal information is given in the tide tables for the Atlantic coast of the United States.

CURRENTS, CHESAPEAKE BAY.

The tidal currents in the bay and its tributaries are greatly influenced by the winds, which also affect the rise and fall of the tides to a marked extent, especially near the head of the bay. Strong northerly winds will increase the velocity of the ebb current and may, for a period, interrupt the flood current, while a strong southerly wind will increase the velocity of the flood current and may interrupt or retard the ebb current. Under normal conditions the velocity of the flood at strength is 1.1 knots at the Tail of the Horseshoe and 0.6 knot off Sandy Point, and the velocity of the ebb at strength is 1.4 knots at the Tail of the Horseshoe and 0.7 knot off Sandy Point. In the entrance of the bay and between the Middle Ground and the Tail of the Horseshoe and in the channels eastward of the Middle Ground the currents have a somewhat greater velocity, and under the influence of strong winds the shoals will sometimes be marked by rips. The effects of the flood and ebb currents are marked at the entrances of the principal tributaries, the effect being felt sometimes for a considerable distance from the entrances. Off the mouths of York, Rappahannock, and Potomac Rivers, especially the latter, a considerable set by ebb or flood currents is often experienced.

At Tail of the Horseshoe light vessel.—Slack water before the flood occurs 3 hours before time of high water at Old Point Comfort and slack water before the ebb 3 hours 30 minutes before time of low water at Old Point Comfort. The mean velocity of the current at strength of flood is 1.1 knots and at strength of ebb is 1.4 knots. These velocities are influenced to a considerable extent by winds. A westerly gale will at times cause a very strong ebb current and will greatly diminish the flood current, and an easterly gale will at times cause a very strong flood current and will greatly diminish the ebb current. The maximum strength of current against a strong gale may sometimes fall as low as 0.7 knot. During six months of observations in the summer and fall the greatest ebb current measured was 2.8 knots during a northwester, and the greatest flood current observed was 2.6 knots in an easterly gale.

At 35-Foot Channel light vessel.—Slack water before the flood occurs 2 hours 40 minutes before time of high water at Old Point Comfort and slack water before the ebb occurs about 3 hours 10 minutes before time of low water at Old Point Comfort. The mean velocity of the current at strength of flood is 1.2 knots and at strength of ebb is 1.4 knots.

Off Wolf Trap lighthouse.—Slack water before the flood occurs about 1 hour 20 minutes before time of high water at Old Point Comfort and slack water before the ebb about 1 hour 40 minutes before time of low water at Old Point Comfort. The mean velocity of the current at strength of flood (northerly) is 1.4 knots and at strength of ebb (southerly) is 1.5 knots.

Southeast of Windmill Point lighthouse.—Off the mouth of the Rappahannock River a set to the eastward, due to an ebb current, and to the westward (to a less extent), due to a flood current, is often experienced.

Off Windmill Point.—The time of greatest strength of ebb current is about 2 hours 30 minutes after time of low water at Old Point Comfort and time of greatest strength of flood current is about 2 hours 15 minutes after time of high water at Old Point Comfort. Slack water before the flood occurs about 40 minutes before the time of high water at Old Point Comfort and slack water before the ebb occurs about 50 minutes before time of low water at Old Point Comfort.

Off Smith Point lighthouse.—Slack water before the flood occurs about at time of high water at Old Point Comfort, and slack water before the ebb occurs about 10 minutes before the time of low water at Old Point Comfort.

Between Smith Point and Point Lookout.—A considerable set to the eastward due to an ebb current and to the westward due to a flood current is frequently experienced. The time of greatest strength of ebb current occurs about 3 hours 15 minutes after time of low water at Old Point Comfort or 1 hour 5 minutes before time of high water at Baltimore. The time of greatest strength of flood occurs about 2 hours 45 minutes after time of high water at Old Point Comfort or 1 hour 45 minutes before time of low water at Baltimore. The mean velocity of the current at strength of flood is 0.9 knot and at strength of ebb is 1 knot.

Off Point No Point.—Slack water before the flood occurs 30 minutes after time of high water at Old Point Comfort or 4 hours before time of low water at Baltimore, slack water before the ebb occurs 20 minutes after time of low water at Old Point Comfort or 4 hours before time of high water at Baltimore.

Off Hooper Island lighthouse.—Slack water before the flood occurs 2 hours 50 minutes before time of low water at Baltimore, and slack water before the ebb 3 hours before time of high water at Baltimore. The mean velocity at strength of current is 0.5 knot at flood and 0.6 knot at ebb.

Off Cove Point.—Slack water before the flood occurs 1 hour 40 minutes before time of low water at Baltimore and slack water before the ebb occurs 1 hour 30 minutes before time of high water at Baltimore. The mean velocity of current at strength of flood is 0.7 knot and at strength of ebb is 0.8 knot.

Off Sharps Island lighthouse.—Slack water before the flood occurs 15 minutes before time of low water at Baltimore, and slack water before the ebb at time of high water at Baltimore.

Off Sandy Point lighthouse.—Slack water before the flood occurs 1 hour and 10 minutes after the time of low water at Baltimore, and slack water before the ebb occurs 1 hour and 30 minutes after the time of high water at Baltimore.

At Sandy Point.—The mean velocity of the current at strength of flood is 0.6 knot and at strength of ebb is 0.7 knot. Proceeding northward from Sandy Point, the strength of the current diminishes rapidly, being about 0.5 knot at Seven Foot Knoll and 0.3 knot at Fort McHenry at strength of flood or ebb. In Baltimore Harbor the currents are small.

At Fort McHenry.—Slack water before the flood occurs 15 minutes after the time of low water at Baltimore and slack water before the ebb occurs 45 minutes after the time of high water at Baltimore.

GENERAL REMARKS, APPROACHES TO CHESAPEAKE BAY.

The prominent landmarks visible in approaching Chesapeake Bay entrance are described on page 127.

From northward.—General remarks and directions for the outside coast from New York to Chesapeake Bay are given on page 37.

Currents for the outside coast are given on page 36.

From eastward.—The entrance may be approached boldly, as there are no outlying dangers. Twenty fathoms will be found about 45 miles eastward of Cape Henry; inside that depth the water shoals irregularly. In clear weather Cape Henry and Cape Charles lighthouses and Cape Charles light vessel will be made about the same time at night, if standing westward near the parallel of 37° N. In thick weather safety may be insured by keeping in 10 fathoms. When in latitude 37° N and 30 fathoms of water, a west (mag.) course will lead directly for Cape Henry lighthouse, but depths of 5¼ to 6 fathoms will be found from 5 to 14 miles eastward of the lighthouse, and deep draft vessels in heavy weather should pass southward of these spots.

From southward.—Between Cape Henry and Cape Hatteras, a distance of about 105 miles, there are no dangerous outlying shoals over 5 miles from the beach; with the exception of a few places, 5 to 9 fathoms may be carried as close as 1 mile from the beach. Vessels of the deepest draft may, in smooth weather, run as close as 5 miles from the beach, but are not advised to do so, as it is a dangerous coast to be caught on in an easterly gale. The narrow stretch of sand beach forming the greater length of the coast is low, and frequently may not be visible more than 4 or 5 miles. The 100-fathom curve, which, abreast of Cape Henry, is about 65 miles offshore, gradually approaches the coast southward; and southeast of Cape Hatteras is only about 20 miles from the beach. The 30-fathom curve is about 5 miles inside of the 100-fathom curve. Abreast of Cape Henry 20 fathoms will be found about 45 miles off the coast, but farther southward that depth is found closer in, and at Cape Hatteras it is only 11 miles offshore. Inside of 15 fathoms the depths are extremely irregular, and there are many holes of limited extent lying far inside of the general limits of corresponding depth. In thick weather, close attention should be paid to the soundings and the chart, and even then the navigator may be confused by the irregularities in depth.

DIRECTIONS, CHESAPEAKE BAY.

Directions for entering Hampton Roads are given on page 133, and for Patapsco River and Baltimore Harbor on page 206. Directions from the head of Chesapeake Bay to Norfolk for vessels following the inside route are given on page 262.

The least depth in the channel between Chesapeake Bay entrance and the entrance to the dredged channel leading to Baltimore is in the dredged channel eastward of York Spit, which is 35 feet deep and

1,000 feet wide. Between the entrance to the bay and this point the channel leads between Middle Ground Shoal and Tail of the Horseshoe, and is well marked by light vessels and buoys. Northward of York Spit the bay is clear in mid-channel, but shoals extend a long distance off many of the points and islands. Strangers, unless in small boats should keep outside the buoys and lighthouses marking the ends of the shoals.

The following table gives courses and distances from Chesapeake Bay entrance gas, whistling, and submarine bell buoy to the entrance of the dredged channel leading to Baltimore. They lead in a least depth of 35 feet, which is found in York Spit dredged channel. Between Tail of the Horseshoe light vessel and Wolf Trap lighthouse vessels of less than 20 feet draft often pass westward of York Spit Channel. Many deviations from these courses are possible for light draft vessels, but for these the chart is the guide.

	Course.		Distance in nautical miles.
	True.	Magnetic.	
1. Chesapeake Bay entrance gas, whistling, and submarine bell buoy to 2 miles northeastward of Cape Henry lighthouse.	° 310	NW ⅛ N.....	8¼
2. To 1 mile southward of 35-foot Channel light vessel.....	324	NNW ¾ W.....	11
The course leads close eastward of Tail of the Horseshoe light vessel and ½ mile or more westward of the red buoys marking the middle ground.			
3. To York Spit Channel entrance gas buoys.	0	N ½ E.....	2¾
The course leads close eastward of 35-foot Channel light vessel.			
4. In York Spit Channel to north end.....	8	N by E ¼ E....	4
5. To ⅜ mile westward of Tangier Island Shoal Lump gas and bell buoy.....	354	N.....	34
The course leads 3 miles eastward of Wolf Trap lighthouse and 4 miles eastward of Windmill Point lighthouse.			
6. To 1 mile eastward of Smith Point lighthouse.....	5	N by E.....	6½
7. To close westward of Sharps Island gas and bell buoy.....	343	N by W.....	42
The course leads 1½ miles eastward of Point No Point lighthouse, 1⅞ miles eastward of Cedar Point lighthouse, 2¼ miles westward of Hooper Island lighthouse, and 1 mile eastward of Cove Point lighthouse.			
8. To Poplar Island Shoal gas and bell buoy..	357	N ⅜ E.....	12
9. To 1 mile eastward of Thomas Point Shoal lighthouse.....	6	N by E ⅛ E....	9
10. To ½ mile eastward of Sandy Point lighthouse.....	15	N by E ⅞ E....	7¼
11. To gas and bell buoy at south end of Craighill Channel.....	343	N ⅞ W.....	3⅙
The course leads ⅓ mile eastward of Baltimore lighthouse and westward of two red buoys.			

Vessels desiring to pass westward of York Spit Channel can continue the 324° true (NNW ¾ W mag.) course for 4½ miles past 35-foot channel light vessel, leaving it ½ mile to starboard, to a position ¼ mile westward of Middle Ground Shoal northeast end gas and whistling buoy, then steer 11° true (N by E ½ E mag.) for 13½ miles to a position 3 miles eastward of Wolf Trap lighthouse, and then follow the courses in the table.

CHESAPEAKE BAY ENTRANCE.

The entrance to Chesapeake Bay leading between Cape Charles on the north and Cape Henry on the south is about 10 miles wide; the main channel leads along the south side and is broad and deep. The northern half of the entrance is obstructed by shoals through which several minor channels lead.

The channel leading westward along the south side of **Nautilus Shoal** and northward along the west side of Fisherman Island and through either **North** or **Beach Channels**, is buoyed, had a least depth by the last survey of about 18 feet, and is used by fish steamers and tugboats up to 12 feet draft, but the shoals are subject to considerable change, and the channel is not recommended for strangers. Nautilus Shoal is moving rapidly southwestward. The general direction of movement of the shoals westward of Nautilus Shoal is southward, though the rate of movement is generally slow.

The most **prominent landmarks** in approaching the entrance to Chesapeake Bay are Cape Charles lighthouse and Cape Charles old tower on Smith Island, and a tank and several buildings on Fisherman Island, all on the north side; and Cape Henry, Cape Henry lighthouse, and Cape Henry old tower on the south side. Cape Charles lighthouse and old tower are described on page 105.

Cape Henry is a prominent bold range of sand hills 80 feet high, with lower ones near the water. On the beach near the point of the cape is Cape Henry lighthouse, and 340 feet southwestward of it is a white unused light tower; near the lighthouse are a storm-warning display station, and a seacoast telegraph station of the United States Weather Bureau, from which vessels are reported to Norfolk and Baltimore, and with which they may communicate by the use of International code signals by day or the Morse code by night.

Cape Henry lighthouse is an octagonal pyramidal tower, upper and lower half of each face alternately black and white. The light is fixed white, with a fixed red sector between 155° true (S by E ¾ E mag.) and 233° true (SW by W ¼ W mag.), 157 feet above the water, and visible 19 miles. The fog signal is a siren, blast 4 seconds, silent 41 seconds.

Tail of the Horseshoe light vessel has a straw-colored hull with "Tail of Shoe" on the sides, and two masts with a grating at the head of each; the lights are fixed white, 45 feet above the water and visible 12 miles. The fog signal is a steam whistle, blast 3 seconds, silent 27 seconds. The submarine bell strikes "6" every 12 seconds.

Lynnhaven Roads, an open bight extending from 2 to 5 miles westward from Cape Henry lighthouse, is sometimes used as an anchorage and is protected from southerly winds. It has depths of 20 to 28 feet. The shoaling is abrupt eastward of Lynnhaven Inlet, and the 18-foot curve lies nowhere more than ⅜ mile from shore. West-

ward of the inlet the shoaling is gradual, and depths of 18 feet can be found ¾ mile from shore.

Lynnhaven Inlet, on the south side of Lynnhaven Roads, forms the approach to **Lynnhaven Bay** and several other shoal bays. It had a depth by the last survey (1913) of 2½ feet across the bar, but is subject to frequent change, and local knowledge is required to enter.

A bridge with a draw opening 30 feet wide crosses the inlet just inside the entrance. The depths in the bays inside are 2 to 10 feet, and they are frequented by many small craft engaged in oystering and fishing.

HAMPTON ROADS AND NEWPORT NEWS.

Hampton Roads, at the south end of Chesapeake Bay, 16 miles westward of Cape Henry, is the approach to Norfolk, Newport News, and points on the James River to Richmond, and is also one of the important anchorages on the east coast of the United States. A well-marked channel with a least depth of 35 feet leads into Hampton Roads, where there is secure anchorage for vessels of any draft.

Willoughby Bank is on the south side of the channel into Hampton Roads. From Fort Wool (Rip Raps) the shoalest part of the bank extends 2½ miles east-northeastward, and is marked off its northeast end by a gas and bell buoy, and off the north side by a gas buoy. This part of the bank has been used as a dumping ground, and has little depth over it. Just southward of Fort Wool is a narrow channel with a depth of 13 feet, which leads south of Willoughby Bank; it is little used except by boats engaged in dredging operations.

Willoughby Bay, formed by Willoughby Spit and the shoals extending northward from it and by Sewall Point, has depths of 8 to 12 feet in the outer part and 3 to 5 feet in the eastern end. Jamestown Exposition Pier and several buildings near it on the south side are prominent. The dredged channel formerly leading to the pier has shoaled to about the natural depth and will not be restored. There is a wharf on the western end of **Willoughby Spit** at which the ferry from Old Point Comfort lands, and there is an electric road from here to Ocean View and Norfolk. The entrance to the bay is ⅜ mile west-southwestward of Fort Wool, has a depth of 7 feet, and is marked by a light on the west side and a black buoy on the east side. In entering, leave the light 40 yards on the starboard side. There is a light on the western edge of the shoal, about midway between the entrance and the wharf at Willoughby Spit. **Mason Creek**, on the south side of Willoughby Bay, is nearly bare at the entrance at low water and is little used. It is crossed by a drawbridge just inside the entrance.

Horseshoe is described under the heading "Hampton Roads to York River." **Thimble Shoal**, with depths of 9 to 11 feet, forms the south edge of the Horseshoe, and forms the north side of the channel into Hampton Roads between Thimble Shoal lighthouse and Old Point Comfort.

Mine fields.—Two mine fields, marked at the corners by red and white buoys, have been set aside for the use of the War Department. One or more submarine mines are usually moored in the fields; while loaded mines are never left in the water, both mines and buoys should be avoided by vessels. The southerly edge of the outer

field lies 7/8 to 1 3/8 miles eastward of Old Point Comfort lighthouse, approximately on a line joining it and Thimble Shoal lighthouse. The southerly edge of the inner field lies 1 1/8 to 1 5/8 miles 232° true (SW by W 1/8 W mag.) from Old Point Comfort lighthouse.

Old Point Comfort, on the north side, at the entrance to Hampton Roads, is a summer resort and the site of a military post (Fort Monroe). It has communication by railroad and electric road with Hampton and Newport News, with Norfolk by steamer, and with the west end of Willoughby Spit by ferry, from which an electric road runs to Ocean View and Norfolk. Most of the steamers plying from Norfolk to points on Chesapeake Bay and tributaries land at Old Point Comfort. Gasoline, provisions, and water in small quantities are obtainable. Landing at the wharf is often rendered difficult by the strong tidal currents. The first of the ebb tide sets southeastward from the wharf and the last of the ebb sets directly on the wharf and northward through the opening eastward of Hampton Bar. The direction of the flood current is approximately west-southwestward.

Mother Hawkins Hole is an anchorage, with depths of 9 to 12 feet, much used by small local craft, on the west side of Old Point Comfort and north of the easterly end of Hampton Bar. The entrance is between the wharf at Old Point Comfort and the horizontally striped buoy close westward of it, and has a depth of 18 feet. Leading northward from the west end of Old Point Comfort is a buoyed channel with depths of 7 to 9 feet, which affords good anchorage for boats.

Mill Creek, inside of Old Point Comfort, has large areas bare at low water, and several narrow channels. It is crossed by two fixed bridges at the mouth, under which small boats can pass. The creek is little used.

Hampton Bar, with 2 to 5 feet over it, extends from 100 yards to 2 miles west-southwestward from Old Point Comfort; it is marked by red buoys on the south side and horizontally striped buoys at each end.

Hampton Creek, 1 1/4 miles west-northwestward of Old Point Comfort, is the approach to the town of **Hampton**. There is a depth of 9 feet across Hampton Flats from both eastward and southwestward to the entrance, and the same depth in the channel in the creek. Steamers from Norfolk make regular trips to several wharves in the creek. It is the headquarters of a large number of boats engaged in oystering and fishing, and has some trade in schooners and barges, the deepest draft being 10 feet. The part of the river between the public wharf and the lower bridge, a distance of 1/4 mile, is used as an anchorage for boats. The river is crossed by several fixed bridges and there is no navigation above them except in small motor boats without houses. Gasoline, provisions, coal, and water are obtainable and there is a shipyard and railway capable of hauling out vessels of 125 tons, 125 feet length, 9 feet draft aft and 6 feet forward.

Hampton Creek is usually approached from eastward, northward of Hampton Bar. Pass 300 yards southward and 175 yards westward of Hampton Creek light, off the entrance, and 150 feet west-

ward of the red buoy near the entrance. Then head midway between the wharves at the entrance, pass in mid-channel eastward of a black buoy about ¼ mile above the entrance, and then follow the wharves on the west side at a distance of about 100 feet.

There is a **privately dredged channel** 1¾ miles west-southwestward of Hampton Creek, leading to a wharf from which a ferry runs to Sewall Point. The channel was dredged to a depth of 10 feet and width of 100 feet, but had shoaled to a depth of about 8 feet in 1915. It is marked by two private lights, the outer one to be left to port and the inner one to starboard when entering.

Newport News is an important seaport and has a trade in vessels up to 32½ feet draft. It is the terminus of the Chesapeake & Ohio Railroad, which owns the wharves, grain elevator, and coal chutes at the southeast end of the city. It is also the site of the Newport New Ship Building & Dry Dock Co. plant, which has wharves at the northwest end of the city. There are depths of 25 to 30 feet at the shipyard wharves, and sufficient depths for the largest vessels at the railroad wharves. Many steamers and small craft land at the Old Dominion Land Co. wharf, 400 yards northward of the most northerly coal pier. Just southward of this wharf is an inclosed basin for small boats about 150 yards square, having a depth of 7 feet in the entrance and 2 to 8 feet inside; it is privately owned but open for public use. Gasoline is obtainable here.

A **harbor for small craft** and a municipal pier have been constructed by the city of Newport News in the mouth of **Newport News Creek**, ¾ mile southeastward of the most southerly coal pier. The harbor is 3,300 feet long and 300 feet wide. In 1915 there was a depth of 13 feet at the outer end of the pier, 8 feet at the entrance to the harbor, and 9 to 11 feet in mid-channel inside the harbor. The best water in approaching the entrance is from southwestward, and leads close along the western side of the pier in entering.

Channels.—The approach to Hampton Roads from eastward is through **Thimble Shoal Channel**, which has been dredged to a depth of 35 feet and width of 500 feet and is marked by red nun buoys on the north side and black gas buoys on the south side. The least depths outside of and near the dredged channel are 27 to 29 feet. From the western end of Thimble Shoal Channel to the eastern end of Newport News Middle Ground the channel has ample width and depth and is marked by Thimble Shoal and Old Point Comfort lighthouses and by several buoys, some of which are lighted.

Two channels have been dredged around **Newport News Middle Ground** to Newport News. The straight **channel northward of the Middle Ground** has been dredged to a depth of 35 feet and width of 400 feet. It is marked by red buoys on the north side and black gas buoys on the south side. The currents do not always set fair with the channel, especially with strong winds, and some trouble has been experienced at times by deep-draft vessels to keep in the channel. The least depths outside of and near the dredged channel are 21 to 24 feet. The channel is used by most vessels, except large vessels under sail, which often use the south channel.

The curved **channel southward of Newport News Middle Ground** has been dredged to a depth of 30 feet and width of 500 feet, but some shoaling has occurred and the channel will not be redredged; it had a depth of about 28 feet in 1915. It is marked by a perpendicularly

striped buoy at the easterly entrance, and by red buoys on its north side at the turns. The least depths outside of and near the dredged channel are 24 to 26 feet.

Prominent objects.—In approaching Hampton Roads the most prominent objects are: **Thimble Shoal lighthouse** (red conical tower on pier); **Old Point Comfort lighthouse** (white tower) and a large red hotel (Hotel Chamberlin) at Old Point Comfort; **Fort Wool**, a low gray structure on the south side of the entrance abreast Old Point Comfort; and a large group of buildings at **Ocean View**, a summer resort on the beach 4 miles southeastward of Old Point Comfort.

From inside the entrance some of the prominent objects are: A tower, the high dome of the **Soldiers' Home**, and several prominent chimneys at Hampton; a grain elevator at Newport News; **Newport News Middle Ground lighthouse** (brown conical tower on pier); and a coal pier and several building at Sewall Point. At night the electric lights at Newport News and Sewall Point are prominent.

Anchorage.—Vessels may select anchorage in any depth from 8 feet to 14 fathoms. In selecting anchorage consideration must be given to leave a clear track for the large number of deep-draft vessels entering Norfolk Harbor and Newport News and the steamers which land at Old Point Comfort, as it is not safe for vessels to anchor in these tracks. The approach to the wharf at Old Point Comfort, to the dredged cut into Elizabeth River and to the cuts which lead southward and northward of Newport News Middle Ground, should also be kept clear.

The usual and best anchorage for the **deepest draft vessels** is in 6 to 14 fathoms on the north side of Hampton Roads between Old Point Comfort and the entrance of the dredged channel northward of Newport News Middle Ground and either northeastward or southwestward of the mine field. Vessels anchored southwestward of the mine field, to swing in a depth of over 6 fathoms, should keep Newport News Middle Ground lighthouse bearing westward of 227° true (SW ⅝ W mag.), and should keep northward of a line joining Old Point Comfort lighthouse and the entrance of the dredged channel northward of Newport News Middle Ground, bearing 44° true (NE ⅜ E mag.), to keep out of the track of shipping.

Vessels anchored northeastward of the mine fields should keep Old Point Comfort lighthouse open southward of the house on the wharf to keep clear of Hampton Bar and should keep the wharf bearing eastward of 40° true (NE mag.) to keep out of the track of shipping. A good anchorage, with depths of 3½ to 5 fathoms and used by large coasting vessels, is westward of the dredged cut into Elizabeth River and northward of Craney Island Flats; also eastward of the dredged cut into Elizabeth River and northward of the Virginian Railroad pier.

Light-draft vessels anchor on Craney Island Flats in 9 to 14 feet; and for a distance of nearly 1 mile southward of the Virginian Railroad pier, on the west side of Sewall Point, there is good anchorage in 13 to 17 feet, eastward of the dredged channel into Norfolk Harbor.

Mother Hawkins Hole, inside of Hampton Bar and just west of Old Point Comfort, is much used by small craft of about 8 feet or less draft; and Hampton Creek is much used by motor boats in heavy weather.

Vessels of less than 7 feet draft can anchor in Willoughby Bay inside of Willoughby Spit, or they may anchor in 9 to 12 feet between Willoughby Spit and Sewall Point Spit, where they are sheltered from the sea by shoals with 2 to 5 feet over them.

The deep-water anchorage, with depths of over 6 fathoms, **at Newport News** in the entrance of James River is about 3/8 mile wide along the wharves and to the dredged channels westward of Newport News Middle Ground; for a distance of 3/8 mile farther from the wharves the depths are 21 to 36 feet.

Pilots for Hampton Roads, Newport News, and Norfolk will be found cruising off or in the entrance of Chesapeake Bay, and can also be had at Old Point Comfort, where a Virginia pilot boat will usually be found. Pilotage is compulsory for certain vessels. For further information see page 119.

Towboats can be had in Hampton Roads, or from Norfolk or Newport News, by telephone from Old Point Comfort.

Quarantine.—The boarding station for all vessels entering Hampton Roads is a vessel moored in Hampton Roads off Hotel Chamberlin. See also page 121.

Storm warnings are displayed at Cape Henry, Old Point Comfort, Newport News, and Norfolk.

Repairs.—There are facilities for the construction and repair of the largest vessels. For the dimensions of the largest dry docks and marine railways at Newport News, Norfolk, Berkley, and Hampton see page 24.

Supplies of all kinds are obtainable at Newport News and Norfolk, and in limited quantities at Hampton and sometimes at Old Point Comfort. Water can be obtained at the wharves and from waterboats. Bituminous coal can be had, through chutes, from the coal wharves at Newport News and the coal piers at Sewall Point and Lambert Point. Anthracite and bituminous coal can be obtained at the wharves in Norfolk or from lighters at the anchorage. Water, provisions, and ship chandlery will be delivered by boat to vessels in Hampton Roads.

Regulations for passing dredges.—The following regulations apply to Norfolk; Hampton Roads; Nansemond, Pagan, and Appomattox Rivers; harbor at Cape Charles City, Va.; waterways from Norfolk Harbor, Va., to Albemarle Sound, N. C., via both Albemarle & Chesapeake and Dismal Swamp Canals; Edenton Bay, and Roanoke River, N. C.:

Vessels propelled by machinery and passing within one-fourth of a mile of plant, employed in the improvement of said waters, shall not proceed at a speed greater than 4 miles per hour. In case it is necessary for any reason to pass said plant at a less distance than one-fourth of a mile the propelling machinery of passing vessels must be stopped while said vessels are abreast of said plant. When it is necessary for a vessel to pass between any such plant and the buoys indicating the position of the mooring anchors of said plant, such vessel shall give as a signal to said plant to lower the mooring lines four short blasts of a whistle or horn in quick succession, given when said vessel is about one-half of a mile away from the plant.

Vessels, when their draft permits, must go outside of the buoys indicating the position of the mooring anchors of all such plant.

No vessel shall anchor in such a place as to obstruct the view of the front or rear range or other marks erected for the guidance of any plant engaged in improving the above-mentioned waters.

No vessel or raft shall pass over or so near to any buoys, piles, or other marks placed in connection with the above-mentioned improvements as to destroy, move, or injure them.

Tides.—The mean rise and fall of tides is 2.5 feet.

Currents.—In the center of the channel, about 2 miles southwest of Old Point Comfort, slack water before the flood occurs 2 hours 30 minutes after time of low water at Old Point Comfort and slack water before the ebb occurs 1 hour 50 minutes after time of high water at Old Point Comfort. The mean velocity of the current at strength of flood is 1.5 knots and at strength of ebb is 1.7 knots; the currents, however, are influenced considerably by the wind and at times attain a velocity much in excess of these mean values. Along the wharves at Fort Monroe the currents change about 1 hour earlier than in the center of the channel.

Ice seldom interferes with navigation in Hampton Roads, even in severe winters.

DIRECTIONS, HAMPTON ROADS AND NEWPORT NEWS.

1. From seaward.—From a position 1⅜ miles north-northeastward of Cape Henry lighthouse a 287° true (WNW mag.) course for 12 miles will lead through the middle of Thimble Shoal Channel and to a position ½ mile southward of Thimble Shoal lighthouse. This channel is marked on its north side by red buoys and on its south side by black gas buoys.

Pass about ¼ mile northward of Willoughby Spit gas and bell buoy and steer 262° true (W ¼ S mag.) for about 1 mile, heading for Old Point Comfort lighthouse. Then bring Thimble Shoal lighthouse astern on a 250° true (WSW ¾ W mag.) course. Pass well northward of a black gas buoy and enter Hampton Roads about midway between Old Point Comfort lighthouse and Fort Wool on a 235° true (SW by W ⅜ W mag.) course, heading for Newport News Middle Ground lighthouse, which will lead about 300 yards northwestward of Sewall Point Shoal gas and bell buoy. Anchor at discretion inside of Old Point Comfort. (See "Anchorages," preceding.)

1 A. From northward, coming down Chesapeake Bay.—Vessels of the deepest draft should reverse the courses for passing up the bay and pass eastward and about ¼ mile southward of Tail of the Horseshoe light vessel. A 265° true (W mag.) course for 4 miles will then lead to the entrance of Thimble Shoal Channel between buoys Nos. 2 and 3.

There is a least depth of 31 feet on the Tail of the Horseshoe between the light vessel and the gas and whistling buoy lying 1½ miles westward of it, and with a smooth sea vessels of a less draft can cross the shoal eastward of the buoy.

With a smooth sea a depth of not less than 17 feet can be carried across the end of Horseshoe Shoal on a line leading to bell buoy No. 12, lying 1¼ miles east-southeastward of Thimble Shoal lighthouse on a bearing of 190° true (S by W ⅜ W mag.) or anywhere

eastward of this line; this course will also lead eastward of the limits of the fish traps on Horseshoe Shoal. From Middle Ground Shoal north end gas and whistling buoy a 180° true (S ½ W mag.) course for 7½ miles will lead eastward of the broken ground with depths of 18 feet off Back River lighthouse; then a 215° true (SW ⅜ S mag.) course with 35-foot channel light vessel astern will lead to bell buoy No. 12. From buoy No. 12 a 265° true (W mag.) course will lead for Old Point Comfort lighthouse, passing 300 yards northward of Willoughby Spit gas and bell buoy.

Vessels crossing Horseshoe Shoal closer to Thimble Shoal lighthouse should keep that lighthouse bearing westward of 224° true (SW ⅜ W mag.) in order to pass eastward of the limits of the fish traps; the least depth is 15 feet.

For courses used by local vessels of 7 feet or less draft crossing Horseshoe Shoal westward of Thimble Shoal lighthouse see Horseshoe Shoal, page 150.

2. Hampton Roads to Newport News—To pass through the dredged cut (35 feet) north of the Middle Ground.—Passing 300 yards northwestward of Sewall Point Shoal gas and bell buoy, bring Old Point Comfort lighthouse astern on a 224° true (SW ⅜ W mag.) course for 1½ miles until up with the buoys at the easterly entrance of the dredged cut. Steer 263° true (W ⅛ S mag.) through the cut, which leads ⅝ mile northward of Newport News Middle Ground lighthouse. The cut is marked on its north side by red buoys, and on its south side by black gas buoys. From the westerly end of the dredged cut steer about 307° true (NW ¼ W mag.) and pass 300 to 500 yards off the wharves at Newport News. Select anchorage ¼ to ¾ mile off the wharves according to draft. (See "Anchorages," preceding.)

To pass through the dredged cut south of the Middle Ground.—These directions are good for a depth of about 27 feet.

Passing 300 yards northwestward of Sewall Point Shoal gas and bell buoy, steer 214° true (SW ½ S mag.) for 2½ miles to Fairway lower buoy (can, black and white perpendicular stripes). Pass through the dredged cut, leaving the red buoys about 200 feet on the starboard hand. The courses are 245° true (WSW ¼ W mag.) from Fairway buoy to buoy No. 2, then 260° true (W ⅜ S mag.) to buoy No. 4, then 290° true (NW by W ¾ W mag.) to buoy No. 6, then 311° true (NW ⅛ N mag.) to buoy No. 8, and then 328° true (NNW ⅜ W mag.) to buoy No. 10. Then steer 318° true (NW ¾ N mag.) and pass from 300 to 500 yards off the wharves at Newport News. Select anchorage ¼ to ¾ mile off the wharves, according to draft. (See "Anchorages," preceding.)

ELIZABETH RIVER AND NORFOLK HARBOR.

Elizabeth River, emptying into Hampton Roads from southward, is important as the approach to the cities of Norfolk and Portsmouth, and the Dismal Swamp and Albemarle & Chesapeake Canals. Vessels of 33 feet draft go to the coal piers inside the entrance, 32 feet draft to Norfolk, and 8 to 9 feet draft through the canals.

The main channel of Elizabeth River has been dredged to a depth of 35 feet and width of 400 feet from Hampton Roads to the Belt Line Railroad bridge, just above the navy yard and 1¾ miles above the junction of the Eastern and Southern Branches. Considerable

dredging has been done to a depth of 30 feet outside the limits of the 35-foot channel. The channel is well marked by buoys, some of them lighted, and by Craney Island lighthouse and Bush Bluff light vessel, and is easily followed.

Sewall Point, on the eastern side of the entrance to Elizabeth River, is the terminus of the Virginian Railway, and has a coal pier to which a channel 30 feet deep and 150 yards wide has been dredged. Vessels load here to a draft of 30 feet. It is connected with Norfolk by an electric road; and a ferry runs to the north side of Hampton Roads, 1¾ miles southwestward of Hampton Creek, from which there is electric railway communication with Newport News, Hampton, and Old Point Comfort.

Tanner Creek, on the east side of Elizabeth River, eastward of Craney Island lighthouse, has a depth of 5 feet in the entrance and 7 feet inside to the fork 3½ miles above the entrance, above which there is a depth of 2 feet in either fork to near the head of navigation. It is frequented only by small boats. The channel at the entrance is marked by buoys, but is narrow and has extensive shoals on either side, and local knowledge is necessary to enter with the best water. There are no marks above the entrance and some local knowledge is required to keep in the best water. The creek and its branches are crossed by several bridges; the first three in order from the entrance have draw openings 60, 40, and 28 feet wide, and those above are fixed.

Craney Island (low and sparsely wooded) is the site of a quarantine station of the cities of Norfolk and Portsmouth. There is a depth of 2½ feet to the wharf on the southwest side. The shoal extending eastward from the island is marked on its northeast end by **Craney Island lighthouse** (white house on piles).

Lambert Point, on the eastern side of Elizabeth River, 1 mile southward of Craney Island lighthouse, is the site of the large coal and other piers of the Norfolk & Western Railroad. Depths of 30 to 33 feet are maintained by dredging alongside the wharves and vessels load here to a draft of 33 feet.

Western Branch, on the west side of Elizabeth River, southward of Lambert Point, has been improved by dredging a channel to a depth of 24 feet to abreast the wharves at West Norfolk below the first bridge. The width of the channel is 300 feet to within ¼ mile of the bridge and 200 feet to abreast the wharves. Some dredging has also been done to a depth of 16 feet on the point of the shoal on the north side at the entrance. The channel below the bridge is frequented by vessels up to 24 feet draft to a wharf at West Norfolk; and by towboats, car floats, and barges to the railroad wharves at Port Norfolk, the deepest draft being 14 feet. The channel is well marked, as shown on the chart.

For a distance of 3 miles above West Norfolk to the fourth bridge, Western Branch has a depth of 8 feet in a narrow unmarked channel. It is shoal in places above the fourth bridge, but is navigable for small boats for a further distance of about 3 miles. There is considerable traffic above West Norfolk in small vessels to farm landings. The chart is the only guide for strangers.

Six bridges cross Western Branch between the entrance and the head of navigation, and all have draw openings, the clear widths of which, in order from the entrance, are 65, 45, 50, 50, 25, and 24 feet.

West Norfolk, on the north side, at the entrance of Western Branch, is the site of a smelting plant to which ore vessels up to 24 feet draft go. The deeper draft vessels usually employ a towboat when entering. There is a shipyard and railway just above the bridge, which can take out vessels of 90 feet length and 10 feet draft.

Port Norfolk, on the south side, at the entrance of Western Branch, has a wharf and several ferry slips on the north side, at which car floats, towboats, and barges from the town of Cape Charles make landings. A depth of 15 feet can be taken to the wharves.

Pinner Point, on the southwest side of Elizabeth River, just above the entrance to Western Branch, is the main terminal of the Atlantic Coast Line and Southern Railroads, and has several wharves at which large vessels load and discharge.

Scott Creek, between Pinner Point and Hospital Point, has been improved by private enterprise, and has a depth of 7 feet in a narrow channel for a distance of ½ mile above the entrance to a drawbridge, above which it is shoal. It is used by vessels to the lumber wharves on the south side just below the bridge, and by small boats to the oyster houses just above the bridge. The bridge has a center pier draw, each opening 35 feet wide, with a headroom of 4½ feet at high water when closed.

Hospital Point is the site of a naval hospital. It is wooded and a black water tank and the dome of the main hospital building are visible above the trees.

Smith Creek, opposite Hospital Point, has a depth of 8 feet in the entrance and 6 to 7 feet inside to several wharves on its west and south sides. It is frequented by towboats, barges, and car floats, carrying coal and building material to the yards inside, and is also used as an anchorage by motor boats.

Norfolk, on the east bank of Elizabeth River, 7 miles above Sewall Point, is one of the important ports of the United States for the shipment of coal, cotton, and merchandise; it has a large foreign and coasting trade, and is a terminus of several railroads. Several lines of coasting and bay steamers ply from the port, and it is the center of steamboat traffic to Cape Charles City and to the tributaries on the west side of the bay as far as Rappahannock River. It has ferry communication with Portsmouth and Berkley, and frequent communication by steamers with Newport News, Old Point Comfort, and Hampton.

Public docks.—There are two public docks on the Norfolk water front used by small local craft. One is eastward from Hospital Point and at the head of the slip on the north side of the Merchants & Miners' Transportation Co. wharf; there is also a small boat landing at the head of the slip on the south side of this wharf, at which landings can be made with permission of the agent. The other public dock is a slip 100 yards long lying 80 yards westward of the ferry slips.

Berkley, a part of the city of Norfolk, is on the point between Eastern and Southern Branches. The main freight terminus of the Norfolk Southern Railroad and several lumber and fertilizer wharves are located here, and there are also several shipyards and marine railways. The United States naval training station is on the Southern Branch, opposite the navy yard.

Portsmouth, on the west side of Elizabeth River, opposite Norfolk and Berkley, is the site of a **United States navy yard** and is the main terminus of the Seaboard Air Line Railroad. It has several other commercial wharves and has considerable trade in foreign and coastwise vessels.

Eastern Branch, extending eastward along the south side of the city of Norfolk, has been improved by dredging a channel with a depth of 25 feet to the first bridge, 7/8 mile above the entrance, and 22 feet a farther distance of 1/2 mile to the second bridge. The branch above this point has a natural channel with a depth of 16 feet to the third bridge, 2 1/2 miles above the entrance, and 10 feet to the fork, 3 1/2 miles above the entrance.

The north fork (**Broad Creek**) has a depth of 2 feet for 1 3/8 miles, and the south fork a depth of 2 feet for about 2 miles. Below the second bridge there is an extensive traffic to the wharves at Norfolk and Berkley, but above that point the branch is little used except by small local craft.

From the entrance to the first bridge the entire channel of Eastern Branch is clear, with a depth of 18 feet or more, if the ends of the wharves on the Berkley side be given a berth of 70 yards. The width, with a depth of 25 feet, is about 100 feet, and the best water leads along the north side. Between the first and second bridges the channel favors the north side, a straight course between the draws of the first and second bridges leading in the middle of the dredged channel. From the second bridge the channel favors the north side for 1/2 mile, and then leads for the draw of the third bridge. From the third bridge the best water trends eastward for 400 yards, and then about 74° true (E by N mag.) for 5/8 mile to the fork. It is easily followed to this point with the aid of chart 451.

Three **drawbridges** cross Eastern Branch between the entrance and the fork. The Norfolk & Western Railroad bridge, 7/8 mile above the entrance, has a lift opening 140 feet wide and a headroom of 7 feet at high water when closed. The Campostella Bridge, 1 3/8 miles above the entrance, has a center pier draw with a single clear opening 37 1/2 feet wide and a headroom of 6.4 feet at high water when closed; it is to be rebuilt in 1916 with a draw opening 65 feet wide. The Virginian Railway bridge, 2 1/2 miles above the entrance, has a center pier draw, each opening 60 feet wide, with a headroom of 6 feet at high water when closed. The ebb current through the latter bridge has a southerly set. Three bridges cross the north fork (Broad Creek). The first two, just above the fork, have draw openings about 30 feet wide, and the third, 1 1/8 miles above the fork, has a draw opening 28 feet wide, but there is little navigation above.

Indian River, on the south side of Eastern Branch, 2 1/2 miles above the entrance, has a depth of 3 feet for 3/4 mile above the mouth.

Southern Branch of Elizabeth River (chart 451) forms the northern approach to the two canals which afford passages from Chesapeake Bay to the inland waters of North Carolina. This branch is of considerable commercial importance; there are several large lumber mills and other manufactories at which vessels load, and the commerce using the canals also passes through the branch. The inside route through the canals is described in United States Coast Pilot, section D, Cape Henry to Key West; and Inside Route Pilot, New York to Key West.

Between the first and second bridges the channel of Southern Branch has been dredged 300 feet wide and 25 feet deep, and between the second and third bridges 200 feet wide and 22 feet deep; above this and to the lock of the Albemarle & Chesapeake Canal the depth in the channel is about 9 feet. The channel for its whole length of 10½ miles is marked by buoys and is not difficult to navigate as far as the entrance to Deep Creek with the aid of the chart. Above this, to the lock of the Albemarle & Chesapeake Canal, some local knowledge is needed to follow the channel. Improvements are in progress to deepen the channel from Norfolk to **Beaufort, N. C.**, via the Albemarle & Chesapeake Canal, to 12 feet; the through depth by this route in 1915 was 8½ feet.

Bridges, Southern Branch.—The whistle signal for all bridges across Southern Branch is three long blasts.

Belt Line Railroad bridge, 1¾ miles above the entrance, has a center pier draw, each opening 110 feet wide, with a headroom of 15 feet at high water when closed.

Virginian Railway bridge, 2¾ miles above the entrance, has a center pier draw, each opening 110 feet wide, with a headroom of about 7 feet at high water when closed.

Norfolk & Western Railroad bridge, 5 miles above the entrance, has a single lift opening 125 feet wide, and a headroom of 7 feet at high water when closed.

The railroad bridge across Southern Branch, ¾ mile above the mouth of Deep Creek, has a center pier draw, each opening 80 feet wide, with a headroom of 7½ feet at high water when closed.

The highway bridge ¾ mile farther up has a center pier draw, each opening 80 feet wide, with a headroom of about 6 feet at high water when closed.

The Albemarle & Chesapeake Canal route has been purchased by the Government and is free of tolls. This canal connects the Southern Branch of Elizabeth River with **North Landing River**, and has one lock at its northern end, about 10½ miles from Norfolk. The canal is 7¼ miles long and affords a passage for vessels 200 feet long, 39 feet beam, and 8½ feet draft (in 1915). It is being improved under a project to obtain a depth of 12 feet. It is crossed by four drawbridges. The depth of water in the canal is lowered by northerly winds and raised by southerly winds; severe storms may cause a difference of 2 feet or more below or above the normal.

Deep Creek, which empties into the Southern Branch about 6 miles above Norfolk, is 2½ miles long to the entrance of the Dismal Swamp Canal. The creek has been improved by dredging a channel 100 feet wide and 10 feet deep from the Southern Branch to the canal. On the south side at the entrance of the creek there is a lighted signboard directing the way to the Dismal Swamp Canal.

Dismal Swamp Canal (Lake Drummond Canal & Water Co.'s canal) connects Deep Creek with the **Pasquotank River.** The northern lock of the canal is about 8½ miles above Norfolk. This canal is about 19 miles long, 60 feet wide, and 9 to 10 feet deep, with turnouts at distances of about 3 miles where vessels may pass each other; the two locks are 250 feet long and 39 feet wide.

Anchorage, Elizabeth River.—Anchorage in Elizabeth River is along the sides of the dredged channel, is limited in area, and is frequently congested.

The usual and best anchorage for deep draft vessels is on the west side of the channel opposite Lambert Point, between Craney Island lighthouse and the entrance of Western Branch, in depths of 24 to 36 feet.

The generally used anchorages near Norfolk for small vessels and barges are on the west side of the channel between Hospital Point and the lower wharves at Portsmouth, on the east side of the channel at the mouth of Smith Creek, and on the south side of the channel in Eastern Branch between Norfolk and Berkley.

For **general information** for Elizabeth River relating to pilots, towboats, supplies, repairs, storm warnings, and dredge regulations, see "Hampton Roads."

Quarantine for the district of Elizabeth River is under the control of the United States Public Health Service and the boarding station is at Old Point Comfort.

Harbor regulations.—The harbor masters of Norfolk and Portsmouth have control of the berthing of vessels and designate the anchorage grounds. Vessels are not permitted to anchor in the dredged channels. The limits of speed for vessels above Sewall Point are, for vessels under 100 tons, 10 statute miles per hour; 100 to 1,500 tons, 9 miles; over 1,500 tons, 8 miles.

A **United States Branch Hydrographic Office** is located at the customhouse. Bulletins are posted here giving information of value to seamen, who are also enabled to avail themselves of publications pertaining to navigation and to correct their charts from standards. No charge is made for this service. A time ball is dropped at noon, seventy-fifth meridian time, from the Citizens' Bank Building, and is visible from anywhere in the harbor.

Ice.—The harbor is generally free of ice and navigation is never obstructed. In severe winters the upper part of Southern Branch is sometimes closed for short periods.

Tides.—The mean rise and fall of the tides is 2.6 feet at Craney Island and 2.8 feet at the navy yard.

Currents.—In the Southern Branch of the Elizabeth River, opposite the navy yard, the tidal currents change at about the times of high water and low water at the navy yard, or, slack water before the flood occurs at about 45 minutes after time of low water at Old Point Comfort and slack water before the ebb occurs at about 30 minutes after time of high water at Old Point Comfort. The mean velocity of the currents at strength is about 1.3 knots.

DIRECTIONS, ELIZABETH RIVER.

There are no natural ranges for the 35-foot dredged channels, and some local knowledge is required for vessels of the deepest draft to follow the best water. Otherwise the channel is well marked and easily followed in clear weather, although the channel is often crowded with traffic. Shoals rise abruptly in places on the sides of the channel, as shown on the chart. A towboat is generally used by large vessels when docking. The following are the courses through the dredged channels:

Passing about 300 yards westward of Sewall Point Shoal gas and bell buoy, steer 184° true (S ⅞ W mag.) for 3½ miles, being guided

by the buoys, some lighted, which mark the sides of the channel, until up with Bush Bluff light vessel. Pass westward of the light vessel and steer 172° true (S ¼ E mag.), being guided by the buoys, and passing about 200 yards eastward of Craney Island lighthouse and about 150 yards westward of the northerly piers at Lambert Point. From a position 300 yards off the southerly piers at Lambert Point the course is 131° true (SE ⅛ S mag.) for the ends of the wharves at Norfolk; two iron stacks showing to left of clock tower at Berkley are ahead on this course. For anchorage areas, see "Anchorages," preceding.

NANSEMOND RIVER (CHART 529),

on the southwest side of Hampton Roads, 2 miles southwestward of Newport News Middle Ground lighthouse, is the approach to the city of Suffolk, 18 miles above the mouth. It has considerable trade in small produce boats and a few barges and schooners, the deepest draft being 12 feet; this draft can be taken to Suffolk at high water. There are several wharves below Suffolk from which farm produce is shipped. The channel has been improved by dredging to a depth of 12 feet and width of 80 feet from the mouth to Suffolk, and had a depth of 11 feet in 1915. Small boats can go several miles above Suffolk. For regulations for passing dredges, see page 132.

From the entrance to the mouth of Western Branch, 6 miles below Suffolk, the river is wide, but the channel is crooked and leads between extensive shoals which are nearly bare in places at low water. Above this point the river is narrow and crooked, but the mid-channel is clear to Suffolk. The channel is marked by buoys and several lights as far as Western Branch. There is a dike on the eastern side of the channel opposite the mouth of Western Branch; the northern end is submerged at extreme high water and unmarked. Strangers up to 6 feet draft should have no trouble in following the channel to Suffolk with the aid of the chart. Those of deeper draft are advised to take a pilot. One can usually be obtained near the mouth of the river or at Norfolk or Newport News.

Bennett Creek, on the south side of Nansemond River, 2¾ miles above Nansemond River lighthouse, has a depth of about 1 foot on the bar at the entrance and 6 feet inside for 5 miles above the entrance. It is frequented by produce and pleasure boats, the deepest draft being 4 feet.

Western Branch, on the west side of Nansemond River, 6 miles below Suffolk, is said to have a depth of 5 feet at high water for 5 miles above the mouth, and is used by a few small produce and wood boats.

Suffolk, a city at the head of navigation for vessels on Nansemond River, 18 miles above the mouth, is an important railroad center. Gasoline and provisions are obtainable, and there is water on the wharves. A drawbridge having a draw opening 34 feet wide crosses the river at the upper end of the wharves, and there is little traffic above.

Tides.—The mean rise and fall of tides is 2.6 feet at the entrance and 3.4 feet at Suffolk.

JAMES RIVER,

emptying into the western end of Hampton Roads at Newport News, is the approach to the cities of Richmond and Petersburg and the towns of Smithfield and City Point. It is navigable to the city of Richmond, 89 miles above Newport News. The river has a large trade in coal, oil, farm and wood products, and general merchandise, carried in barges, schooners, and the regular steamers. The deepest draft going to Richmond is 16 feet and the usual draft not over 13 feet.

Channel.—James River is being improved under a project to obtain a depth of 22 feet from the mouth to Richmond. The project width is 400 feet from the entrance to City Point, 60 miles above Newport News, 300 feet to Drury Bluff, 6½ miles below Richmond, and 200 feet to Richmond, widened to 400 feet abreast the wharves at Richmond to form a turning basin. In December, 1915, there was a channel 20 feet deep and at least 250 feet wide from the entrance to City Point, and 18 feet deep and at least 100 feet wide from City Point to Richmond.

There are numerous wharves along the main channel of James River, many of them with a store and post office but no settlement near them. They are used as shipping and receiving points for farm and wood products and supplies for the surrounding country. Regular day steamers between Norfolk and Richmond make stops at most of them.

The small creeks tributary to James River are usually shoal at the entrances with deeper water inside for long distances. Most of them are frequented by small produce boats, and by barges and small sail vessels carrying wood and lumber. Local knowledge is generally necessary to keep in the best water.

Chuckatuck Creek, 4 miles southwestward of Newport News, has a depth of 3½ feet across the bar at the entrance and deeper water inside to the village of **Crittenden,** just above the entrance. There is a depth of 3 feet to the village of **Chuckatuck,** 5 miles above the entrance. There is a shipyard and railway at Crittenden capable of hauling out any of the boats navigating the creek. The channel in the approach leads northward and westward of the light in the entrance of Ragged Island Creek, then southward of the red buoy in the entrance of Chuckatuck Creek.

Ragged Island Creek, just northward of Chuckatuck Creek, is shoal and little used. Small boats can go to near the head at high water only.

White Shoal, a middle ground 5 miles northwestward of Newport News, is marked by **White Shoal lighthouse** (white hexagonal house on piles). There are channels on either side, but the buoyed channel with a depth of 17 feet southward of the lighthouse is generally used.

Pagan Creek, on the southwest side of James River, southwestward of White Shoal lighthouse, has been improved by dredging a channel 10 feet deep and 40 feet wide to the town of Smithfield, 5 miles above the entrance, but is subject to some shoaling. The deepest draft entering is 10 feet at high water, and usual draft not over 8 feet. There is a black bell buoy on the southwest side of the main channel of James River, in line with the entrance cut of Pagan

Creek. The channel is also marked by a buoy and several lights. In 1914 several day ranges used in connection with the dredging operations, and bush stakes maintained by the steamboat company, were in position. Navigation by vessels is rendered difficult on account of the narrow channel and the sharp turns, and strangers should take a pilot; one can be obtained at Newport News or Battery Park. For regulations for passing dredges see page 132. The mean rise and fall of tides is 2.5 feet.

Jones Creek, on the south side of Pagan Creek, just inside the entrance, has a depth of 3 feet across the flats at the entrance and deeper water inside for 3½ miles. It is crossed by two drawbridges, having a least width of 25 feet; the first is near the mouth and the second 2½ miles above.

Battery Park is a post village on the south side of Pagan Creek, just inside the entrance. There are marine railways here, the largest capable of hauling out boats of 50 tons, 60 feet length, and 8 feet draft.

Cypress Creek, a tributary of Pagan Creek from southward just below Smithfield, has a depth of 4 feet for about 3 miles above the mouth. A highway bridge with a single clear opening 30 feet wide crosses the creek at the entrance.

Smithfield, a town at the head of steamboat navigation on Pagan Creek, is connected with Newport News and Norfolk by steamer. There are depths of 10 feet at the wharves. Gasoline, provisions, and water are obtainable. A highway bridge having a draw opening 24 feet wide crosses the creek just above the wharves at Smithfield. Pagan Creek is navigable for small boats for 3 miles above the bridge, but is little used.

Warwick River, on the north side of James River, 7 miles above Newport News, has a depth of 6 feet in a narrow unmarked channel for 2 miles above the entrance, 2½ feet for the next ¾ mile, and deeper water for a further distance of 3 miles or more. The entrance is used as an anchorage by small oyster and fishing boats. The deepest draft entering is about 5 feet. There are unmarked shoals with depths of 3 to 5 feet off the entrance. A 351° true (N ⅜ W mag.) course, with White Shoal lighthouse astern, will lead to the entrance.

Point of Shoals is an extensive shoal area in mid-river 10 miles above Newport News, and there are extensive unmarked shoals extending to the shore northeastward. The main shoal is marked by a watch house on the southeast end and by **Point of Shoals lighthouse** on the western end. Small local boats pass northeastward of the shoal, but strangers should follow the main channel southward and westward of it.

Fergussons Wharf (Rushmere post office) is on the western side of James River westward of Point of Shoals lighthouse.

Lawns Creek, 1¾ miles westward of Deep Water Shoals lighthouse, has a depth of about 3 feet across the bar, and this depth can be carried for 4 miles above the entrance. The deepest draft entering is about 5 feet.

Skiff Creek, 2 miles northeastward of Deep Water Shoals lighthouse, has a depth of 2 feet across the flats at the mouth and deeper water inside for about 3 miles. It is little used.

Hog Point, 23 miles above Newport News, is low, with scattered clumps of trees. Homewood Wharf and post office are on the east side of the point.

College Creek, on the north side of James River, northward of Hog Point, has a depth of 2 feet across the flats at the mouth, 6 feet inside for 2 miles, and 2½ feet for a farther distance of ½ mile to **Williamsburg Landing**, 1 mile from the town of **Williamsburg**. The channel is difficult without local knowledge.

Jamestown Island is on the north side of James River, 27 miles above Newport News. **Jamestown Landing** and post office are on the western end. A white monument and the wharf are the most prominent marks. **The Thoroughfare** and **Back River**, northward of Jamestown Island, have a depth of about 2 feet at the eastern and western ends and 7 to 20 feet in the narrow channel northward of the western end of the island. They are used to some extent as an anchorage for small boats, but through navigation is prevented by a fixed bridge, under which only small boats without houses can pass.

Cobham Wharf is a landing and post office on the south side of James River, southward of Jamestown Island and ⅜ mile westward of Goose Hill Channel range lights. One mile northwestward is **Scotland Wharf** and post office, from which there is railroad communication with the Norfolk & Western Railroad at **Wakefield**. A large amount of lumber and wood is shipped in schooners and barges. Just westward of Scotland is **Greys Creek**, which has a depth of 3 feet across the flats at the entrance and deeper water inside for about 4 miles.

Chickahominy River (chart 530) is on the north side of James River, 33 miles above Newport News and 5 miles above Jamestown Island. It has been improved by dredging a channel 14 feet deep across the bar at the entrance and 8 feet deep to Windsor Shades, but the project is abandoned and the channels have shoaled. In 1914 there was a depth of about 11 feet at the entrance, 10 feet to **Binns Bar**, 20 miles above the entrance, and 6 to 7 feet for a farther distance of 2 miles to **Windsor Shades**. Small boats can go several miles farther, but navigation is difficult. The principal trade in the river is in wood and lumber, carried in barges and an occasional schooner. The deepest draft loaded in the river at or below Windsor Shades is about 9 feet.

The channel of Chickahominy River is crooked, narrow, and obstructed by shoals, and local knowledge is necessary to keep in the best water. Towboats are always employed and are usually obtained from Norfolk. The best water in the approach leads along the north shore from Jamestown Landing to the buoys at the mouth. The mean rise and fall of tides is 1.9 feet at the mouth and 2.4 feet at Windsor Shades.

Chickahominy River has several narrow tributaries with a good depth of water for several miles. **Gordons**, **Morris**, and **Yarmouth Creeks** are the ones most often entered by barges and schooners.

Lanexa is a village and railroad station on Chickahominy River, 15 miles above the entrance.

Claremont is a village and railroad station on the south side of James River, 38 miles above Newport News. There are several wharves, with depths of 7 to 15 feet, from which forest products are

shipped in barges and schooners. Gasoline and provisions are obtainable. On the north side of the river, opposite Claremont, is **Sandy Point Landing** (Tettington post office).

Chippoak Creek is on the south side of James River, 1½ miles westward of Claremont. It has a depth of about 5 feet for 4 miles and 2 feet to near the head of navigation. The deepest draft entering is 7 feet. A pilot can be obtained at Claremont. The best water in the entrance leads close along the south side. There are two wharves with white warehouses on the south side at the entrance.

Between Chippoak Creek and the bend 3½ miles northward are **Brandon Wharf** and post office and **Ritchie Wharf** on the west side, and **Trees Point Wharves** and **Oldfield Wharf** and post office on the east side.

On the north side of James River, opposite Kennon Marsh, are two wharves and **Sturgeon Point** post office. There is a brickyard at the upper wharf. On the south side of the river, 2 miles southwestward of Kennon Marsh, are two wharves and **Edlow** post office. **Kittewan Creek**, on the north side, 1¼ miles westward of Kennon Marsh, is nearly bare at the mouth at low water and has deeper water inside.

Ward Creek, on the south side, ¾ mile southeastward of Weynoak Point, has a depth of 1 to 2 feet across the flats at the mouth and deeper water inside for 3 miles. The ruins of a pier, submerged at extreme high water, are on the edge of the main channel at the entrance of the creek.

Weynoak Wharf and post office are on the east bank of the river, 1 mile above the bend at Weynoak Point.

Wilcox Wharf and post office are on the north bank of James River, northward of Windmill Point.

Herring Creek, on the north side, 2 miles westward of Windmill Point, has a depth of 2 feet across the flats at the entrance and is used by boats of 4 feet draft at high water. A wharf and prominent water tank lie ½ mile westward of the creek, and ¾ mile farther westward are **Westover Wharf** and post office. On the south side, opposite the entrance to the creek, are **Blairs Wharf** and post office.

Powells Creek, just eastward of Coggins Point, has a depth of 4 feet for 3 miles above the entrance, and is entered by boats of 6 feet draft at high water.

City Point is a town at the junction of James and Appomattox Rivers, 60 miles above Newport News, and is the terminus of a branch railroad line to Hopewell and Petersburg. There is a depth of 15 feet at the wharf. Gasoline and provisions are obtainable. Pilots for the upper part of James River and Appomattox River can be obtained here, and towboats may be ordered by telephone or telegraph.

Hopewell, 3 miles inland from City Point, is the site of a large powder factory.

Appomattox River, on the west side of James River, 61 miles above Newport News and 28 miles below Richmond, is navigable for vessels to the head of navigation at Petersburg, 10 miles above the mouth. The river has been improved by dredging and the construction of training walls to obtain a channel 80 feet wide and 9 feet deep to Petersburg, and had a depth of 8 feet in 1915. It is frequented by passenger steamers and a few barges and schooners, the deepest draft being 8½ feet. There are no wharves between Petersburg and

the mouth. The most difficult part of the channel, through the flats at the mouth and from Point of Rocks to a point about 1 mile above, are marked by buoys, and for the remainder of the river a general mid-channel course is the best, although unmarked shoals extend nearly to mid-channel in places. Strangers should have no trouble in taking a draft of about 6 feet to Petersburg with the aid of chart 531. A pilot can be obtained at City Point. The depth at the entrance is about 11 feet and the best water lies about 75 yards south of the light. For regulations for passing dredges, see "Hampton Roads." The mean range of tides is about 2.8 feet.

The **northern branch of Appomattox River**, entering the main channel at **Point of Rocks**, has a depth of 7 feet at the entrance. There is a farm landing ¾ mile above the entrance, at which barges are sometimes loaded. The best water in entering leads 100 feet off Point of Rocks.

Petersburg has communication by railroad and by steamboat with City Point and points on the James River to Richmond. All kinds of supplies are obtainable. Ice and freshets do not interfere with navigation.

Bermuda Hundred is a village on the west bank of James River, 1½ miles above City Point. It is connected by a branch railroad with the main line of the Norfolk & Western Railroad at **Farmville**. The wharf has depths of 5 to 9 feet; considerable wood products are shipped from it in schooners and barges. Opposite Bermuda Hundred is **Shirley Wharf** and post office. **Hardens Wharf**, on the east bank, 2¼ miles above Bermuda Hundred, is a lumber-shipping point.

There are several farm wharves between Hardens Wharf and Richmond but no villages. The shores are generally wooded on both sides and present no characteristic features.

Curles Swamp Creek, on the west side, 6 miles above City Point, has a depth of 1 foot at the entrance and deeper water inside.

Richmond, at the head of navigation on James River, has considerable trade in the regular steamers and barges and schooners, the deepest draft being 16 feet and usual draft not over 13 feet. It is connected with Petersburg and Norfolk and intermediate landings by steamers. There are depths of 10 to 15 feet at the wharves on the northeast side of the river.

Manchester is a town on the south side of the river, opposite Richmond, with which it is connected by several bridges.

Richmond City Dock, having its entrance at the upper end of the wharves on the northeast side of the river, is an inclosed basin a little over ½ mile long and 75 to 150 feet wide. It is entered through a lock 180 feet long and 33½ feet wide, with a depth of 14 feet on the sill. The depth is 10 feet in the approach to the lock and 15 feet in midchannel inside, and it can be entered by vessels of 13 feet draft at high water. A railroad bridge with a draw opening 50 feet wide crosses the dock just above the entrance lock. The dock is extensively used for the loading and discharge of small vessels and is a secure harbor during freshets. Lockage is free, but a charge is made for loading and discharging cargo.

A public wharf with a depth of 15 feet alongside extends about 700 feet downstream from **Gilliss Creek**, on the east side, ¼ mile below the entrance to the lock and ⅛ mile below the steamboat wharf.

Freshets occur irregularly in the fall, winter, and spring, their height at Richmond ranging from 4 to 28 feet, though the latter is exceptional. The maximum freshet heights usually occur between the middle of March and the middle of April, the freshets occurring at other times not usually reaching a greater height than 4 to 6 feet above the normal high water. The number of freshets causing the water to rise above the level of the wharves on the main channel at Richmond average about one per year, and the water level seldom rises above the level of the city dock. The rise of water level due to freshets rapidly decreases below Richmond and is little felt at City Point.

Anchorage.—Hampton Roads and the channel off the wharves at Newport News are available as anchorage for large vessels. Vessels anchor anywhere near the channel of the river where the depth and width are suitable. Anchorage out of the way of traffic is permitted in the channel at Richmond, but vessels usually go to the wharves. Small boats anchor on the flats or in the cove having its entrance just westward of the entrance to the city dock. The harbor master at Richmond attends to the berthing and anchorage of vessels on request.

Pilotage is not compulsory for James River above Newport News. Pilots can be obtained at Hampton Roads or Newport News, or at City Point for Appomattox River or James River above that point. The pilotage fee is $1.50 per foot of draft between Newport News and any point on James River.

Supplies.—All kinds of supplies are obtainable at Newport News and Richmond. Gasoline and provisions can also be obtained at Smithfield, City Point, and Claremont, and there are stores at many of the other landings where some supplies are obtainable. Artesian water can be obtained at many of the landings.

Repairs.—Minor repairs to machinery can be made at Richmond and Petersburg, and there are small railways at Battery Park; but the nearest dry dock is at Newport News, and extensive repairs to hulls and machinery can best be made there or at Norfolk.

Towboats can be had at Hampton Roads and Richmond.

Ice.—There is some drift ice in the river during severe winters, and at times the river is frozen over, interrupting navigation for a few days. Navigation to Richmond is hardly ever suspended 30 days at one time on account of ice.

Tides.—The mean rise and fall of tides is 2.5 feet in Hampton Roads, 2.8 feet at City Point, 3.4 feet at Dutch Gap, and 3.7 feet at Richmond.

Currents.—The currents follow the general direction of the channel except between Hog Island and Jamestown Island, where they set across Goose Hill Flats. Their velocities are very variable; in the lower reaches the flood current approximately equals the ebb in velocity; the main counteracting effect on the flood is the freshet current. The times of slack water also vary to a considerable extent, due principally to freshets, especially in the upper reaches of the river. The strength of current and the times of slack water in the following list are for normal conditions, and under abnormal conditions may differ, therefore, sometimes to a considerable extent

At Newport News.—In the center of the channel off the shipyard slack water before flood occurs 2 hours 50 minutes before time of high water at Old Point Comfort and slack water before ebb occurs 3 hours 15 minutes before time of low water at Old Point Comfort. The mean velocity of the current at strength of flood or ebb is 1.3 knots.

In the center of the channel **near Point of Shoals lighthouse** slack water before the flood occurs 1 hour before time of high water at Old Point Comfort, and slack water before ebb occurs 2 hours before time of low water at Old Point Comfort. The mean velocity of the current at strength of flood is 0.5 knot and at strength of ebb is 0.7 knot.

Off Claremont Landing, in the center of the channel, slack water before the flood occurs about at time of high water at Old Point Comfort and slack water before the ebb occurs about at time of low water at Old Point Comfort.

Off Wilcox Wharf slack water before the flood occurs 30 minutes after time of high water at Old Point Comfort, and slack water before the ebb occurs 40 minutes after time of low water at Old Point Comfort.

Off City Point slack water before the flood occurs about 1 hour 10 minutes after time of high water at Old Point Comfort, and slack water before the ebb occurs 1 hour 10 minutes after time of low water at Old Point Comfort. The mean velocity of the current at strength of flood is 1.1 knots and at strength of ebb is 1.3 knots.

Above City Point the velocity of the current and times of slack water are very variable. At Richmond the currents are chiefly nontidal.

DIRECTIONS, JAMES RIVER.

From Newport News to City Point the channel is easily followed by day by vessels of 15 feet or less draft with the aid of the charts; strangers of deeper draft should take a pilot. The river is generally broad, but the channel is contracted by flats and middle grounds. The channel is well marked by lights and buoys; most of the dredged channels are marked by range lights, which do not show well as day marks and can not usually be seen at a greater distance than 1 to 1½ miles.

Between Newport News and City Point the dredged channels were made 400 feet wide and 20 feet deep, with the exception of the one at Harrison Bar, which for a part of its length had a least width of 250 feet in June, 1915.

There are fish traps in places on both sides of the channel from Newport News to City Point, but they are thickest below Point of Shoals lighthouse. Black and white horizontally striped buoys have been established to mark the outer limits of allowable areas.

1. **Newport News to Point of Shoals lighthouse.**—Passing about ¼ mile off the wharves at Newport News, steer 315° true (NW ½ N mag.) until abreast buoy No. 3. Then bring the elevator at Newport News astern on a 300° true (NW ⅞ W mag.) course, passing midway between White Shoal lighthouse and the black bell buoy off the entrance of Pagan Creek and to a position ¼ mile northeastward of the black buoy off Days Point.

Then steer 294° true (NW by W ⅜ W mag.) for Point of Shoals lighthouse with White Shoal lighthouse astern, to a position 350 yards northeastward of buoy No. 7. Then steer 271° true (W ½ N mag.) on the Burwells Bay range, and follow the dredged cut (400 feet wide and 20 feet deep) from buoy No. 2 to buoy No. 2A. The range does not show well in the afternoon. Pass about 70 yards southward of buoy No. 2A and steer 290° true (NW by W ¾ W mag.) for about ½ mile to a position about 100 yards southwestward of buoy No. 2B, and with Point of Shoals lighthouse bearing 349° true (N ½ W mag.) then steer 344° true (N by W mag.) to a position 250 yards westward of it.

2. **Point of Shoals lighthouse to Jamestown Island.**—Passing 250 yards westward of Point of Shoals lighthouse, steer 23° true (NNE ½ E mag.) through a dredged cut (400 feet wide and 20 feet deep) which is marked by two black buoys. From the upper buoy, lying 1¼ miles above the lighthouse, steer 4° true (N ¾ E mag.) for 3¾ miles to a position 300 yards westward of Deep Water Shoals lighthouse.

Then bring that lighthouse astern on a 337° true (N by W ⅝ W mag.) course until 2¾ miles from it and up with buoy No. 2. Leave this buoy 40 yards on the starboard hand and steer 305° true (NW ½ W mag.) to buoy No. 4. Leave it 50 yards on the starboard hand and haul a little westward so as to pass about 100 yards northward of the bell buoy off Hog Point. The directions of this paragraph lead through the **Hog Island Swash Channel** in a least depth of 15 feet, westward of a middle ground; the deeper channel, leading eastward of the middle ground, is also buoyed but is about 1 mile longer.

From the bell buoy off Hog Point steer 245° true (WSW ¼ W mag.) for 1½ miles to the red buoy at the entrance of the dredged cut, and then steer 229° true (SW ¾ W mag.) through the cut on the Goose Hill Channel range to the red bell buoy at the western end. The range does not show well in the afternoon.

3. **Jamestown Island to Claremont.**—Continue on the Goose Hill Channel range for ¼ mile past the bell buoy. Then steer 314° true (NW ⅜ N mag.) to a position 300 yards southwestward of Church Point light at the end of Jamestown wharf. Then steer 308° true (NW ⅛ W mag.) and pass 150 yards eastward of buoy No. 23 and bell buoy No. 25.

Pass 50 yards northward of the bell buoy and steer 265° true (W mag.) for 4⅝ miles on the Sunken Marsh range, which leads for nearly the whole distance through a dredged channel 400 feet wide and 20 feet deep; a red buoy ⅝ mile westward of the bell buoy marks the north edge of the cut, and the remains of Dillard Wharf will be left nearly ⅜ mile on the port hand. When about ⅝ mile from the front light and up with buoy No. 25A, steer 301° true (NW ¾ W mag.), leaving buoy No. 10 on the starboard hand and then keeping near the middle of the river until abreast of Claremont.

4. **Claremont to Windmill Point.**—Continue the 301° true (NW ¾ W mag.) course about 1½ miles above the railroad wharves at Claremont, and when off the middle of the entrance to Chippoak Creek steer 328° true (NNW ⅜ W mag.) for the small wharf at Brandon Point. Pass about 300 yards off this wharf and then follow the east bank for 1½ miles to Bachelor Point. Favor slightly the north

bank, keeping out of the bights in the bend north of Kennon Marsh and until off the entrance of Kittewan Creek. Then favor the south bank, keeping out of the bight at the mouth of Ward Creek. The ruins of an old pier, which show above water, stand on the edge of the flat at the mouth of Ward Creek.

Pass in mid-channel through the narrow part of the river at Weynoak Point, and then follow the broad channel eastward of Minzie Middle Ground. The horizontally striped buoys marking the ends of the middle ground must be given a good berth when passing eastward of it, as shown on the chart.

A channel with a depth of 13 feet or more leads westward of **Minzie Middle Ground**. To go through this channel steer 345° true (N 7/8 W mag.) on the Wilcox Wharf range, and pass westward of the two horizontally striped buoys marking the middle ground and 150 yards eastward of Windmill Point (marked by a thick clump of trees at the end). Wilcox Wharf range must be followed closely, as the range is slow. The range shows about 300 yards to the right of a water tank and about 50 yards to the right of the tallest clump of trees.

5. **Windmill Point to City Point.**—Pass midway between Windmill Point and Wilcox Wharf, and steer 251° true (WSW 3/4 W mag.) on the Maycox Point range, leaving the black buoy northwestward of Windmill Point on the port hand and the red buoy southward of Bucklers Point on the starboard hand. The rear range has a triangular day mark showing above the trees.

Pass 200 yards off the south bank westward of the Maycox Point range, and steer 280° true (WNW 5/8 W mag.) on the Jordan Point range (white slatted structure in range with the white square tower of Jordan Point lighthouse) and follow the buoyed dredged cut. Pass northward of buoy No. 31 and steer 293° true (NW by W 1/2 W mag.) on the Harrison Bar range astern. This range does not show well by day, but its approximate position is indicated by a lane cut in the woods.

From buoy No. 33 follow the middle of the curved channel as marked by the buoys and Wood Wharf light until past buoys Nos. 26 and 45, and then steer 313° true (NW 1/4 N mag.) for the northeasterly edge of the wharf at City Point. Anchor in the channel, which is 300 yards wide southeastward of the wharf.

From Westover to City Point there are flats on one or both sides of the channel, which are nearly bare at low water and are generally indicated by ripples or the color of the water.

6. **City Point to Richmond.**—Local knowledge is necessary for vessels in this part of the river, and strangers should take a pilot. Small craft should have no difficulty in following the channel with the aid of chart No. 531. Wing dams which show above water extend out to the edges of the channels in places; in many places the shoals between these dams have been raised by deposit, and now show above water or by the grass covering them.

Woodson Rock is awash at low water, and the Woodson Rock range leads clear of it; the range shows through a narrow opening in the trees.

Dutch Gap Canal, a short artificial cut 16 miles above City Point and 13 miles below Richmond, has ample depth and width, but the

point on the north side at its easterly end must be given a berth of about 100 yards. The tidal currents offer considerable difficulty on account of the sharp bend, especially for tows. The southwest side of the canal is marked by lights at both entrances, and there are a prominent white house and monument on the northeast side. Navigation through the canal is difficult during freshets.

HAMPTON ROADS TO YORK RIVER.

Horseshoe is the shoal with depths less than 18 feet, which extends 5 miles from the shore between Old Point Comfort and Back River lighthouse, its southern edge bordering the north side of the channel into Hampton Roads. This shoal has depths of 13 to 18 feet over its eastern half; its western half has a least depth of 8 feet if the shore be given a berth of ½ mile, but there are depths of 6 to 7 feet ¾ to 1 mile southeastward of Back River lighthouse.

Local steamers and small craft of 7 feet or less draft with a smooth sea, plying between Hampton Roads, York River, and Mobjack Bay, use the following routes, varying the course as necessary to clear the fish traps:

From the southeasterly mine field buoy, lying 1⅝ miles eastward of Old Point Comfort lighthouse, 26° true (NNE ¾ E mag.) for 5¼ miles to the perpendicularly striped bell buoy lying 2 miles eastward of Back River lighthouse. Then 336° true (N by W ⅝ W mag.) for 7¾ miles to the black buoy marking the channel of York River 2 miles westward of York Spit lighthouse; or, when going to Mobjack Bay, 350° true (N ⅜ W mag.) for 7½ miles and pass close westward of York Spit lighthouse. These courses lead across areas of possible fish traps.

A channel 400 yards wide, for the use of small craft, is kept clear of fish traps between Hampton Roads and the entrances of Back and York Rivers. From the southeasterly mine field buoy, lying 1⅝ miles eastward of Old Point Comfort lighthouse, the westerly edge of this channel extends 15° true (N by E ⅞ E mag.) for 5¾ miles to a position 1⅜ miles 56° true (NE by E ½ E mag.) from Back River lighthouse, and then 341° true (N by W ¼ W mag.) for 7 miles to a position ¼ mile northeastward of the black buoy marking the channel of York River, 2 miles westward of York Spit lighthouse. The channel is marked on its western side by black and white buoys.

Buckroe Beach is a summer resort on the shore 2½ miles north-northeastward of Old Point Comfort lighthouse. It has communication by electric road with Old Point Comfort, Hampton, and Newport News. A ferris wheel is the only mark visible above the trees.

Back River, having its entrance 6½ miles north-northeastward of Old Point Comfort, has a depth of about 9 feet across the bar at the entrance and 7 feet to abreast **Amorys Wharf** (Earnest post office), which is on the north side at the intersection of Northwest and Southwest Branches. There is a depth of 6 feet at the wharf. Gasoline is obtainable.

Northwest Branch has a depth of 6 feet for ¾ mile above the entrance and 2 feet to near the head. **Southwest Branch** has a depth of 4 feet for 1½ miles, above which it shoals rapidly. **Harrison Creek**, on the south side of Back River, has a depth of 3 feet for ¾

mile; **Fox Hill** (Ripraps post office) is a village on the east side near its head.

Back River is the center of a large oystering and fishing industry, and is also frequented by many produce boats, the deepest draft being 7 feet. **Back River lighthouse** (white tower showing against the trees) and a wharf and house on the western end of **Northend Point** are the most prominent marks in the approach. The main channel is narrow in places, but is marked by buoys and lights and is easily followed with the aid of the chart. The tributaries are unmarked. The shore and shoals near the entrance are subject to some change. A channel 800 yards wide and marked by black and white buoys is kept clear of fish traps in the approach, the south edge of this channel extending from the black buoy at the entrance through the perpendicularly striped bell buoy lying 2 miles eastward of Back River lighthouse. The mean rise and fall of tides at the mouth is 2.4 feet.

There are shoals, covered with scattered oyster rocks nearly bare at low water, extending from 1 to 2 miles offshore between Back River and Poquoson River entrances. Strangers, even in small boats, should keep outside of the 6-foot curve.

Poquoson River, on the south side of York River entrance, westward of York Spit lighthouse, has a depth of 6½ feet to the village of **Yorkville** and 2 feet to near the heads of all its tributaries. The river is frequented by small produce boats and a few schooners and barges loading wood, the deepest draft being 9 feet. There are no wharves on the main branch except for small boats. The mean rise and fall of tides at the mouth is 2.4 feet.

Bennett Creek, on the southeast side, at the entrance of Poquoson River, has a depth of 6 feet for 1½ miles above the entrance, and is marked by buoys for ¾ mile.

Cheeseman Creek, on the north side of Poquoson River, just inside the entrance, has a depth of 6 feet in a narrow channel for 2 miles, and 3 feet nearly to the head. It is unmarked. There is a prominent fish factory on the northeast side ½ mile west-northwestward of York Point, with a wharf extending to a depth of 7 feet. Gasoline and some provisions can be obtained near the head of the creek, and there is a railway capable of hauling out boats of 75 tons and 6 feet draft.

To enter Poquoson River, bring York Spit lighthouse astern on a 267° true (W ¼ N mag.) course and pass ¼ to ⅜ mile northward of the black buoys off the north side of Poquoson Flats. This course leads through an area of possible fish traps. Pass about ½ mile northwestward of buoy No. 3 and steer 215° true (SW ⅜ S. mag.), keeping about midway between the converging shores until the entrance buoys are sighted. Pass about ¼ mile northward of buoy No. 1 and steer westward, passing southward of buoy No. 2 and northward and well westward of buoy No. 5, above which the mid-channel is clear to Yorkville.

Back Creek, having its entrance 2 miles southward of Tue Marshes lighthouse, has a depth of 8 feet to abreast **Slates Wharf,** on the south side westward of **Clarkston Creek,** and 2 feet to near the head. The most prominent mark is a fish factory on the south end of **Goodwin Islands.** The creek is frequented by fish steamers of 9 feet or less draft, and by many smaller oyster and produce boats. Gasoline and

some provisions are obtainable near the head. The channel is marked by beacons and buoys as far as the entrance to Clarkston Creek. The beacons are maintained by the owners of the fish factory and lights are maintained on them during the fishing season. A 269° true (W ⅜ N mag.) course with York Spit lighthouse astern will lead to the first beacon. The channel leads south of the first and third beacons and north of the second.

The Thoroughfare, connecting Back Creek with York River westward of Goodwin Islands, has a depth of about 3 feet at high water and is extensively used by small local boats. The channel is usually marked by bush stakes, but is difficult without local knowledge.

YORK RIVER,

formed by the junction of Mattaponi and Pamunkey Rivers at West Point, 35 miles above the entrance, has a broad and comparatively straight channel with a least depth of 20 feet to West Point. It is marked by lights and buoys, and is easily followed by day with the aid of the chart.

The river has considerable trade, carried mostly in the regular steamers from Norfolk and Baltimore, and in schooners and barges. The deepest draft ordinarily taken to West Point is 15 feet. The tributaries have a large trade in wood products carried in schooners and barges.

York Spit Swash, the slough leading through York Spit 5 miles northwestward of York Spit lighthouse and 1¼ miles southeastward of the marshy islands between York River and Mobjack Bay, had a least depth of 8 feet by the last survey, and is used by local vessels up to 7 feet draft. It is marked by buoys, but strangers should proceed with caution.

Monday Creek is described under Mobjack Bay.

The Thoroughfare, connecting York River with Back Creek, is described above.

Sedger Creek, on the north side, 2 miles northwestward of Tue Marshes lighthouse, has a depth of 7½ feet in a narrow, crooked channel to **Browns Wharf** (Perrin post office), at the bend ⅜ mile above the entrance. A river steamer drawing 7 feet makes regular landings at two wharves in the creek. The channel is usually marked by bush stakes, but navigation is difficult without local knowledge. There is a store at the wharf and gasoline is obtainable. **Ellen Island,** on the west side at the entrance, is a marsh marked by a clump of trees.

Wormley Creek and **West Branch,** on the south side, 4 miles westward of Tue Marshes lighthouse, have a common entrance with a depth of 4 feet across the bar and 2 feet in both creeks nearly to the heads. They are little used.

Sarah Creek, on the north side, 1 mile eastward of Gloucester Point, has a depth of about 7 feet in the entrance and for a short distance up the west branch, and 3 feet in either branch for about ¾ mile. The deepest draft using it is 7 feet. There are no wharves.

Yorktown is a town on the south side of York River, 6 miles above Tue Marshes lighthouse. The main part of the town is on the high bank and is not visible from the river. **Yorktown Monument** is a

prominent mark. Pilots for the river to West Point can be obtained here.

Gloucester Point is a village on the point opposite Yorktown. The end of the point is low and marked by a wharf and a group of buildings. There is ferry communication with Yorktown. Gasoline and some provisions are obtainable.

Clements Wharf, Claybank, and **Almondsville** are long wharves and post offices on the northeast side of the river 2⅝, 8¼, and 11¾ miles, respectively, above Gloucester Point.

Timber Neck, Bush, Carter, and **Aberdeen Creeks,** between Clements and Claybank Wharves, are shoal and frequented only by small local boats.

Kings Creek, on the southwest side, 4 miles above Yorktown, has a depth of 2 feet across the flats at the entrance and a little deeper water inside. It is little used.

Queens Creek, on the southwest side, 1½ miles west-southwestward from Pages Rock lighthouse, has a depth of 2½ feet across the flats at the entrance, 5 feet inside for 2½ miles, and 1½ feet for a farther distance of 2 miles to a fixed bridge 1½ miles from the town of **Williamsburg.** It is used by a few produce boats in the lower end and by small motor boats to the bridge. The channel is difficult in places without local knowledge.

Poropotank Creek, 4 miles above Almondsville Wharf and eastward of Poropotank Creek light, has a depth of 6 feet in the entrance, 3½ feet across **Morris Bay,** and 5 feet above to **Miller Landing,** 4½ miles above the entrance. Small boats can go several miles farther. There are several landings on the creek from which wood products are shipped in boats of 6 to 7 feet draft. The channel is usually marked by bush stakes, but is crooked and narrow in places and difficult without local knowledge. The best water favors the east shore in the approach through Poropotank Bay.

West Point, at the junction of Mattaponi and Pamunkey Rivers, is the terminus of a branch of the Southern Railway, and is connected by steamer with Baltimore and the intermediate landings on York River. It has considerable trade in bay and coasting vessels, the deepest draft being 15 feet. Gasoline, provisions, water, and coal in limited quantities are obtainable. Towboats and pilots for Mattaponi and Pamunkey Rivers can be obtained. There is a machine shop for minor repairs to machinery, and a railway capable of hauling out vessels of 150 tons, 120 feet length, and 12 feet draft.

Mattaponi River (chart 504) is the approach to the villages of **Walkerton** and **Aylett,** 25 and 33½ miles, respectively, above West Point, and many other landings. It has a depth of 12 feet to **Mantapike,** 18½ miles above West Point, and 10 feet to Walkerton. Between Walkerton and Aylett the river has been improved by dredging a channel 5½ feet deep and 40 feet wide, but considerable trouble is experienced in maintaining it. There is a depth of about 2 feet for a distance of 2½ miles above Aylett to the fixed bridge at **Dunkirk.** The river for a distance of 53 miles above Dunkirk is shoal, but is used for rafting and logging at high stages.

A steamer from West Point makes regular trips to the principal landings on Mattaponi River as far as Aylett. There is also considerable trade in wood products carried in schooners and barges, the

deepest draft being 14 feet. The river is unmarked, and navigation is difficult without local knowledge. Pilots and towboats can be obtained at West Point. Schooners usually carry a gasoline boat to assist them in the narrow channels. Supplies can best be obtained at West Point, though gasoline and provisions are usually obtainable at Walkerton and Aylett. Artesian water can be obtained at many of the landings.

Freshets occur at irregular intervals, being more severe during March and April, and have reached a height of 17½ feet above mean low water at Aylett and 5 feet at Walkerton, though this is exceptional. The mean tidal range during low stages of the river is 2.9 feet at West Point, 3.6 feet at Walkerton, and 2.3 feet at Aylett.

Two highway **drawbridges** cross the Mattaponi River; one at West Point has a single lift opening 80 feet wide and has a headroom of 7 feet at high water when closed, and the other at Walkerton is a center pier draw, each opening 47 feet wide, and has a headroom of about 8 feet at high water when closed.

Pamunkey River (chart 504) has a depth of 15 feet to **Lester Manor**, 9 feet to the railroad bridge at **White House**, 7 feet to **Bassett Ferry**, and 5 feet to **New Castle bridge**, 24, 28, 43, and 45 miles, respectively, above West Point. It is navigable for small lighters and rafts for a farther distance of about 7 miles to **Hanovertown**. The channel between White House and Bassett Ferry has been improved by dredging to a depth of 7 feet and width of 100 feet.

There are no towns on Pamunkey River, but there are many landings, from which considerable wood products and grain are shipped in schooners and barges, the deepest draft being 15 feet. There are post offices and railroad stations at **Sweethall** and Lester Manor, and a railroad station at White House.

From West Point to Sweethall Landing, 14½ miles above, the river is easy of navigation with the aid of the chart. Above this point navigation is difficult without local knowledge. Pilots can be obtained at West Point, Lester Manor, and White House, and towboats at West Point. Artesian water can be obtained at several of the landings, and the river water is fresh above Cumberland Landing. There are several narrow cut-offs with sufficient depth for small boats, but local knowledge is usually necessary.

Freshets occur at irregular intervals in Pamunkey River, being more severe during March and April. The mean rise and fall of tides during low stages of the river is 2.9 feet at West Point and 1.7 feet at New Castle.

The railroad bridge at White House has a draw opening 46 feet wide and a headroom of 8 feet at high water when closed. The bridge at New Castle has a draw opening 40 feet wide and a headroom of about 13 feet at ordinary stage of the river, and sometimes not more than 7 feet during freshets. It is seldom opened.

Anchorage.—Vessels can anchor anywhere in the wider part of the channel of York River where the depth is suitable. A good anchorage for deep draft vessels is eastward or northwestward of Gloucester Point, on the north side of the channel. There is anchorage in the channel off the wharves on either side of West Point in depths of 18 to 40 feet.

Pilots.—Pilotage is compulsory as far as Yorktown for all vessels other than those exclusively engaged in the coastwise trade and those

made exempt by United States statutes. Vessels required to take a pilot will get one at Chesapeake Bay entrance or Hampton Roads. Pilots can be obtained at Yorktown for the river above that point. Pilots for Mattaponi and Pamunkey Rivers can be obtained at West Point.

Towboats.—Sailing vessels seldom take a towboat, but usually carry a small motor boat to assist them. Towboats for York River can be obtained at Hampton Roads, and for Mattaponi and Pamunkey Rivers at West Point.

Supplies.—Gasoline and provisions can be obtained at Yorktown, Gloucester Point, and West Point, and water and coal in limited quantities at West Point.

Repairs to small vessels can be made at West Point, but extensive repairs to machinery and to hulls of large vessels can best be made at Baltimore, Newport News, or Norfolk.

Freshets occur in Mattaponi and Pamunkey Rivers, but are little felt at West Point or below. The river is not fresh below West Point.

Ice sometimes interferes with navigation for short periods during severe winters, but in ordinarv winters navigation is not interrupted below West Point.

Tides.—The mean rise and fall of tides is 2 feet at the entrance, 2.4 feet at Yorktown, and 2.9 feet at West Point.

Currents.—The currents follow the general direction of the channel, except in its narrowest parts, where they have a tendency to set a vessel on shoals.

The velocity of the current and the times of slack water vary somewhat in York River, and to a considerable extent in the Mattaponi and Pamunkey Rivers, due principally to freshets, but also to some extent to winds.

At York Spit lighthouse slack water before the flood occurs 2 hours 30 minutes before time of high water at Washington, or 3 hours 20 minutes before time of high water at Old Point Comfort. Slack water before the ebb occurs 3 hours 20 minutes before time of low water at Washington, or 3 hours 30 minutes before time of low water at Old Point Comfort.

Off Claybank slack water before the flood occurs 2 hours before time of high water at Washington, and slack water before the ebb occurs 2 hours 40 minutes before time of low water at Washington.

In the York River below West Point the observed velocity of current at strength of flood was 1.2 knots and at strength of ebb was 1.5 knots.

Just below West Point, opposite Goff Point, slack water before the flood occurs 1 hour 10 minutes before time of high water at Washington, and slack water before the ebb 1 hour 45 minutes before time of low water at Washington.

In the Mattaponi River the flood and the ebb currents commence running about 40 minutes to 1 hour before they do in the Pamunkey River. The observed velocity of the currents in the Mattaponi River, between West Point and Walkerton, was 1.1 knots on the ebb and about 1 knot on the flood.

In the Pamunkey River, between West Point and Bassett Ferry, the observed velocity of the currents was 1.15 knots on the ebb and about 1 knot on the flood.

In the Mattaponi River, at Mattaponi, slack water before the flood occurs 20 minutes before time of high water at Washington, and slack water before the ebb occurs 1 hour 40 minutes before time of low water at Washington.

In the Pamunkey River, at Whitehorse railroad bridge, slack water before the flood occurs 30 minutes after time of high water at Washington, and slack water before the ebb occurs 15 minutes after time of low water at Washington.

DIRECTIONS, YORK RIVER.

The easterly limit of the fish traps off Mobjack Bay and York River is defined by a line extending 188° true (S by W ¼ W mag.) from buoy No. 11, southeastward of Wolf Trap lighthouse, leading for the perpendicularly striped bell buoy lying 2 miles eastward of Back River lighthouse until 3¼ miles from it, then trending 168° true (S ⅝ E mag.) for 3¾ miles, to a position 1¼ miles eastward of the bell buoy. Channels leading into Back River, York River, and Mobjack Bay are kept clear of fish traps, and should be used by strangers at night. Above Tue Marshes lighthouse fish traps will be found in places on the shoals to the edges of the channel. The easterly limit of fish traps in Chesapeake Bay, and the limits of the clear channels leading into York River and Mobjack Bay are marked by black and white buoys.

The routes used by local steamers of 7 feet or less draft crossing the Horseshoe, and the easterly limit of the fish traps on that shoal, are described on page 150.

The directions of section 1 are good for a least depth of 34 feet, and section 1A for 15 feet. Vessels of 15 feet or less draft should have no difficulty in the daytime, in following the directions from Yorktown to West Point with the aid of the chart.

1. **Main entrance to Yorktown.**—A channel 1,200 yards wide is kept clear of fish traps in the main entrance of York River up to Tue Marshes lighthouse. It has least depths of 34 to 35 feet, and is good for vessels of the deepest draft. From the entrance, lying 3¾ miles 152° true (SSE mag.) from York Spit lighthouse, the center line of the channel trends 318° true (NW ¾ N mag.) to York Spit lighthouse abeam, distant ⅞ mile, then 307° true (NW ¼ W mag.) for 2¾ miles to buoy No. 2 abeam, distant 600 yards, and then 289° true (NW by W ⅞ W mag.) with York Spit lighthouse astern and passes 600 yards northward of buoy No. 3. At night a white sector in York Spit lighthouse covers the fairway between the southwest edge of York Spit and the northeast edge of the shoals off Tue Point.

Continue the last course until Tue Marshes lighthouse bears 230° true (SW ⅞ W mag.) distant ¾ mile. Then steer 259° true (W ½ S mag.), passing ⅜ mile northward of Tue Marshes lighthouse and buoy No. 5. Then bring Tue Marshes lighthouse astern on a 268° true (W ¼ N mag.) course, passing about ⅜ mile southward of buoy No. 4. When Gloucester Point light bears 302° true (NW ⅝ W mag.), steer 293° true (NW by W ½ W mag.), pass midway between Gloucester Point and Yorktown, and proceed as directed in section 2.

1 A. **Entering from northward.**—A channel 800 yards wide is kept clear of fish traps, the center line of the channel trending 228° true

(SW ¼ W mag.) and passing ⅝ mile northwestward of New Point Comfort Middle Ground buoy No. 7 and 1¼ miles northwestward of York Spit lighthouse. This channel leads in a least depth of 15 feet across York Spit. When across the spit, bring York Spit lighthouse astern on a 289° true (NW by W ⅞ W mag.) course, passing 600 yards southward of buoy No. 2 and the same distance northward of buoy No. 3. Then follow the directions in the preceding paragraph.

2. **Yorktown to Claybank.**—Passing midway between Gloucester Point and Yorktown steer 317° true (NW ⅝ N mag.) for 2⅜ miles, heading for Pages Rock lighthouse, to a position about 300 yards northeastward of buoy No. 7. Then steer 307° true (NW ¼ W mag.) and pass about 300 yards southwestward of buoy No. 6.

When Pages Rock lighthouse bears 348° true (N ⅝ W mag.), steer 336° true (N by W ⅝ W mag.) for the end of the long wharf at Claybank, and leave the lighthouse nearly ¼ mile on the starboard hand and buoy No. 9 on the port hand.

3. **Claybank to West Point.**—Pass 200 yards off the wharf at Claybank and steer 320° true (NW ⅞ N mag.), following the buoyed channel, and passing 300 yards southwestward of Purtan Bay light (on the end of the long wharf at Almondsville) and 200 yards southwestward of Purtan Island light. Poropotank Creek light will be ahead on this course.

Passing 200 yards southwestward of Purtan Island light, steer 317° true (NW ⅝ N mag.) and pass 200 yards southwestward of Poropotank Creek light and 250 yards southwestward of buoy No. 10. Then steer 332° true (NNW mag.) for Bells Rock lighthouse and pass buoy No. 13 at a distance of about 200 yards.

Pass 150 yards southwestward of Bells Rock lighthouse and bring it astern on a 299° true (NW by W mag.) course, heading about 150 yards northward of the black buoy at the south entrance of the upper cut. Pass through the cut on a 331° true (NNW ⅛ W mag.) course, following the black buoys which mark its western side at a distance of 100 feet. Continue the course and anchor off the railroad wharves at West Point, favoring that side.

MOBJACK BAY (CHART 494),

having its entrance between York Spit and New Point Comfort, has several tributaries, the most important being East, North, Ware, and Severn Rivers. It is obstructed by extensive shoals, but has a depth of 22 feet in the entrance and 15 feet through the bay and for a considerable distance in the tributaries.

The entrance is marked on the north side by **New Point Comfort lighthouse** (white tower) and on the south side by **York Spit lighthouse** (white house on piles), and these are the only prominent marks in the approach. Many of the shoals in the bay and tributaries are marked by buoys and lights. Steamers from Norfolk make regular trips to the principal wharves in Mobjack Bay and tributaries, and they are also frequented by produce boats and by others engaged in oystering and fishing. A good anchorage can be found in the bay, with shelter from all but southerly and southeasterly winds. Small craft find safe anchorage in the bight westward of New Point Comfort and in the rivers and creeks.

New Point Comfort, marked by a lighthouse, is low and sparsely wooded and has a wharf on its west end at which the steamers make landings during the fishing season. Gasoline is obtainable.

Bayside Wharf is a long wharf on the northeast side of Mobjack Bay, 1¾ miles northwestward of New Point Comfort lighthouse.

East River, emptying into Mobjack Bay from northward, has a narrow channel with a depth of 13 feet for 4 miles above the entrance and 4 feet for a farther distance of 2 miles to near the head. The entrance is marked by **Pultz Bar light** and by buoys. Unmarked shoals extend for some distance off many of the points above the entrance, but the mid-channel is clear if the points be given a good berth.

There are four wharves with post offices on East River: **Philpots** (Mobjack post office), on the west side, and **Diggs** (Traders post office), on the east side, just inside the entrance, and **Williams and Hicks Wharves**, about 3¼ miles above the entrance. Gasoline and provisions can be obtained at Mobjack, and there is a railway capable of hauling out boats of 40 tons, 40 feet length, and 5 feet draft. There is a store at Williams Wharf and a railway capable of hauling out vessels of 100 tons, 50 feet length, 8 feet draft aft, and 6 feet forward.

North River, emptying into the head of Mobjack Bay from northward, is wide, but has shoals making off for a long distance from many of the points. The channel is marked by lights and buoys. **Auburn Wharf**, on the north bank 4 miles above the entrance, and **Dixondale Wharf** and post office, on the west bank 5 miles above the entrance, are the principal landings, and have depths of 7 feet at the ends. There is a depth of 12 feet in the channel to abreast Auburn Wharf, and 8 feet to abreast Dixondale Wharf.

Ware River, emptying into the head of Mobjack Bay from northwestward, has a depth of 15 feet to the mouth of **Wilson Creek**, 3 miles above the entrance, and 8 feet for a farther distance of 2 miles. Shoals, some of them marked by buoys, extend for a long distance off many of the points. The landings are **Roanes Wharf** and **Baileys Wharf** and post office on the west side, and **Hockley Wharf** on the east side, distant 3¼, 4¼, and 4¾ miles, respectively, above the entrance. Gasoline is obtainable at Baileys Wharf.

Severn River, emptying into Mobjack Bay from southwestward, has a depth of 15 feet to the junction of Northwest and Southwest Branches, and 8 feet for 1¼ miles in **Southwest Branch** and 1¾ miles in **Northwest Branch**. The most prominent shoals are marked by buoys. **Severn Wharf** is on the south side of Southwest Branch 1⅛ miles above the fork. There is a store here, and gasoline is obtainable. There are wharves, used by local boats, on Northwest Branch about 1 and 2 miles above the entrance.

Monday Creek, forming a thoroughfare between Mobjack Bay and York River, has a depth of about 3 feet at high water and is extensively used by small local boats. It is difficult without local knowledge.

Pilots.—There are no regular pilots for Mobjack Bay and tributaries, though a pilot can usually be obtained from boats at work near the entrance.

Tides.—The mean rise and fall of tides is about 2 feet.

DIRECTIONS, MOBJACK BAY.

See the remarks relating to fish traps in the directions for York River; also section 1A of that heading for the channel which is kept clear of fish traps, leading across Mobjack Bay entrance inside of New Point Comfort Middle Ground.

A channel 800 yards wide is kept clear of fish traps in the main entrance of Mobjack Bay. Passing 400 yards southwestward of Middle Ground Shoal north end gas and whistling buoy, the center line of the channel trends 320° true (NW ⅞ N mag.) until New Point Comfort lighthouse bears 88° true (E ¼ S mag.), distant nearly 2 miles, and then 333° true (N by W ⅞ W mag.) for Pultz Bar light. The latter course leads a little westward of a depth of 10 feet on the edge of the shoal 1⅝ miles south-southeastward of Pultz Bar light.

Any other course into the bay leads across areas of possible fish traps, and should be used with caution by strangers at night. The routes used by local steamers of 7 feet or less draft crossing the Horseshoe are described on page 150. Passing ¼ mile westward of York Spit lighthouse, a 333° true (N by W ⅞ W mag.) course will lead for Pultz Bar light, but leads through an area of possible fish traps until New Point Comfort lighthouse bears a little forward of the beam.

To East River.—Standing for Pultz Bar light on a 333° true (N by W ⅞ W mag.) course, when about 1 mile from it steer 349° true (N ½ W mag.) and pass about ¼ mile eastward of the light and 100 yards or more westward of buoy No. 2. Then bring the light astern on a 24° true (NNE ⅝ E mag.) course, passing 100 yards eastward of the black buoy nearly opposite Diggs Wharf. Then follow the west bank for about 1½ miles until around the first bend, taking care to give the points on that side a berth of 300 to 400 yards. Then keep near mid-river, except at Williams Wharf, which should be rounded at a distance of 100 to 150 yards.

To North River.—Pass ½ mile southwestward of Pultz Bar light, steer 310° true (NW mag.), and pass about 200 yards northeastward of Ware Point Shoal light. Then bring the latter light astern on a 342° true (N by W ⅛ W mag.) course, pass 100 yards eastward of a black buoy, and continue the course to a position ¼ mile eastward of Love Point light. Then steer 287° true (WNW mag.) and pass 100 yards northward of Love Point light and 150 yards southward of Cradle Point light. Above the latter light the deeper water favors slightly the west bank to Dixondale Wharf.

To Ware River.—Passing ½ mile south-southwestward of Pultz Bar light, steer 287° true (WNW mag.), heading just clear of the end of Windmill Point, and pass 200 yards southward of buoy No. 2, southward of Ware Neck Point. Continue the course nearly ½ mile past buoy No. 2, and then steer 309° true (NW mag.) to a position northward of buoy No. 1. Then steer 270° true (W ½ N mag.) until Windmill Point is abeam, and then steer 242° true (WSW mag.) to a position about 300 yards east-southeastward of buoy No. 4. Pass 100 to 200 yards southward of the buoy, 200 yards northward of Roanes Wharf, and anchor north-northeastward of the wharf and before reaching buoy No. 3. The channel is close eastward of the latter buoy and is narrow.

To Severn River.—A 284° true (WNW ¼ W mag.) course with New Point Comfort lighthouse astern will lead northward of buoy No. 1 at the entrance, but leads across an area of possible fish traps in the bay. To insure clearing the fish traps, pass not more than 1 mile southward of Pultz Bar light, and bring it astern on a 230° true (SW ⅞ W mag.) course to the entrance.

Pass 150 yards northwestward of buoy No. 1 and steer 242° true (WSW mag.) for 1 mile. Then follow the north bank at a distance of ¼ mile and pass 100 yards northward of buoy No. 3, at the entrance to Southwest Branch. In Southwest Branch pass well westward of buoy No. 3, favor the western point at the entrance, passing it at a distance of 350 yards, and then keep near the middle for a distance of 1 mile to the landing. In Northwest Branch the channel is near the middle, keeping out of the bights; about 1 mile above buoy No. 3 the channel leads northward and westward of buoy No. 5, between it and the wharf at Cod Point (north bank).

MOBJACK BAY TO PIANKATANK RIVER.

The shoals on the west side of Chesapeake Bay between Mobjack Bay and Rappahannock River are generally more or less obstructed by fish traps during the fishing season. The easterly limit of the fish traps extends from the black bell buoy at the end of Rappahannock Spit to buoy No. 11, southward of Wolf Trap lighthouse, and thence to within 3¼ miles of the bell buoy lying 2 miles eastward of Back River lighthouse. It is marked by black and white buoys.

Horn Harbor, 3 miles northward of New Point Comfort lighthouse, has a depth of about 3½ feet across the bar at the entrance and 6 to 15 feet in a narrow channel inside for about 2 miles above the bar. It is considerably used as a harbor by fishing and oyster boats. The depth on the bar is subject to some change. The best water favors the western shore in entering, as shown on the chart. There is a detached pier outside the bar, at which steamers from Norfolk make regular landings during the fishing season.

Winter Harbor and the other sloughs and creeks having their entrance 4½ miles north-northeastward of New Point Comfort lighthouse are shoal at the entrance and generally consist of mud flats bare at low water inside. They are little used.

PIANKATANK RIVER (CHART 534),

just south of Rappahannock River entrance, has a depth of 12 feet to within 2½ miles of the village of **Freeport,** and 6 feet to Freeport. Small boats and lighters can go several miles above Freeport. Steamers from Baltimore drawing 6 feet land at the principal wharves as far as Freeport, and schooners up to 12 feet draft carrying wood products also make use of it.

The river is marked by **Stingray Point lighthouse** (white house on piles), on the north side at the entrance, and by several lights and buoys, but the channel is obstructed by many shoal spits and middle grounds. Strangers should have no trouble in taking a draft of 10 feet to **Doctor Point,** 11 miles above the entrance, with the aid of the chart.

Between Doctor Point and Freeport the channel is shoal and very narrow in places. It is usually marked by bush stakes but is difficult without local knowledge. Schooners and barges usually complete their loading from lighters about 2½ miles below Freeport. Gasoline and some provisions can be obtained at **Green Point** (Dixie post office) southward of Wilton Point, and at Freeport.

Hills Bay, on the south side of Piankatank River just inside the entrance, forms the approach to Milford Haven and Queens Creek.

Milford Haven can be entered from Piankatank River at the northwest end and from Chesapeake Bay at the southeast end. The entrance at the southeast end has a depth of 3 feet and is used by small local boats, but is unmarked, exposed to a heavy sea, and difficult without local knowledge. The main entrance, at the northwest end, has been improved by dredging a channel 10 feet deep and 200 feet wide from Hills Bay to **Callis Wharf** (Gwynn post office), on the north side ¾ mile above the entrance, and by the construction of a jetty 1,200 feet long on the north side at the entrance. There is a depth of 6½ feet from Callis Wharf to **Fitchetts Wharf** and post office, on the south side of **Stutts Creek** 3 miles above. Steamers from Baltimore drawing 6 feet make regular trips to the landings in Milford Haven as far as Fitchetts Wharf. The entrance to the dredged channel is marked by buoys, and the most prominent shoals as far as Fitchetts Wharf are marked by single pile beacons with slatted daymarks.

In **entering Milford Haven** a 185° true (S by W mag.) course with Stove Point light astern will lead through Hills Bay to the entrance. Pass 75 yards eastward of the red buoy, follow the jetty at a distance of 60 yards to the inner end, and then head for **Cricket Hill Wharf**. From this wharf steer 45° true (NE ½ E mag.) with Callis Wharf a little on the port bow for 350 yards, to avoid a shoal on the northwest side, marked by a beacon, and then bring Callis Wharf well on the starboard bow until close to it to avoid a middle ground, nearly bare at extreme low water and marked by a beacon. From Callis Wharf to Fitchetts Wharf follow a general mid-channel course and give the points a good berth, being guided by the chart. There are stores at Cricket Hill and Callis Wharves, and gasoline is obtainable.

Queens Creek, at the southwest end of Hills Bay, has a depth of 6 feet for 1 mile, and 2½ feet to near the head. It is frequented only by small local boats and is unmarked.

Ice.—Piankatank River is closed by ice for short periods only, during severe winters.

Tides.—The mean rise and fall of tides is 1.2 feet at the entrance.

DIRECTIONS, PIANKATANK RIVER.

From southward.—The easterly limit of possible fish traps off Piankatank River entrance is a line joining Rappahannock Spit bell buoy and the black buoys off Wolf Trap lighthouse, and is marked by a line of black and white horizontally striped buoys. Vessels approaching from southward, in order to avoid areas of possible fish traps, should keep outside this line until 2⅝ miles southward of Rappahannock Spit bell buoy and 1½ miles northward of the third fish trap buoy northward of Wolf Trap light-

house. Then steer 266° true (W ⅛ N mag.) for 5⅝ miles, passing ⅜ mile northward of buoy No. 1 and to a position 400 yards northward of buoy No. 3.

From northward.—Pass eastward and ½ mile southward of Rappahannock Spit bell buoy, and steer 245° true (WSW ¼ W mag.), heading for the end of Stove Point, for 6 miles, passing ¾ mile south-southeastward of Stingray Point lighthouse, and to a position 400 yards northward of buoy No. 3.

Cherry Point to Roane Point.—Pass ¼ mile westward of buoy No. 3 and steer 189° true (S by W ¼ W mag.), so as to pass 200 yards westward of Cherry Point light and the same distance eastward of Stove Point light. Pass southward and 300 yards southwestward of Stove Point light and head northwestward for ¼ mile until northward of a black buoy. From here a 289° true (NW by W ¾ W mag.) course for 1½ miles, with Roane Point light a little on the starboard bow, will lead to a position ⅜ mile northeastward of Iron Point, and then a 307° true (NW ¼ W mag.) course for 1⅛ miles will lead to a position 350 yards northward of Roane Point. Above this point the chart is the guide.

RAPPAHANNOCK RIVER,

on the western side of Chesapeake Bay, 40 miles above the entrance and 111 miles below Baltimore, is the approach to the city of Fredericksburg, at the head of navigation 95 miles above the entrance, and to numerous villages and landings. Steamers from Baltimore and Norfolk of 7 to 10 feet draft make regular trips to the principal wharves on the river and its tributaries as far as Fredericksburg. The lower end of the river is frequented by fish steamers of 9 to 11 feet draft, and by many smaller craft engaged in the oystering and fishing industry. Fredericksburg has some trade in wood products, carried mostly in barges of 8 to 9 feet draft. The tributaries have some trade in farm and wood products, carried in barges, lighters, and schooners.

Channel.—Rappahannock River has a natural channel 30 feet deep for 26 miles, and 14 feet deep to the town of Tappahannock, 39 miles above the entrance. Above Tappahannock the river is being improved to obtain a channel 12 feet deep and 200 feet wide to the town of Port Royal, 25 miles below Fredericksburg, and 12 feet deep and 100 feet wide to Fredericksburg. The project has been completed but is subject to some shoaling in places. In 1915 there was a depth of 10 feet to Fredericksburg.

Westland Wharf and post office is on the north side, ¾ mile westward of Windmill Point. **North End Wharf** (Grinels post office) is on the south side, 3 miles westward of Stingray Point. Each is distinguished by several white buildings on the end of the wharf.

Mill Creek and **Lockley Creek**, on the south side of Rappahannock River 6 miles westward of the entrance, have depths of 5 feet or more until well inside the entrances, and are frequented by many small local craft. There are railways in both creeks capable of hauling out boats of 30 feet length and 4 feet draft. The approach to Mill Creek is marked by two lights. Mill Creek wharf, eastward of the entrance to Mill Creek, can be reached with a draft of 9 feet at low water. To enter, give the edge of the shoal northeastward of

Parrot Island a good berth, steer 231° true (SW by W mag.) for the outer light, and pass 50 yards eastward of it on a 197° true (SSW mag.) course. To go farther in, the best water will be carried by passing about 200 feet off the wharf, the same distance southward and westward of the inner light, and then with that light astern steer for **Clarks** (formerly Woodland) **Wharf** until less than 300 yards from it.

Whitestone Wharf (Taft post office) is on the north side of Rappahannock River 6 miles above Windmill Point.

Carter Creek, on the north side of Rappahannock River 9½ miles above Stingray Point, is the approach to the villages of **Weems** and **Irvington.** It has several oyster houses and a fish factory, is the center of a large oystering and fishing industry, and is extensively used as an anchorage by local vessels. The channel has been improved by dredging to a depth of 15 feet and width of 200 feet across the bar at the entrance and to a depth of 12 feet and width of 100 feet to Irvington, and is marked by lights.

There are several railways in Carter Creek, the largest capable of hauling out vessels of 200 tons, 148 feet length, 8 feet draft aft and 6 feet forward; ordinary repairs to machinery can be made. Storm warnings are displayed at Weems. The mean rise and fall of tides is 1.4 feet.

To enter Carter Creek, pass 40 yards eastward of the outer light, 40 yards westward of the second light, and not over 100 yards eastward of Weems Wharf. Good anchorage can be had anywhere in mid-channel above the wharf. To go to Irvington, follow a general mid-channel course and give the points a good berth; the third light should be left 75 yards on the port hand.

Corrotoman River, on the north side of Rappahannock River 12 miles above the entrance, has a depth of 18 feet to the junction of Eastern and Western Branches, 4 miles above the entrance. **Eastern Branch** has a depth of 9 feet for 2½ miles and 6 feet for a farther distance of ¾ mile. **Western Branch** has a depth of 12 feet for 2½ miles and 6 feet for a farther distance of 1 mile. The channel is obstructed by shoal spits and middle grounds, but the principal shoals as far as the fork, and for ½ mile above in Western Branch, are marked by buoys. **Millenbeck Wharf** and post office, on the western side 1½ miles above the entrance, and **Ottoman Wharf** and **Merry Point Wharf** and post office, on Western Branch, ¾ and 1 mile, respectively, above the fork, are the principal landings. There are stores at Millenbeck and Merry Point. The mean rise and fall of tides is 1.4 feet.

To enter Corrotoman River head for Millenbeck Bar buoy No. 1 on any course between 357° true(N ¼ E mag.) and 33° true (NE ½ N mag.). Pass eastward and northward of it and steer west-northwestward with buoy No. 2 a little on the starboard bow; pass westward of the buoy and 250 yards eastward of Millenbeck Wharf. Then steer northeastward, passing 300 yards eastward of the point ¾ mile northeastward of the wharf. Then pass westward of buoy No. 4 on a northerly course, and when well past it steer north-northeastward and pass eastward of buoy No. 3.

Burhans Wharf (Cooper post office) is on the south side of Rappahannock River southwestward of the entrance to Corrotoman River.

Urbana Creek, on the southwest side of Rappahannock River 15 miles above the entrance, has been improved by dredging a channel

10 feet deep and 150 feet wide across the bar at the entrance, and to the steamboat wharf at **Urbana** ½ mile above, with a turning basin of the same depth off the wharf. The creek has a depth of 6 feet for ¾ mile above the steamboat wharf, and is extensively used as a harbor for small vessels. There is excellent anchorage for a limited number of vessels of 9 feet or less draft, and depths of 4 to 9 feet at the wharves. It is frequented by passenger steamers, schooners, and barges of 10 feet or less draft. The mean rise and fall of tides is 1.6 feet. There is a railway at Urbana for hauling out boats of 50 feet length and 5 feet draft, and a machine shop for ordinary repairs to motors.

The entrance of Urbana Creek is marked by a buoy and two lights, and there is a large brick factory on the north side of the entrance. To enter, approach the outer light on a westerly course, pass 100 feet southward of it and the red buoy near the inner end of the jetty, pass about midway between the wharf just westward of the red buoy and the inner light, and then keep in mid-channel to the steamboat wharf at the north end of the bridge. The bridge crossing Urbana Creek has a sliding draw with an opening 27.8 feet wide.

There is a long wharf at **West Urbana**, ¾ mile northwestward of the entrance to Urbana Creek, at which the steamers make regular landings. A water tank on shore and the white buildings on the end of the wharf are prominent.

Robinsons Creek, just northward of West Urbana, has a depth of 5 feet in the entrance and 3 feet to the head.

La Grange Creek, 1¾ miles northward of Urbana Creek, has a depth of 7 feet in the entrance and 3 feet for 1½ miles above.

Weeks Creek, on the southwest side of the river 4 miles above Urbana Creek, has a depth of about 2 feet and is seldom used.

Monaskon is a post office and wharf on the northeast side of the river, 5½ miles above Urbana Creek.

Waterview is a wharf and post office on the southwest side of the river 6 miles above Urbana Creek. Just westward of Waterview is **Parrots Creek**, which has a depth of 4 feet in the entrance and 2 feet to near the head. **Mud Creek**, just northward of Parrotts Creek, is generally bare at low water inside.

Deep Creek, on the northeast side of Rappahannock River 8 miles above Urbana Creek, has a depth of 2 feet across the flats at the entrance and 4 to 6 feet inside to the several branches. The deepest draft using it is about 4 feet.

Whealton Wharf (Morattico post office), on the northeast side of the river 9½ miles above Urbana Creek, is an important shipping point. The long wharf and several buildings on the end are prominent. **Mulberry Creek**, just eastward of the wharf, has a depth of 4 feet at the entrance and 2 feet to the head. Just westward of Whealton Wharf is **Lancaster Creek**, which has a depth of 5 feet for 1 mile and 2 feet to **Woodhouse Landing**, 4½ miles above the entrance. **Moradica Creek**, emptying into Lancaster Creek from northward, has a depth of 3 feet at the entrance and 2 feet to near the head. **Farnham Creek**, 3½ miles northwestward of Whealton, has a depth of 2½ feet at the entrance and for a distance of 3 miles above. All of these creeks are frequented by many motor boats and lighters carrying farm and wood products and general merchandise.

Bayport is a wharf and post office on the southwest side of the river opposite Whealton. On the northeast side 4 miles above Whealton is **Sharps Wharf**, and on the southwest side just westward of Bowlers Rock lighthouse is **Bowlers Wharf**. A draft of 8 feet can be taken to the latter from north-northwestward and 9 feet from east-southeastward.

Totuskey River, on the northeast side of Rappahannock River, 3 miles above Bowlers Rock lighthouse, has a depth of 4½ feet across the bar at the entrance and 3½ feet inside to a fixed bridge, 4½ miles above the entrance. The deepest draft using it is 6 feet. The channel is narrow in places and difficult without local knowledge.

Wellford Wharf is on the northeast side of Rappahannock River 4 miles above Bowlers Rock lighthouse, and **Wares Wharf** is directly opposite on the southwest side.

Piscataway Creek, on the southwest side 2½ miles below Tappahannock, has a depth of 3½ feet across the flats at the entrance and 6 feet inside for a distance of 5 miles; the deepest draft using it is 6 feet. It is crossed by a drawbridge 4 miles above the entrance, having a single opening 28.6 feet wide. Directly opposite Piscataway Creek is **Little Carters Creek**, having a depth of 3½ feet at the entrance and 2 feet for a distance of 3 miles.

Tappahannock is a village on the western side of Rappahannock River 39 miles above the entrance. The wharf with red warehouse on the end, and a cannery with iron stack, are prominent. There is a depth of 9 feet at the wharf.

Hoskins Creek, just below Tappahannock, has a depth of 2 feet across the bar at the entrance and deeper water inside for a considerable distance. It is crossed by a drawbridge ⅝ mile above the entrance.

There are numerous wharves and landings between Tappahannock and Fredericksburg, some of them being post offices, but no villages except Port Royal. The most important landings are **Naylors** and **Leedstown**, 2¾ and 15 miles, respectively, above Tappahannock.

Cat Point Creek, on the northeast side 2½ miles above Tappahannock, has a depth of about 5 feet across the bar at the entrance and deeper water inside for 7 miles. The deepest draft using it is 6 feet. A drawbridge crosses the creek just inside the entrance.

Mount Landing Creek, on the southwest side 2 miles above Tappahannock, has a depth of 1½ feet across the flats at the entrance and deeper water inside for 3½ miles.

Occupacia Creek, on the western side 7 miles above Tappahannock, has a depth of 4 feet across the bar at the entrance and for 5¾ miles above in the main branch. The eastern branch has a depth of 2 feet to a fixed bridge 1¼ miles above its entrance. There are no wharves on either branch.

The creeks emptying into Rappahannock River above Occupacia Creek are all shoal and of little interest to navigation.

Port Royal is a village on the southwest side of Rappahannock River 70 miles above the entrance. **Port Conway** is a village opposite Port Royal.

Newton Rock, on the southwest side 2 miles below the wharves at Fredericksburg, is bare at a little below high water. It lies 50 feet from the high water shore line and the best water leads 100 feet outside of it.

Fredericksburg, a city at the head of navigation on Rappahannock River, has some trade by water, carried mostly in the regular steamers and in barges of 8 to 9 feet draft. Steamer navigation terminates at the wharves at the southern end of the city, though small boats can go about 1 mile farther. The river is crossed by two fixed bridges just above the wharves. Anchorage room is limited and vessels generally make fast to the wharves.

Anchorages.—Good anchorage for deep-draft vessels will be found in the mouth of the river southward or westward of Mosquito Point. Vessels can anchor anywhere in the channel of the river where the bottom is soft and the depth suitable. Carter and Urbana Creeks are extensively used as harbors for small craft.

Pilots.—Pilotage is not compulsory for Rappahannock River. Strangers bound up the river can obtain a pilot at Carter Creek, Urbana, or Tappahannock, and unless of light draft should not go above the latter place without one. Pilots for the upper part of the river can also be found at Port Royal.

Supplies.—Gasoline and provisions can be obtained at Irvington, Weems, Urbana, Tappahannock, Port Royal, Port Conway, and Fredericksburg, and there are stores at many of the other landings where some supplies are obtainable. Artesian water can be had at or near the wharves in Carter Creek, at Urbana, Tappahannock, Fredericksburg, and several other landings. Coal can be obtained at Fredericksburg and in limited quantities from the fish factories in Carter Creek.

Repairs to hulls of vessels up to 200 tons, 148 feet length and 8 feet draft, can be made in Carter Creek, and to boats of 50 feet length and 5 feet draft in Urbana Creek. There are machine shops at both places and at Fredericksburg, where ordinary repairs to machinery can be made. Railways for hauling out small motor boats can be found in Mill and Lockley Creeks, Eastern Branch of Corrotoman River, and at Fredericksburg.

Ice, during severe winters, closes the river nearly to its mouth, but during ordinary winters the channels are usually kept open by the regular steamers. Ice sufficient to interfere with navigation of small craft will usually be met with in January and February, and is most often found above Port Royal.

Freshets occur during the spring and fall, but are of short duration, and are not ordinarily dangerous to shipping. The highest water level on record was 32.8 feet above mean low water at Fredericksburg, but the usual height due to freshets is not over 9 to 12 feet, and only occasionally rises above the wharves. The effect on the water level due to freshets decreases rapidly below Fredericksburg, and is ordinarily negligible below Farleyvale Reach, 11 miles below. The water is usually fresh above Port Royal, but is not suitable for use in boilers.

Tides.—The mean rise and fall of the tides at the mouth of the river is 1.2 feet; at Tappahannock, 1.6 feet; and at Fredericksburg, 2.8 feet. It is high water at the mouth of the river 1 hour 36 minutes after high water at Old Point Comfort, and at Tappahannock 2 hours 56 minutes later than at the mouth of the river.

Currents.—The currents follow the general direction of the channel. In the upper reaches of the river the velocities of the currents

and the times of slack water vary to a considerable extent, due principally to freshets, but also to some extent to winds; they vary in a similar manner in the lower part of the river, but to a much less extent.

Abreast Windmill Point, at the mouth of the river, slack water before the flood occurs 1 hour before time of high water at Old Point Comfort, and slack water before the ebb occurs 45 minutes before time of low water at Old Point Comfort.

At Tappahannock slack water before the flood occurs 45 minutes after time of high water at Old Point Comfort, and slack water before the ebb occurs 40 minutes after time of low water at Old Point Comfort. The observed velocity of the current at strength of ebb was 1 knot and at strength of flood was 0.9 knot.

DIRECTIONS, RAPPAHANNOCK RIVER.

The channel from the mouth to Tappahannock is comparatively straight, gradually decreases in width, and leads between shoals which make out from both banks. The principal dangers are marked by buoys and lights. Strangers should have no trouble in taking a draft of 10 feet to Tappahannock by day with the aid of the chart. Above Tappahannock, the river is narrow and crooked and requires local knowledge. Rocks occur in places on both sides of the channel for a distance of 4 miles below Fredericksburg, and the shores should be given a good berth. Strangers can safely carry a draft of 6 feet to Fredericksburg with the aid of the chart, but with a deeper draft are advised to take a pilot at Tappahannock.

The approach to Rappahannock River leads between Rappahannock Spit on the north and Stingray Point Shoal on the south. The shores on both sides at the entrance are wooded, and the most prominent landmarks are Windmill Point and Stingray Point lighthouses, both white houses on piles.

Rappahannock Spit, extending 4⅜ miles east-southeastward from Windmill Point, is marked by Windmill Point lighthouse near the center, and a black bell buoy at the outer end. Vessels of 10 feet draft can cross the spit anywhere between the lighthouse and the bell buoy, and boats of 6 feet draft for a distance of 1 mile west-northwestward of the lighthouse. Rappahannock Spit is entirely within the area of possible fish traps; strangers should not cross it at night and should proceed with caution in the daytime.

The eastern limit of fish traps in the vicinity of Rappahannock River entrance is a line drawn from Smith Point lighthouse to Rappahannock Spit bell buoy, thence to buoy No. 11 south-southeastward of Wolf Trap lighthouse, and they are prohibited in water exceeding 45 feet in depth. The outer limit is marked by a line of black and white horizontally striped buoys.

Entering from southward.—Vessels should keep outside the line of buoys marking the eastern limit of fish traps, until 2⅝ miles southward of Rappahannock Spit bell buoy and 1½ miles northward of the fish trap buoy 5½ miles south-southeastward of Windmill Point lighthouse; the lighthouse will bear 328° true (NNW ⅜ W mag.), distant 4 miles. Then steer 314° true (NW ⅜ N mag.) for 3¾ miles to a position 1 mile south-southwestward of Windmill Point light-

house. Then steer 279° true (WNW ¾ W mag.) for 5⅜ miles, passing ⅜ mile northward of Sturgeon Creek Shoal light, to a position ⅜ mile southward of the red buoy off Mosquito Point.

Entering from northward.—Keep outside the line of buoys marking the outer limit of fish traps until down to Rappahannock Spit bell buoy. Passing eastward and ½ mile southward of this, a 279° true (WNW ¾ W mag.) course for 8 miles will lead 1 mile southward of Windmill Point lighthouse, ⅜ mile northward of Sturgeon Creek Shoal light, and to a position ⅜ mile southward of the red buoy off Mosquito Point.

Mosquito Point to Tarpley Point.—From a position ⅜ mile southward of the red buoy off Mosquito Point, steer 299° true (NW ⅞ W mag.) for 4⅝ miles, to a position 1 mile southward of the light at the entrance to Carter Creek and 1⅜ miles north-northwestward of Grey Point. Then steer 266° true (W ⅛ N mag.) for 3⅛ miles to a position ¼ mile south-southwestward of the red buoy off Tolls Point. From here a 302° true (NW ⅝ W mag.) course for 2⅜ miles will lead to a position ⅞ mile northeastward of Urbana Creek outer light, and with the outer and inner lights in range, and then a 346° true (N ¾ W mag.) course for 4½ miles with Monaskon Wharf (marked by several buildings on the end) a very little on the starboard bow will lead to a position ⅝ mile southward of the wharf and the same distance from the shore eastward. From here steer 317° true (NW ⅝ N mag.) for 3 miles to a position 250 yards northeastward of a black buoy, and then steer 293° true (NW by W ½ W mag.) for 2¼ miles to a position 200 yards southwestward of Tarpley Point Shoal gas and bell buoy.

Tarpley Point to Tappahannock.—The channel is narrow above Tarpley Point and strangers must depend upon the buoys and lights. The current has considerable strength at times and care must be taken not to be set off the courses by it.

From Tarpley Point gas and bell buoy steer 319° true (NW ⅞ N mag.) for 1¼ miles to a position 100 yards northeastward of the black buoy off Jones Point, then head for Bowlers Rock lighthouse on a 309° true (NW mag.) course until ½ mile from it, being guided by the buoys. Pass 200 yards northeastward of the lighthouse and steer 326° true (NNW ½ W mag.) for 2¼ miles to the northerly black buoy off Eubank, then steer 329° true (NNW ¼ W mag.) for 1⅜ miles to a position ⅜ mile west-southwestward of Accaceek Point and ½ mile south-southwestward of Wellfords Wharf. From here steer 340° true (N by W ¼ W mag.), passing ¼ mile off the wharf, and continue ¾ mile beyond until Ross Rock light bears 314° true (NW ⅜ N mag.), distant ⅝ mile. Then steer 308° true (NW ⅛ W mag.) for 2¾ miles to the black buoy off Jones Point, passing 150 yards southwestward of the light, and after passing the buoy, head for the wharf at Tappahannock. Anchorage can be had in 13 to 17 feet anywhere in the channel between the wharf and the red buoy 1 mile east-southeastward.

RAPPAHANNOCK RIVER TO GREAT WICOMICO RIVER.

The western shore of Chesapeake Bay between Rappahannock River and Great Wicomico River is generally low and presents no prominent features. It is indented by numerous creeks and by Great

Wicomico River. The creeks have numerous small villages and landings, but no large towns. Fish factories are located on most of them, and they are frequented by fish steamers of 8 to 12 feet draft and by many smaller craft engaged in the oystering and fishing industry. Steamers from Baltimore make regular trips to the principal landings between Great Wicomico River and Dymer Creek.

The outer **limit of fish traps** is a line joining Smith Point lighthouse and Rappahannock Spit bell buoy, and in water not exceeding 45 feet in depth. The outer limit is marked by a line of black and white horizontally striped buoys. Inside this limit, fish traps are numerous in season, but are prohibited along the regular navigable channels and at a greater distance from shore in the tributaries than one-third their width between shores. On account of the fish traps, strangers should not attempt to enter at night. Local vessels approaching the creeks from southward usually pass a little eastward of Windmill Point lighthouse, and keep outside the 18-foot curve until off the entrance, and when approaching from northward keep outside the 12-foot curve. The mean rise and fall of tides in all of the tributaries is about 1.1 feet.

Rappahannock Spit is described under Rappahannock River.

Fleets Bay, just northward of the entrance to Rappahannock River, forms the approach to Little Bay and Tabbs, Dymer, and Indian Creeks.

Little Bay and **Antipoison Creek**, emptying into Fleets Bay from southward, have a depth of 8 feet in a narrow channel for 2½ miles above the entrance. A prominent shoal in Little Bay is marked by a buoy, and otherwise the chart is the guide. The creeks are frequented only by small local boats.

Tabbs Creek has a depth of 12 feet in the entrance and 7 feet to near the head. It is unmarked and frequented only by small craft.

Dymer Creek has been improved by dredging a channel to a depth of 15 feet and width of 200 feet in the approach through Fleets Bay, and has a natural channel 15 feet deep for 1 mile above the mouth and 8 feet to near the head. The dredged channel is marked by a red buoy and a light on the north side, and the entrance to the creek by a light on each side. Fish steamers drawing 12 feet are the deepest draft entering.

Ocran, a village on the south side of Dymer Creek ⅝ mile above the entrance, is the principal landing, and a fish factory here is the most prominent mark in the vicinity. Gasoline, provisions, and water are obtainable, and coal in limited quantities from the fish factory. There is a railway in the creek capable of hauling out boats of 40 feet length and 4 feet draft.

Approaching Dymer Creek entrance, give the outer light a berth of over ¼ mile when eastward of it, and approach the light on a west-northwesterly course. Pass 50 to 100 yards southward of buoy No. 2, 60 yards southward of the outer light, and steer 300° true (NW ⅞ W mag.) for ¼ mile, heading for the fish factory at Ocran. Then steer 317° true (NW ¾ N mag.) for the lights at the entrance; pass 50 yards or more southward of the red structure and 50 to not over 150 yards northward of the black one. Above the entrance the mid-channel is clear, but the points should be given a good berth. Approaching Ocran Wharf pass northward of a post with barrel which marks the end of a shoal eastward of the wharf.

Indian Creek has a depth of 10 feet to Kilmarnock Landing and 6 feet to near the head. The principal landings are **Byrdton**, on the northeast side 1 mile above the entrance, and **Grace Point** and **Kilmarnock Landing**, on the southwest side 2 and 2½ miles, respectively, above the entrance; the latter is at the foot of a road leading to the village of **Kilmarnock**. There are fish factories at Byrdton and Kilmarnock Landing. Gasoline, provisions, and water are obtainable. There is a light on the north side at the entrance between the shoals, and two small private beacons, lighted during the fishing season, to mark the ends of the shoals on the northeast side between the entrance light and Byrdton.

To enter Indian Creek, keep southward of the shoals with depths less than 18 feet lying eastward of the outer light, and steer for the fish factory at Byrdton open southward of the outer light, course 305° true (NW ⅜ W mag.). Pass 75 yards southward of the outer light and the beacon ½ mile above it, and continue the course for the fish factory until inside the entrance. Pass 75 yards southward of the beacon lying ¼ mile southeastward of Byrdton, above which the mid-channel is clear to Kilmarnock Landing, but the points should be given a good berth.

Dividing Creek has its entrance between shoals 7¼ miles 343° true (N by W mag.) from Windmill Point lighthouse. It has a depth of 12 feet to **Hardings** and **Harveys Wharves,** 1¾ miles above **Hughletts Point** at the entrance, and 6 feet for a further distance of ¾ mile. The channel is marked by lights and buoys from the entrance between the shoals up to Prentice Creek and by bush stakes on the ends of the prominent shoals above that point. Prominent white fish factories are located on the point on the south side of Prentice Creek, ¼ mile above its entrance, and on the north side of the north point of Prentice Creek, and are visible from outside. There is a light on the south side at the entrance of **Prentice Creek.** Gasoline, provisions, water, and coal in limited quantities are obtainable.

The best water can be taken to the entrance of Dividing Creek by keeping Windmill Point lighthouse astern on a 345° true (N ⅞ W mag.) course, with Dividing Creek light a little on the port bow; this course leads through an area of possible fish traps. But a depth of 10 feet can be taken to the entrance by approaching Dividing Creek light on any bearing between 264° true (W mag.) and 343° true (N by W mag.). In entering, pass eastward and close northward of Dividing Creek light and 100 yards southward of the light ⅝ mile west-northwestward of it. Then steer northwestward into the creek, passing southward of a red buoy and northward of the light on the south side at the entrance. When inside the creek follow a general mid-channel course, keeping outside the bush stakes which mark the ends of the shoals.

GREAT WICOMICO RIVER (CHART 534),

6 miles southwestward of Smith Point lighthouse, is a good and convenient harbor and is extensively used by small vessels. It is also frequented by fish steamers, the regular passenger steamers, and schooners and barges carrying wood products. The draft of vessels entering it does not ordinarily exceed 12 feet. It has a depth of 18 feet for 5¾ miles above Great Wicomico River lighthouse, 10

feet for 2½ miles farther to abreast Sampsons Wharf, and is navigable for small craft for a farther distance of 2½ miles. Vessels load with wood products as far up as Sampsons Wharf, cargoes being brought from above by lighters.

The channel is marked by lights and buoys to **Haynies Point,** 3 miles above Wicomico River lighthouse. The principal landings on the main channel of Great Wicomico River are **Mila, Blackwells, Tipers,** and **Sampsons Wharves.** The principal marks for the entrance are **Great Wicomico River lighthouse** (white house on piles) and a group of buildings, a church spire and an iron stack at Fleeton, on **Fleets Point.** The shoals outside the entrance are generally covered by fish stakes.

Ingrams Bay and **Mill Creek,** west-southwestward of Great Wicomico River lighthouse, have a depth of 12 feet for 3 miles above the lighthouse and 8 feet for a further distance of 1 mile. The channel is narrow and unmarked and strangers should not enter without a pilot.

Cockrells Creek, on the north side, just inside the entrance of the river, has numerous fish factories and is the center of a large trade by water. **Fleeton, Fairport,** and **Reedville** are villages on the creek, and there are several other landings. All kinds of supplies are obtainable, and there is a railway for hauling out boats of 50 feet length and 5 feet draft. Some ship chandlery can be obtained at Reedville, and storm warnings are displayed there. There are depths of 8 to 15 feet at the wharves. Fleet Point light is the principal guide to the entrance.

The other tributaries of Great Wicomico River are used by small local boats, but are unmarked and of little interest to general navigation.

Anchorage.—Vessels entering Great Wicomico River for shelter usually anchor off and in the mouth of Cockrells Creek in 15 to 20 feet. Motor boats usually anchor in the creek. Cockrells Creek is also considerably used as a secure harbor from ice.

Ice does not close the river to navigation except in severe winters, and then only for short periods.

Tides.—The mean rise and fall of tides is 1.1 feet at the entrance of Great Wicomico River.

Directions, Great Wicomico River.—Fish traps will usually be found on the shoals near and off the entrance to Great Wicomico River, and strangers entering at night should follow the deepest water and proceed with caution.

The best water will be taken into the entrance on a 287° true (WNW mag.) course, passing 300 yards north-northeastward of Dammeron Marsh Shoal buoy, 350 yards southward of Great Wicomico River lighthouse, and 150 yards southward of Fleet Point buoy.

If bound above Cockrells Creek, from a position 150 yards southwestward of Fleet Point buoy, steer 326° true (NNW ½ W mag.) for Sandy Point light (black structure); round it at a distance of 100 yards or more and steer northwestward for Haynies Point light (red structure); round this light at a distance of 100 yards or more and be guided by the chart. A general mid-channel course is the best, but unmarked shoals extend for a considerable distance offshore in places.

To enter Cockrells Creek pass 300 yards westward of Fleet Point light and steer 34° true (NE ½ N mag.), passing 150 yards off the wharf on the north side of Fleet Point. Then pass about 75 yards off the wharf on the west bank and leave the next point on the west bank 150 yards on the port hand. Anchor in the channel anywhere below the fish factory on the west bank at Fairport.

POTOMAC RIVER,

on the western side of Chesapeake Bay, 66 miles above the entrance and 84 miles below Baltimore, forms the boundary between the States of Maryland and Virginia, and is the approach to the cities of Alexandria and Washington, and many villages and landings. It is navigable by vessels to Washington, 95 miles above the entrance, and by small unmasted vessels for about 3 miles above to Little Falls. The vessels using the Potomac River are occasional coasting and foreign vessels bound to Alexandria and Washington, the regular steamers from Washington, Baltimore, and Norfolk to the landings, and a large number of small craft engaged in oystering and fishing.

The **channel** is good for a depth of 18 to 22 feet, which is found between the lumps when crossing Kettle Bottom Shoals. There is a narrow channel with a navigable depth of 23 to 24 feet through Kettle Bottom Shoals along the north bank. The dredged cuts between Maryland Point and Douglass Point and through **Mattawoman Shoals** are about 200 feet wide, with a depth of 24 feet. A draft of 22 feet has been taken up the river to Washington, but this is exceptional; 18 to 20 feet is about the ordinary deepest draft.

Little Wicomico River, entering the south side of Potomac River ⅞ mile northwestward of Smith Point, is nearly dry at low water at the entrance, and not more than 3 feet can be taken across the bar under the most favorable conditions of high water and a smooth sea. The entrance is also subject to change. The depths in the river are said to range from 6 to 15 feet. There is no traffic to and from the river, shipments being made by way of Great Wicomico River. **Sunnybank** is a post office on the south side of the river, 1 mile above the entrance.

Hack Creek, Cubitt Creek, Hull Creek, Presley Creek, and **Cod Creek,** on the south side of Potomac River between Little Wicomico and Coan Rivers, are not used. The entrances are often dry at low water.

Coan River is on the south side of Potomac River, 14 miles above Smith Point lighthouse and 6½ miles 251° true (WSW ⅞ W mag.) from Point Lookout lighthouse. Steamers drawing 9 feet or a little over make regular trips to the landings. The entrance is marked by aids, some of which are lighted, and is easy of access. Above the entrance, pile beacons with slatted daymarks are maintained in a depth of about 6 feet on the principal shoals as far as the landings, but some difficulty may be experienced in taking a greater draft than 8 feet to Coan and Bundick. The mean rise and fall of tides is 1.4 feet.

The landings are **Lewisetta, Cowart, Walnut Point, Lake, Coan,** and **Bundick,** and these landings are post offices. The bight on the south side of Walnut Point is used as an anchorage by small craft. There are stores at the landings, and artesian water and gasoline can be had at some of them.

Kingscote Creek, the northern branch on the west side of Coan River, is navigable for vessels of 8 feet draft for a distance of ¾ mile above the wharf at Lewisetta. Shoals extend halfway across the entrance from the west side northward of Cowarts Wharf, and otherwise the mid-channel is clear.

The Glebe, the principal tributary on the west side of Coan River, is navigable for vessels of 9 feet draft for a distance of 1½ miles above Cowarts Wharf; the mid-channel is clear, except for a shoal which extends well off from the point on the south side ¾ mile above Cowarts Wharf. The south arm at the head of the Glebe has a channel depth of 8 feet for a distance of ½ mile above the entrance.

Directions, Coan River.—A channel 500 yards wide is kept clear of fish stakes in the approach to Coan River; passing ⅝ mile southeastward of Coan River gas and bell buoy, the center line of this channel trends 231° true (SW by W ⅛ W mag.) to a position 250 yards northwestward of Coan River light (black pile structure). Pass 100 yards westward of Coan River light, steer 169° true (S ½ E mag.) and pass eastward and southward of Travis Point Spit light, rounding it at a distance of 200 to 300 feet. Then steer 271° true (W ⅝ N mag.) for Cowarts Wharf, passing midway between the beacons southward of Lewisetta, from which point the channel is clear to the wharves at Lewisetta and Cowarts.

To continue up Coan River, pass 300 to 400 feet eastward of the beacon off the entrance of the Glebe, about 200 feet eastward of the next beacon southward, about 150 feet eastward of the beacon westward of Walnut Point, and 200 feet eastward of the beacon southward of Walnut Point. Then keep about mid-river, giving the beacons a berth of about 300 feet, and pass about midway between the beacons southeastward of Lake Landing on a southerly course. Above Lake Landing favor slightly the west bank until approaching Coan Wharf. A draft of 6 feet can be taken about ¾ mile above Bundick Wharf to the old wharf on the west side, and 3 feet about ½ mile farther to the small landing at the head of the river; the points should be given a good berth.

Judith Sound, just northward of the entrance to Coan River, is shallow, and motor boats bound northward from Coan River must go outside of Hog Island.

Yeocomico River is on the southwest side of Potomac River, 17 miles above Smith Point lighthouse and 9 miles 269° true (W ½ N mag.) from Point Lookout lighthouse. It has a depth of 13 feet in the entrance and 9 feet to **Lodge Landing** on **South Yeocomico River** and to **Kinsale** on **West Yeocomico River.** Steamers between Baltimore and Washington drawing 9½ feet make regular trips to several landings in the river. Lynch Point light, on the north side, is the principal guide to the entrance. A light and a red buoy mark the entrance to West and South Yeocomico Rivers, and single pile beacons with slatted daymarks are maintained in a depth of about 6 feet to mark the most dangerous shoals in these branches. The mean rise and fall of tides is 1.4 feet.

The landings in Yeocomico River are **Cintra** (south side of Lynch Point), **Kinsale, Mundy Point,** and **Lodge,** and there is a post office at each. Kinsale is the principal village, and gasoline, provisions, and water are obtainable there. Some supplies can also be obtained at the other landings.

White Point Branch, the northwestern branch of Yeocomico River, has a depth of 9 feet for 1 mile above the entrance. **White Point** is a post office on its southwest side. There are no wharves except for small boats. To enter, bring Barn Point light astern on a northwesterly course, heading southward of the end of White Point, and pass about 150 yards off the northeast bank southeastward of White Point. The mid-channel is then clear, except for a shoal which extends northeastward to mid-river from the point on the north side of Mill Branch.

A channel 650 yards wide is kept clear of fish stakes in the entrance of Yeocomico River. From a position nearly 2 miles 68° true (ENE 5/8 E mag.) from Lynch Point light, the center line of this channel trends 244° true (WSW 1/4 W mag.) to a position 325 yards southward of Lynch Point light, and then 261° true (W 1/4 S mag.) to a position 325 yards northward of Barn Point light. Pass 200 yards northward and westward of Barn Point light, steer southward for the red buoy westward of Barn Point, and pass eastward of it.

To enter West Yeocomico River, pass between the red buoy and the beacon southwestward of it and steer westward to Kinsale, following a general mid-channel course and keeping outside the beacons which mark the ends of the shoals. A depth of 9 feet can be taken alongside the wharf at Kinsale, or anchorage may be had in a depth of 10 feet in the mouth of Hampton Hall Branch, just below the wharf.

To enter South Yeocomico River, pass eastward of the red buoy westward of Barn Point and steer southward, passing 100 yards off Mundy Point wharves, 70 yards eastward of the beacon just southward of them, and follow a general mid-channel course to Lodge Landing, giving the points a good berth and keeping outside the beacons which mark the ends of the shoals. There is a depth of 3 feet for 3/4 mile above Lodge Landing.

Cornfield Harbor, just inside of Point Lookout, is sheltered from northerly and northeasterly winds and vessels bound up and down the bay frequently use it as an anchorage for the night. The shoaling is gradual and the lead a good guide except off **Cornfield Point** and at the south end of the shoal (marked by a red buoy) extending 3/4 mile southward from Point Lookout, where it is abrupt and the bottom hard sand. The only outlying danger is a shoal with 6 feet over it and 15 to 20 feet around it, lying 650 yards west-northwestward of Point Lookout lighthouse, and marked by a red buoy. There is a short wharf with 10 feet at its end just westward of the lighthouse. **Point Lookout** and Cornfield Point are post offices. **Point Lookout Creek** has a depth of about 2 feet in its entrance.

The small creeks between Cornfield Point and Smith Creek are shoal and little used; most of them can not be entered at low water.

Smith Creek, on the north side of Potomac River, 5 1/2 miles northwestward of Point Lookout, has a depth of 10 feet across the bar at the entrance and 17 feet inside to the junction of the northern and eastern branches. Both branches have a depth of 12 feet for 3/4 mile and 8 feet to near their heads. Steamers drawing 9 1/2 feet make regular trips to **Millers Wharf** (Wynne post office) in the creek, and many small boats make use of the creek as a harbor. There is a store at Millers Wharf where gasoline and some provisions are obtainable.

The channel at the entrance of Smith Creek is very narrow and difficult and is marked by lights and buoys. A channel 600 yards wide is kept clear of fish stakes, the center line of the channel trending 355° true (N 1/8 E mag.) for 1 3/4 miles to a position 300 yards westward of the red buoy off the entrance. Pass 200 yards westward of the buoy and steer north-northeastward with the outer light (black structure) a little on the port bow. Pass about 200 yards southeastward and 100 feet northeastward of the outer light, and 150 feet southwestward of the red buoy and inner light. Above this point the midchannel is clear, but a shoal extends 300 yards northwestward from the point 1/4 mile southwestward of Millers Wharf and is usually marked by a bush stake.

St. Marys River, on the north side of Potomac River, 6 miles northwestward of Point Lookout, has a depth of 24 feet or more to Priests Point, 21 feet to St. Marys, and 8 feet to Lynch Island, distant 3 1/2, 6, and 8 1/2 miles, respectively, above the entrance. It is 2 miles wide at the entrance and has a channel width of 1/2 to 3/4 mile up to Priests Point, forming a secure harbor. It is the principal anchorage in the mouth of Potomac River for vessels seeking shelter in heavy gales. The mean rise and fall of tides is 1.7 feet.

A shoal extends 1 1/4 miles southeastward from St. George Island and is marked by a horizontally striped buoy, which is the principal guide to the entrance. There is a horizontally striped buoy 1/2-mile south-southeastward of Cherryfield Point, but depths of 12 to 17 feet extend 1/2 mile southeastward of it. **Priests Point** is marked by a large white house, and there is a light on the end of the shoal off the point. **Windmill Point** is a low yellow bluff, with a cluster of trees at the end; the shoal off the point is marked by a black buoy. **St. Marys Point** is marked by a low church spire visible above the trees and a monument on the end of the point.

The landings are **Bromes Wharf** (St. Marys City post office) and **Portobello**, on St. Marys River, and **Grason Landing**, on the south side of **St. Inigoes Creek**, 1 mile above its mouth. Steamers drawing 10 feet make regular trips to all of them. Some provisions can be obtained at St. Marys.

Directions, St. Marys River.—The outer limit of the fish traps in the vicinity is defined by a line extending 301° true (NW 3/4 W mag.) from Point Lookout Shoal buoy, passing 1/4 mile off the south point of St. George Island, and continued 1 1/2 miles past that point; and then trending 312° true (NW 1/4 N mag.) and passing 3/8 mile off Piney Point lighthouse. Vessels should keep southward of these lines, especially at night. A channel 800 yards wide is kept clear of fish traps in St. Marys River, the center line of the channel trending 346° true (N 3/4 W mag.) and passing 3/4 mile westward of Kitts Point, 5/8 mile eastward of the horizontally striped buoy lying southeastward of St. George Island, and 1 1/8 miles eastward of the island.

Passing 1/4 mile or more southward and 1/4 mile eastward of the horizontally striped buoy southeastward of St. George Island, steer 355° true (N 1/8 E mag.) for Windmill Point; this course leads across an area of possible fish traps for a distance of 1 mile above the buoy. Pass 200 yards westward of Priests Point light, about the same distance eastward of the black buoy off Windmill Point, and round Windmill Point at a distance of at least 1/4 mile. Pass

300 yards or more off Chancellor Point (on east bank 5/8 mile above Windmill Point), and then keep near the middle of the river to the head, except abreast the shoal which extends 300 yards southwestward from Horseshoe Point, 3/4 mile northwestward from St. Marys.

St. George Island is a long, low, sparsely wooded island on the west side of the entrance to St. Marys River, and the southwest side of St. George River. It is thickly settled, mostly by oystermen and fishermen, and is also used to a considerable extent as a summer resort. There is a post office and two landings for small boats on the northeast side, where gasoline and provisions can be obtained. Pilots can also be obtained for any of the adjacent tributaries.

St. George River has a narrow, crooked channel with a depth of 10 feet for 4 miles. Shoals make out from many of the points. It is frequented by oystering and fishing boats during the entire year, and by many pleasure craft during the summer; 3 to 5 feet is the usual draft of boats frequenting it, though vessels of 8 to 10 feet draft sometimes load with wood products. The red and black horizontally striped buoy southeastward of Cherryfield Point is the only mark, and local knowledge is required to carry the best water above the entrance. A channel 600 yards wide is kept clear of fish traps in the entrance, the north edge of the channel trending 309° true (NW mag.) to the horizontally striped buoy.

St. George River can be entered with a depth of 3 feet at low water through **the Straits**, at the northwest end of St. George Island. To enter, keep the end of the sand spit on the eastern side in range with a lone pine tree on the northeast side of St. George River, on a course about N by W (mag.) until up with the point, then round it at a distance of about 50 feet. There is a post office (Piney Point) on the southwest side of St. George River just above the Straits, and gasoline can be obtained.

Piney Point is marked by **Piney Point lighthouse** (white tower). There is a steamboat wharf with a depth of 10 feet 1/4 mile northeastward of the end of the point. The point should be given a berth of 300 yards to avoid a shoal, bare at low water, extending southward from it, and to avoid the fish stakes just eastward of the point.

Ragged Point, on the southwest side of Potomac River, 15 miles above Point Lookout, has shoals extending off it in all directions, the northeast edge of the shoals being marked by **Ragged Point lighthouse** (white house on piles). Deep-draft vessels should give the lighthouse a berth of 1/4 mile or more.

Machodoc River, 2 1/2 miles westward of Ragged Point lighthouse and 5 miles 127° true (SE 1/8 E mag.) from Blackistone Island lighthouse, has a depth of 12 feet for 1 1/2 miles, 8 feet in a dredged channel through the narrows 2 miles above the entrance, and 6 feet above to near the head of navigation. Steamers from Washington drawing 6 feet make regular trips to **Edgewater Wharf** and **Parham Point**, which are the principal landings. The entrance is narrow and obstructed by shoals extending from either side and is marked by a light and buoys. There are no marks above the entrance.

To enter Machodoc River, steer for the light at the entrance on about a south (mag.) course; pass westward and southward of the light, and midway between the two buoys southeastward of it. Follow a general mid-channel course to the narrows, and pass through the

narrows on a 208° true (SW by S mag.) course, heading for the end of a ruined wharf and passing 75 yards off the point on the west side and 100 yards off the point on the east side. Pass close to the end of the ruined wharf and the new wharf just above it, and follow a general mid-channel course to Parham Point.

Nomini Bay, on the south side of Potomac River, 22 miles above the entrance and 3½ miles 165° true (S ¾ E mag.) from Blackistone Island lighthouse, has depths of 15 to 19 feet and forms the approach to Nomini Creek and Currioman Bay. The shoaling is abrupt on the east side and gradual on the west side.

Nomini Creek has been improved by dredging a channel 9 feet deep and 150 feet wide from the head of Nomini Bay to **Hickory Point,** 1 mile above, and by the construction of a jetty on the east side at the entrance. The creek has a natural depth of not less than 7 feet from the head of the dredged channel to Nomini, 2½ miles above, 5 feet to a drawbridge 1 mile above Nomini, and 3 feet for a further distance of 1 mile.

The landings are **Beales, McGuires,** and **Mount Holly,** on the southeast side, and **Deep Point** and **Nomini** on the west side. Mount Holly is a post office. Gasoline, provisions, and water are obtainable in several places. Steamers from Washington of 6 feet draft make regular trips to all of the landings. A center pier drawbridge, each opening 60 feet wide, with a headroom of 5 feet at high water when closed, crosses the creek at Nomini. The mean rise and fall of tides is 1.8 feet.

The dredged channel into Nomini Creek is marked by buoys and lights and by bush stakes maintained by the steamboat company. To enter give the shores of Nomini Bay a berth of ½ mile and head for the outer end of the jetty. Pass 100 yards westward of it, and steer 152° true (SSE mag.) in the dredged channel, following the buoys, and passing 100 feet westward of White Point light and 250 feet westward of Ice House Point light. Bring the latter light astern on a 181° true (S ⅝ W mag.) course, following the dredged channel, and passing eastward of the red buoy at its south end. From this point to Nomini the mid-channel is clear. Shoals make off from many of the points, and they should be given a good berth.

Currioman Bay, emptying into Nomini Bay from westward, has a depth of 8 feet at its entrance and 7 to 10 feet anywhere in mid-channel to near the head. It is separated from the river by a narrow, marshy spit, wooded in the center. **Currioman Wharf** is the principal landing and is used by steamers from Washington drawing 6 feet. The end of the shoal extending southeastward from **Elbow Point** is marked by buoys, and usually by a bush stake. To enter, pass 200 yards westward of the north end of the jetty at the head of Nomini Bay, steer southwestward for about 400 yards and then westward, passing southward of the buoys and bush stake marking the end of the shoal. When past the second buoy steer northwestward into the bay, favoring slightly the northeast side at the entrance, and then keep in mid-channel.

Piney Point, Herring, Blake, Poplar Hill, and **Flood Creeks,** between Piney Point and Bretons Bay are shoal and unimportant; 1 or 2 feet can be taken into most of them at low water, but they are little used.

Bretons Bay is on the north side of Potomac River, 2 miles eastward of Blackistone Island lighthouse. Steamers drawing 10 feet make regular trips to the landing on the northeast side of **Lovers Point (Abell Wharf)**, and to **Leonardtown** at the head. There is a depth of 13 feet or more for 3½ miles above the entrance, to Lovers Point light; the channel for this distance is marked by buoys and easily followed, but care is required to follow the best water above this point to Leonardtown. The latter is reached through a dredged channel 170 feet wide and 10 feet deep, and there is a turning basin 300 feet wide at the wharf. Gasoline can be obtained at Leonardtown and **Compton**; the latter is a post office inside the entrance of a creek on the north side of Bretons Bay, 2 miles above the entrance. A channel with a depth of about 4 feet leads into the creek to the landing at Compton; there is a railway for launches. The mean rise and fall of tides in Bretons Bay is 1.8 feet.

Directions, Bretons Bay.—A shoal with little depth extends ¾ mile southwestward from **Higgins Point**, on the east side at the entrance, and is marked by a buoy. Passing ¼ mile northeastward of Ragged Point lighthouse, a 309° true (NW mag.) course for 6 miles will lead southwestward of buoy No. 2. Or, coming down the river, pass well southward of Heron Island Shoal, and from the horizontally striped buoy at its eastern end a 14° true (N by E ¾ E mag.) course will lead westward of buoy No. 2.

Passing 100 yards or more westward of buoy No. 2, steer 14° true (N by E ¾ E mag.) and keep near the middle of Bretons Bay. Give **Paw Paw Point**, on the north shore nearly 3 miles above the entrance, a berth of about ¼ mile. Pass midway between Lovers Point light and the point westward on a northerly course, and pass westward and northward of the light at a distance of about 200 yards until heading about 106° true (ESE mag.); the shoal extending 100 yards northward of the light is marked by a buoy. To go to Abell Wharf, approach it on a bearing westward of 185° true (S by W mag.).

To continue to Leonardtown pass 100 yards off the point on the south bank above Lovers Point, and steer 35° true (NE ⅜ N mag.), following the dredged channel, with Buzzard Point light a little on the port bow. Pass 150 feet southeastward of the light, make the turn with a starboard helm to a position 100 feet southwestward of a bush stake, then steer 300° true (NW ¾ W mag.) in the dredged channel, heading about 75 feet outside the wharf at Leonardtown.

St. Clement Bay is on the north side of Potomac River, north-northeastward of Blackistone Island lighthouse. There are three entrances: the eastern or main entrance between Heron Island Shoal and Newtown Neck is ½ mile wide with a depth of 18 feet, and is easily followed by day; the middle entrance between Heron Island Shoal and Blackistone Island is narrow and crooked, is marked by beacons and buoys, and is easily followed in the daytime; the western entrance, called Dukeharts Channel, requires some local knowledge.

Steamers drawing 10 feet make regular trips to the landings at **Cobrums Wharf** and **Stones Wharf** (Bayside post office), near the head of steamboat navigation 5 miles above the entrance of St. Clement Bay; the channel is easily followed. Steamers drawing 6 feet land at **Coltons Wharf**, on the west side, at the entrance, where some provisions and water are obtainable. **Palmers**, on the south side of St.

Patrick Creek, is a post office; the creek is navigable for motor boats. **Canoe Neck Creek** has a depth of 6 feet for about 1 mile. The mean rise and fall of tides in St. Clement Bay is 1.8 feet.

Directions, St. Clement Bay.—Passing ¼ mile northeastward of Ragged Point lighthouse, a 305° true (NW ⅜ W mag.) course for 6 miles will lead northward of the horizontally striped buoy on the eastern end of Heron Island Shoal. Pass ⅛ to ¼ mile northeastward of this buoy and continue the course for 1½ miles to the buoy southwestward of Newtown Neck.

Or, coming down the river, to pass between Blackistone Island and Heron Island Shoal, pass southward and 100 yards eastward of the black buoy at the entrance, 100 yards eastward of Blackistone Island Shoal beacon on a northwesterly course, 150 yards westward of Heron Island Bar beacon on a northerly course, and then port slowly to a 28° true (NE by N mag.) course, which should lead to the red buoy southwestward of Newtown Neck.

Pass 300 yards westward of the latter buoy and steer 354° true (N mag.), giving Long Point a berth of over 300 yards. Then keep in mid-channel, giving the points a good berth. Pass 100 yards or more northeastward of Cedar Point light and steer for Cobrums Wharf, or follow a mid-channel course to Stones Wharf; the latter should be approached on a 7° true (N by E ⅛ E mag.) course to avoid shoals on either side.

Dukeharts Channel, leading into St. Clement Bay northward of Blackistone Island, is good for a depth of 7 feet, is used by the regular steamers drawing 6 feet and by motor boats, and is marked by buoys and usually by bush stakes. It should not be used by strangers except in small boats.

To enter Dukeharts Channel, pass southward and about ¼ mile eastward of buoy No. 6 and steer for a prominent white house at the mouth of Dukeharts Creek on a 23° true (NNE ⅝ E mag.) course, and pass 100 yards westward of a bush stake on the end of the shoal extending northwestward from Blackistone Island. Make a sharp turn around the stake with a port helm, and head down a little northward of the middle of Blackistone Island until nearly up to buoy No. 4. Pass 100 yards southward of this buoy on an east-northeasterly course. Coltons Wharf should be approached on a bearing westward of 331° true (NNW mag.). To continue into St. Clement Bay, pass 300 yards northward of Blackistone Island on an easterly course, 50 yards northward of the black buoy at the eastern entrance of Dukeharts Channel, and about 200 yards northwestward of Heron Island Bar beacon.

Heron Island Shoal is an extensive shoal area entirely submerged at high water, and having an extensive area bare at low water. It is marked at the eastern end by a horizontally striped buoy.

Blackistone Island is sparsely wooded and is marked at the south end by **Blackistone Island lighthouse** (white dwelling). Shoals extend from it in all directions, the southern limit of the shoal area being marked by a red buoy.

Wicomico River, on the north side of Potomac River, 28 miles above Point Lookout, has a depth of 24 feet or more for 3½ miles above Cobb Point Bar lighthouse, at the entrance, and 12 feet for a further distance of 1½ miles. Above this point there are many detached

shoals which render navigation difficult for boats of a greater draft than 5 feet, though with local knowledge a draft of 8 feet can be taken 8 miles above the entrance, and 3 feet to the head of navigation, 12 miles above the entrance. The river is characterized by spits, with little depth and terminating abruptly, which extend to mid-river in places; those near the entrance are marked by **Cobb Point Bar lighthouse** (white house on piles) and by several buoys. The mean rise and fall of tides is 1.9 feet.

Steamers drawing 10 feet make regular trips to **Rock Point** and **Bushwood** (**Blackistone post office**), and a steamer drawing 6 feet goes to **Chaptico Landing**, at the foot of a road ¾ mile southeastward of Mill Point, and these are the principal landings. Gasoline and provisions are obtainable at Rock Point.

St. Catherine Sound, on the east side of Wicomico River, at the entrance, has depths of 5 to 9 feet through the middle, but there are extensive shoals close to the channel. A depth of 2½ feet can be carried through it into Wicomico River. **River Springs** is a post office on the northeast side.

Neals Sound, on the west side of Wicomico River, southward of Rock Point, has a depth of 6 feet in the entrance and 7 to 11 feet inside, and forms a secure anchorage for motor boats. The entrance is obstructed by rocks close to the channel and a stranger should proceed with caution. The outlet into Potomac River, near the head, has a depth of about 1 foot at low water.

Chaptico Bay, on the east side of Wicomico River, 6½ miles above the entrance, has a depth of 2 to 5 feet. It has no wharves and little business by water.

To enter Wicomico River, pass southward and eastward of the horizontally striped buoy at the entrance and ¼ mile eastward of Cobb Point Bar lighthouse, and steer 339° true (N by W ⅜ W mag.) for the church spire at Rock Point. Passing 150 yards westward of the red buoy on the end of the shoal extending westward from St. Margarets Island, vessels can steer for Rock Point Wharf, being careful to avoid a shoal extending eastward from the island on the west side and usually marked by a bush stake. Or from the red buoy a 30° true (NE ¾ N mag.) course can be steered for Bushwood Wharf.

Or if bound to points above, from the red buoy steer 10° true (N by E ⅜ E mag.) for the island on the end of White Point Bar to a position eastward of the black buoy on the end of the shoal extending eastward from Rock Point, and then steer 339° true (N by W ⅜ W mag.), being guided by the chart.

Pope Creek, on the southwest side of Potomac River, 4 miles below Colonial Beach, is bare at low water at the entrance.

Mattox Creek, 1 mile southward of Colonial Beach, has a depth of 6 feet in a narrow, crooked channel to **Wirts** and **Masseys Wharves**, 2 miles above the entrance, and 4 feet for a farther distance of 2 miles to a highway drawbridge. The entrance is marked by lights and buoys, but strangers seldom enter except in small boats. Steamers of 6 feet draft make regular trips to Wirts and Masseys Wharves, and motor boats and an occasional schooner carrying wood products go several miles farther. In entering, pass 100 yards westward of the lights and be guided by the chart and the buoys. The shoal extending eastward from **Paine Point** is usually marked by a bush stake.

Colonial Beach is a summer resort on the southwest side of Potomac River, 34 miles above the entrance and 61 miles below Washington. It is connected with Washington by steamer and with the railroad at Popes Creek by motor boat; 9 feet can be carried to the two wharves from any position in midriver. There are telephone and telegraph connections. Water, provisions, gasoline, and coal in limited quantities can be obtained, and there is a railway for motor boats.

Monroe Creek, having its entrance at the south end of Colonial Beach, is extensively used as an anchorage for boats; it has a depth of 6 feet in the entrance and 3 feet almost anywhere in the creek. There is a wharf on the east side of the entrance, where gasoline can be obtained. To enter, give the east and south shore of Colonial Beach a berth of over ¼ mile and approach the entrance on a northerly course about 500 feet from the west shore. Pass through the entrance close along the end of the wharf, head for a small clump of trees about 100 yards from the end of Dickinson Point, on the west side, until nearing the point, above which 3 feet can be carried anywhere.

Wilkinson is a post office and landing on the south side of Potomac River southeastward of the mouth of Rosier Creek. Steamers drawing 6 feet make stops there. Gasoline and some provisions can be obtained.

Rosier Creek, 3 miles above Colonial Beach, has a depth of 4 feet in the entrance and 3 feet for 1 mile above. The best water in the approach leads close along the ends of the wharves at Wilkinson and follows the shore at a distance of 100 yards. The creek has no wharves and is little used.

Upper Machodoc Creek is on the west side of Potomac River, 2 miles southwestward of Lower Cedar Point lighthouse. It has been improved by dredging a channel 6½ feet deep and 100 feet wide to **Little Ferry Landing**, 4 miles above the entrance, and 6 feet deep and 50 feet wide to **Milford Landing**, 6¾ miles above the entrance, with a turning basin at both places. Steamers from Washington drawing 6 feet make regular trips to the wharves as far as Little Ferry Landing. The entrance is also extensively used as an anchorage by small boats during the oystering and fishing season. There is a store at Berrys Wharf, 1½ miles above the entrance, where gasoline and some provisions are obtainable.

Beabors Point light, on the south side of the entrance to Upper Machodoc Creek, is the guide to the entrance. There are no marks above the entrance, and strangers may find it difficult to keep in the dredged channels. In entering, pass 250 yards northward of Beabors Point light and steer west-northwestward to **Berrys Wharf**. Above this point the chart is the guide. The mean rise and fall of tides is 1.8 feet.

Cuckold Creek, 3 miles southeastward of Lower Cedar Point, is said to have a depth of 2½ feet at the entrance and deeper water inside. It is unmarked and little used.

Piccowaxton Creek, 1¾ miles southeastward of Lower Cedar Point, can be entered only by small boats at high water.

Lower Cedar Point has a wharf and post village (**Morgantown**) on the end, is an important shipping point, and is used by the regular steamers of 10 feet draft. A channel 10 feet deep and 150 feet wide, with a turning basin 300 feet wide and 400 feet long, has been dredged

to the wharf from westward, and is marked by buoys on both sides. There is a strong cross current on both ebb and flood tide. A range for the channel is the outer end of the wharf in range with the left corner of a red barn about ¼ mile beyond. At night a lighted range on the wharf leads in the best water. A depth of 7 feet can be taken to the wharf on a course between northwest and north-northwest, passing eastward of the shoal extending southwestward from the turning basin.

Popes Creek, 3¼ miles above Lower Cedar Point, is a post village, the terminus of a railroad from Baltimore and Washington, and is connected with Colonial Beach by motor boat. The creek is not navigable, but a depth of about 4 feet can be taken to the wharf at the railroad. Gasoline and provisions are obtainable and there are telephone and telegraph connections.

Port Tobacco River, having its entrance in the northern end of the shoal bight northward of Mathias Point, has a depth of 9 feet to the entrance, 7 feet for 1¾ miles above, and 3 feet to near the head. Steamers drawing 6 feet make regular trips to **Brents Wharf** (Brentland post office) which is the principal landing. The generally used route in entering, which leads in a depth of 7 feet, is to pass ¼ mile eastward of Port Tobacco River Flats light and steer 17° true (NNE mag.) for 1¾ miles to a position ⅜ mile from the eastern shore at the entrance. Favor somewhat the eastern side at the entrance to avoid the shoal which extends nearly half way across from Windmill Point, and then follow a general mid-channel course to the head. The mean rise and fall of tides is 1.5 feet.

Mathias Point landing and post office is on the northwest side of Mathias Point ½ mile southwestward of Mathias Point lighthouse.

Nanjemoy Creek, 1½ miles westward of Upper Cedar Point lighthouse, has a depth of 7 feet in the entrance and is navigable by small vessels for about 5 miles. It has considerable trade in wood products. The best water favors the east side at the entrance, as shown on the chart. **Riverside Landing** and post office is 3 miles west-southwestward of Upper Cedar Point lighthouse. On the south side, ½ mile southwestward of Metomkin Point, is **Stewart Landing**.

Somerset Beach is a landing and excursion resort on the south side, 1 mile southeastward of Maryland Point lighthouse. It has a store and post office.

Potomac Creek, 4 miles westward of Maryland Point lighthouse, has a depth of 7 feet at the entrance and 3 feet for 2 miles above. It is used only by light-draft boats carrying wood products. The best water favors the south shore at the entrance, as shown on the chart. **Bull Bluff**, high and wooded, is on the south side, at the entrance. **Smith Landing**, 1½ miles eastward of Bull Bluff, has a depth of 7 feet at its end.

Aquia Creek, on the west side, 6 miles above Maryland Point lighthouse, has been improved by dredging a channel 6 feet deep and 100 feet wide to a railroad bridge 3½ miles above the entrance, 6 feet deep and 60 feet wide to **Coal Landing**, 5¾ miles above the entrance, and widened in the upper 500 yards to a width of 100 to 150 feet to form an anchorage basin. Small boats can go 1 mile above Coal Landing. The channel from the entrance to the **Narrows**, 1 mile above the railroad bridge, leads between broad flats on either side. Above the Narrows the creek is narrow and crooked, the best water

generally favoring the high land. The creek has considerable trade in wood products, carried in small sailing vessels and a few barges. Several beacons in a depth of 5 feet mark the channel for a distance of 1½ miles above the entrance, to Thorney Point. Above this point there are no marks, and strangers may have difficulty in keeping in the dredged channel. The outer beacon is on the end of the shoal extending ⅞ mile southward from **Brents Point**, on the north side, at the entrance. The mean rise and fall of tides is 1.6 feet.

The railroad bridge crossing Aquia Creek has a draw opening 28 feet wide, and a headroom of 19 feet at high water. The draw will be opened at all times between sunrise and sunset and between 9 p. m. and midnight on signal, unless a train is due within 15 minutes.

Dent Landing (Clifton Beach) is on Smith Point, 5½ miles above Maryland Point lighthouse. The white house on the end of the wharf is prominent.

Chopawamsic Creek, on the west side, 1 mile below Quantico, has a depth of 3 feet across the bar at the entrance and deeper water for 1½ miles above. The best water in the entrance leads northward and close westward of the island in the mouth. The creek is crossed by a railroad drawbridge having an opening 24.8 feet wide, which will be opened at all times between sunrise and sunset on signal unless a train is approaching or due within 15 minutes.

Chicomuxen Creek, on the east side, opposite Quantico Creek, has a depth of 5 feet in the entrance and to **Poseys Wharf,** but shoals up rapidly above. It is little used except by boats carrying wood products.

Quantico Creek has a depth of 7 feet in a narrow, crooked channel in the entrance, and 2 feet for about 2 miles above. It is crossed by a railroad bridge at the entrance having a draw opening 30 feet wide. The draw will be opened at all times between sunrise and sunset on signal unless a train is approaching or due within 15 minutes. **Quantico** is a village and railroad station on the south side, at the entrance. The creek is considerably used as an ice harbor by local boats, when the river above is closed.

Mattawoman Creek, on the east side of Potomac River, 3 miles below Indian Head, has a depth of 7 feet across the flats at the entrance, deeper water for 4 miles above, and 6 feet for a further distance of 2 miles. Steamers drawing 6 feet make regular trips to a landing 1¾ miles above the entrance, and tugboats tow barges loaded with coal to a wharf 4 miles above the entrance. The creek is clear in mid-channel for a distance of ¾ mile, but above this point the channel is very narrow and crooked and leads between flats on both sides. It is sometimes partially marked by bush stakes, but is difficult without local knowledge. The marsh extending southeastward from Deep Point to the edge of the channel is marked by a clump of trees at the end. The mean rise and fall of tides at the entrance is 1.6 feet.

Powells Creek, opposite Mattawoman Creek, has a depth of 3 feet to a railroad bridge at the entrance and 1 to 2 feet for a short distance above. The railroad bridge has a draw opening 30 feet wide, with a headroom of 10 feet at high water; it will be opened between sunrise and sunset within four hours after notice of desire to pass. **Cherry Hill,** a village and railroad station 1 mile southward of the entrance, has landings for small boats.

Occoquan Bay and Creek, on the west side of Potomac River, westward of Indian Head and 23 miles below Washington, is the approach to the town of **Occoquan** and the **District of Columbia workhouse,** at the head of navigation 5 miles above the entrance. It has considerable trade, carried mostly in scows and schooners. The creek has been improved by dredging a channel 6 feet deep, with a width of 150 feet to Taylors Point and 100 feet to Occoquan. The mean rise and fall of tides is 1.8 feet. The bay is used as an ice harbor by local boats, when the channel of the river is closed above.

The channel for a distance of 3 miles is marked by buoys and lights and is easily followed. The range of the light (or lighted buoy) on the west side of the entrance and Sandy Point light, bearing 346° true (N ¾ W mag.), will lead in the best water to the entrance of the dredged channel. From the upper buoy, ⅜ mile below the bridge, the best water favors the east bank to Occoquan, except in the bend ½ mile above the bridge and just below Wagner Point, where it leads close along the southwest bank.

Occoquan Creek is crossed by a fixed railroad bridge 3½ miles above the entrance, having a headroom of 66 feet at high water, and by a fixed highway bridge just above the wharves at Occoquan. There are depths of 10 to 14 feet anywhere in mid-channel off the wharves at Occoquan.

Neabsco Creek, a tributary of Occoquan Bay at its south end, has depths of 2 to 4 feet. It is crossed by a railroad bridge having a draw opening 30 feet wide.

Indian Head is a prominent, high, wooded bluff on the southeast side of the river 21 miles below Washington.

Glymont is a landing on the southeast side, 1½ miles above Indian Head. There is a light on the end of the wharf.

Craney Island, northward of Glymont, is an islet marked by a clump of trees. It is surrounded by an extensive shoal, and there is a narrow unmarked channel with a depth of 7 feet northward of it.

Pamunkey Creek, 2 miles above Glymont, is nearly bare at low water above the entrance.

Gunston Cove, on the west side, 16 miles below Washington, has a depth of 3 to 4½ feet across the bar, the deeper water favoring the southwest side. Above the bar there is a depth of 6 feet, except near the shores, to the junction of **Accotink** and **Pohick Bays,** and 2 to 4 feet in both bays for about ½ mile. **Gunston** is a landing (4 feet at low water) and post office on the southwest side a little above the entrance.

Dogue Creek, on the west side of Potomac River, opposite Marshall Hall, has depths of 2½ to 5 feet, but is covered with grass and little used. White Stone Point light is off the mouth.

Marshall Hall, on the east side, 14 miles below Washington, is an excursion resort. The wharf has a depth of 10 feet.

Mount Vernon, the home of Washington, is on the west side, 13 miles below Washington, with which it is connected by steamer and electric railway. A channel 10 feet deep has been dredged across the flats to the wharf, but considerable shoaling has occurred. The wharf is not open to the public.

Bryan Point is marked by a white house and windmill, and has a wharf with a depth of 13 feet at which steamers from Washington stop.

Little Hunting Creek, opposite Bryan Point, has a depth of about 5 feet in a narrow dredged channel leading to a brickyard 1¼ miles above the entrance. The channel is sometimes marked by bush stakes, but is difficult without local knowledge. A bridge having a draw opening 27 feet wide crosses the creek just below the brickyard.

Piscataway Creek, on the east side, 11 miles below Washington, has depths of 2 to 4 feet but is covered with grass in summer and little used. Considerable sand dredging is done in the creek.

Sheridan Point has the ruins of a long wharf, marked by a light on the end extending to the edge of the channel.

Fort Washington has a wharf with a lighthouse (white tower) on the end.

Opposite Fort Washington, a channel 12 feet deep and 100 feet wide was dredged in 1909 to a wharf on the west bank; the channel is marked by a light on the north side at the entrance and a light on the end of the wharf.

River View is an excursion resort on the east side, ¾ mile above Fort Washington.

Broad Creek, on the east side, 8 miles below Washington, has depths of 2 to 4 feet. There are landings for boats on the south side near the entrance, but the creek is covered with grass in summer and is little used.

Rosier Bluff is a prominent wooded bluff on the east side, 2 miles below Alexandria. **Fort Foot Wharf** is at the southern end and is marked by a light, and **Notley Hall** is an excursion resort at the northern end. The latter is reached by a dredged channel 6 feet deep, which has a row of piles along its south side.

Hunting Creek, on the south side of Alexandria, has depths of 1½ to 4 feet, but is covered with grass in summer and little used. It is crossed by two bridges. The lower bridge has a center pier draw, each opening 40 feet wide, and the upper bridge is fixed, but motor boats without houses can pass under it.

Alexandria has considerable trade, mostly in river and bay vessels and a few coasting vessels, the deepest draft being 18 feet. The area in front of the wharves has been dredged to a depth of 24 feet. Coal and water are obtainable, and there is a shipyard and a railway capable of hauling out vessels of 200 feet length, 11 feet draft forward and 15 feet aft.

Oxon Creek, eastward of the northern end of Alexandria, has depths of 1 to 3 feet, but is little used except by sand dredgers. Channels have been dredged by them across the flats; these are generally marked by bush stakes, and the channels are well indicated at low water by the grass.

Washington Harbor consists of three parts—Washington Channel, Virginia Channel, and Anacostia River.

Washington Channel leads between the sea wall of Potomac Park and the wharves of the city. It has been dredged to a depth of 20 feet over nearly the entire area and 24 feet along the eastern side to the head. The principal wharves of the city are on the eastern side of the upper part of the channel.

Virginia Channel, the main channel of Potomac River, leads to the wharves at Georgetown (West Washington), 4 miles above the junction with the Washington Channel. The channel has been improved

by dredging to a depth of 21 feet and width of 400 feet, and is marked by buoys. The depth in the channel is liable to some change on account of freshets.

Virginia Channel is crossed by two **bridges** below Georgetown. The lower, a railroad bridge, has a center pier draw, each opening 105 feet wide, with a headroom of 18 feet at high water when closed. The second, a highway and street railway bridge, has a center pier draw, each opening 100 feet wide, with a headroom of 18 feet at high water when closed. The Aqueduct Bridge, crossing the river at Georgetown, is fixed and has a headroom of 27 feet at high water. Small unmasted vessels can go about 3 miles above.

Regulations prescribed for the two drawbridges crossing Virginia Channel require that the draws shall be opened on a signal of three blasts, sounded when a vessel is not more than five minutes distant from the bridge, at any time of day or night, except between 8.20 and 8.50 a. m., except when there is a train actually on the railroad bridge block, or a mail train is in motion toward the railroad bridge in sight of the tender or operator of the bridge, or a train on the highway bridge is approaching the draw span and within four spans thereof.

In case the draws can not be opened immediately, the fact shall be signaled from the bridges by the display of two red lights in a vertical line by night, or by the waving of a red flag or by four short blasts of a steam whistle by day.

All vessels propelled by machinery, regularly plying the Potomac River where spanned by the bridges, whose pilot or deck houses will pass under the bridges with a headroom of at least 3 feet at high water, are required to have their smokestacks or other vertical projections hinged so that they can pass underneath the bridges without their being opened.

Anacostia River has been improved by dredging a channel 20 feet deep and 400 feet wide to the United States Naval Gun Factory at Washington, 1½ miles above the mouth, and is marked by buoys and easily followed to this point. It has a depth of 14 feet in a narrow unmarked channel to the Pennsylvania Avenue Bridge, 2¼ miles above the entrance, and is navigable for small boats and lighters to Bladensburg, Md., 7¾ miles above the entrance. It is crossed by several bridges between the naval gun factory and Bladensburg; Anacostia Bridge, just above the naval gun factory, has a draw opening 100 feet wide and a headroom of 21 feet at high water; Pennsylvania Avenue Bridge, ¾ mile above, is fixed and has a headroom of 28 feet at high water; the bridges above are fixed and have a least headroom of about 6½ feet at high water.

Anchorage.—Vessels bound up or down the Potomac River anchor anywhere in the channel where the bottom is soft. St. Marys River is the best anchorage for vessels in the lower end, though deep draft vessels sometimes anchor for the night in Cornfield Harbor. Small craft can find secure anchorage in any of the tributaries near the lower end. There is no anchorage above Alexandria for vessels of any size, except off Georgetown below Aqueduct Bridge. Vessels usually go to the wharves. Motor boats anchor in the north end of Washington Channel, westward of the anchorage buoys.

Harbor Regulations.—Every vessel coming to anchor in the Potomac River between the junction of the Washington and Georgetown Channels of said river and the extension of the south line of P Street SW, in the city of Washington, shall anchor as near the flats in said river as possible, so that the channel of said river will not be obstructed; and if such vessel is to remain over 12 hours it shall be moored with both anchors, so as to give room for passing vessels and so as not to swing and obstruct said channel. Every vessel coming to anchor in any other portion of the navigable waters in the District of Columbia shall also be so moored under the direction of the harbor master, or the pilot of the police boat acting in the harbor master's absence, as not to obstruct the channel, and be secured with an anchor at bow and stern so as to keep the long axis of the vessel parallel with that of the channel and prevent it from swinging so as to obstruct the free passage of the channel by other vessels.

No vessel shall be permitted to anchor in the Washington Channel of the Potomac River between a point 1,000 feet south of the south line of P Street and the north line of K Street south extended, each point to be designated by a white buoy; and all vessels coming to anchor above the north line of K Street south aforesaid shall come to anchor as near the flats as possible and so that the channel will not be obstructed; and all vessels coming to anchor shall be so moored by the use of both anchors as to prevent obstruction of the channel within 400 feet of the nearest wharf, the said anchorage to continue only 24 hours unless otherwise ordered or directed by the harbor master.

Pilots.—Pilotage is not compulsory for vessels bound up the Potomac. If a towboat is taken a pilot is not needed, as the captain of the tug is a licensed pilot. Vessels taking a Maryland pilot in the entrance of Chesapeake Bay are usually turned over to a river pilot at the mouth of the river; the pilotage rate is the same as for the port of Baltimore.

For **quarantine** regulations, see page 121.

Freshets.—Freshets occur at irregular intervals, but as a rule do not interfere with the navigation of the river below Alexandria unless accompanied by floating ice. At Washington, during the highest freshet recorded, the river rose 13.26 feet at the foot of Seventeenth Street, and the deposit in the dredged channels decreased the depth from 20 feet to 14 feet in some places.

Ice.—During severe winters the tributaries of the Potomac are closed by ice, and the river is frozen over to Cedar Point; the upper part of the river is then closed to navigation. During ordinary winters the towboats and steamers plying on the river keep a channel open, but sailing vessels usually require the assistance of steam when bound to Alexandria or Washington.

Tides.—The mean rise and fall of tides is 1.5 feet at Point Lookout, 1.8 feet at Yeocomico River entrance, 2.2 feet at Blackistone Island, 1.6 feet at Lower Cedar Point, 1.3 feet at Maryland Point, 2 feet at Indian Head, and 3.3 feet at Washington.

Currents.—The velocity of the tidal currents in the Potomac River is variable and is influenced by the force and direction of the wind; the set is generally in the direction of the channel. During freshets there is little or no flood current. In the center of the channel off

Alexandria slack water before the flood occurs 55 minutes after time of low water at Washington, and slack water before the ebb occurs at the time of high water at Washington. These times are influenced by the force and direction of the wind and the freshet conditions, and may at times vary considerably.

DIRECTIONS, POTOMAC RIVER.

With the aid of the charts the following directions are good by day for vessels of 18 feet or less draft, except as stated in the description of Kettle Bottom Shoals. The channel is broad and unobstructed for a distance of 27 miles above Point Lookout to abreast Wicomico River, but above this point the aids are not sufficient to make the navigation of the river safe for strangers at night. Strangers of over 18 feet draft should take a pilot.

In many places above Indian Head the shoals are clearly defined at low water by the grass growing on them or by the color of the water. Above Sheridan Point the channel is narrow and shoals abruptly on both sides. The buoys are reliable guides to keep in the channel and are placed to mark the best water.

1. **Entering from southward.**—From a position 1¼ miles northeastward of Smith Point lighthouse steer 307° true (NW ⅛ W mag.) for 22¼ miles, passing 2⅜ miles southwestward of Point Lookout lighthouse, 1 mile northeastward of Coan River gas and bell buoy, 1 mile southwestward of St. George Island, and to a position 1 mile southwestward of Piney Point lighthouse. Then follow the directions in section 2. The northern limit of fish traps on the south side of the river is a line drawn from the black buoy 1½ miles north-northwestward of Smith Point lighthouse, through Coan River gas and bell buoy, and is marked by a line of black and white buoys.

1 A. **Entering from northward.**—The easterly limit of fish traps extends 180° true (S ½ W mag.) from Point No Point lighthouse to a black and white horizontally striped buoy 1½ miles 90° true (E ½ S mag.) from Point Lookout lighthouse, and then extends 240° true (SW by W ⅞ W mag.) to the red buoy lying ⅞ mile southward of the latter lighthouse; vessels should keep eastward and southward of these limits.

From a position 1½ miles southward of Point Lookout lighthouse steer 302° true (NW ⅝ W mag.) for 12¼ miles to a position 1 mile southwestward of Piney Point lighthouse.

2. **Piney Point to Blackistone Island.**—From a position 1 mile southwestward of Piney Point lighthouse steer 317° true (NW ¾ N mag.) for 3½ miles; Ragged Point lighthouse should then bear 208° true (SW by S mag.) distant ¾ mile. Then steer 284° true (WNW ¼ W mag.) for nearly 8 miles to a position ¾ mile southwestward of Blackistone Island lighthouse.

3. **Blackistone Island to Lower Cedar Point.**—**Kettle Bottom Shoals** consist generally of small lumps of hardpan, with deep water close-to, and the lead will not serve as a guide to avoid them; there is often a pocket of slightly deeper water around the lump than is found near by. The area has been closely surveyed, but there are probably lumps which were not found with the lead. They occupy a stretch of the river about 8 miles long, as marked by the buoys, above Wicomico River. The generally used channel follows the perpendicularly

striped buoys near mid-river. There is a general depth of 22 feet in the channel by avoiding the lumps, but this requires the best local knowledge. There are lumps with 14 to 17 feet near the sailing line, and strangers should not depend on carrying more than the latter depth under the most favorable conditions of daylight and a slow speed. A narrow channel with a depth of 23 to 24 feet leads along the north bank passing Kettle Bottom Shoals. The channel is marked by range lights and buoys, but is little used.

Straight channel over Kettle Bottom Shoals.—From a position ¾ mile southwestward of Blackistone Island lighthouse steer 292° true (NW by W ½ W mag.) for 3¼ miles to Kettle Bottom Shoals lower gas buoy, and then steer 286° true (WNW mag.) for 1 mile to a bell buoy. Then steer 296° true (NW by W ⅛ W mag.) for 4¼ miles, passing close to the buoys, to the fourth one, lettered "D," and then steer 306° true (NW ¼ W mag.) for 2¾ miles, passing close to the buoys, to Kettle Bottom Shoals upper gas and bell buoys.

From Kettle Bottom Shoals upper gas and bell buoys steer 333° true (N by W ⅞ W mag.) for 2⅛ miles to a position 350 yards eastward of buoy No. 13, and then steer 357° true (N ¼ E mag.) for 1 mile to a position ¼ mile westward of Lower Cedar Point beacon light; the elbow of the shoal marked by this light lies ¼ mile north-northwestward of the light and is marked by a red buoy. From the light steer 3° true (N ¾ E mag.), passing westward of the buoy, to a position ¼ mile eastward of Cedar Point lighthouse, then follow the directions in section 4.

North channel over Kettle Bottom Shoals.—From a position ¾ mile southwestward of Blackistone Island lighthouse steer 297° true (NW by W ⅛ W mag.) for 4½ miles, passing ¼ mile northeastward of Kettle Bottom Shoals lower gas buoy and ⅞ mile southwestward of Cobb Point Bar lighthouse. Then steer 319° true (NW ⅞ N mag.) on the line of the lights of the lower range ahead, and leave buoys Nos. 8, 10, and 12 about 100 yards on the starboard hand.

Then steer 299° true (NW ⅞ W mag.) on the line of the lights of the middle range astern (the rear light of this range is Cobb Point Bar lighthouse) until up with buoy No. 14. Leave this buoy about 35 yards on the starboard hand, steer 270° true (W ½ N mag.) on the line of the lights of the upper range astern, and follow the buoys; the end of Bluff Point will be nearly ahead. Continue the course until on the line of the mid-channel buoys, and then steer 306° true (NW ¼ W mag.) for ⅝ mile to Kettle Bottom Shoals upper gas and bell buoys. Then follow the directions in the preceding paragraph.

4. **Lower Cedar Point to Maryland Point.**—Passing ¼ mile eastward of Lower Cedar Point lighthouse steer 350° true (N ⅜ W mag.) for 3 miles, passing ¼ mile eastward of Persimmon Point Shoal light and continuing the course for 1⅛ miles past it. Then steer 305° true (NW ⅜ W mag.), heading for Port Tobacco River Flats light until ¼ mile from it, then steer 254° true (W ⅞ S mag.) for 5 miles with Riverside Wharf a very little on the starboard bow.

On this course leave Mathias Point Shoal lighthouse 350 yards on the port hand, Upper Cedar Point lighthouse 400 yards on the starboard hand, and buoy No. 21 about 500 yards on the port hand; and when 1 mile past this buoy and ½ mile from Riverside Landing, steer 229° true (SW ⅞ W mag.) with Maryland Point lighthouse a

little on the starboard bow for 2¾ miles, leaving Metomkin Point Middle Ground light 500 yards on the port hand, buoy No. 28, 400 yards on the starboard hand, and buoy No. 23 about 300 yards on the port hand. From the latter buoy steer 253° true (W by S mag.) to a position 350 yards northward of Maryland Point lighthouse.

5. **Maryland Point to Indian Head.**—Passing 350 yards northward of Maryland Point lighthouse, steer 274° true (W ⅞ N mag.) to a position about 200 yards northward of buoy No. 25, and then steer 287° true (WNW mag.) with the lighthouse astern to the entrance of the dredged cut, which is 200 feet wide. Steer 303° true (NW ½ W mag.) through the dredged cut, to the red gas buoy at the bend, then steer 332° true (NNW mag.) for 1⅝ miles to the lower end of the second dredged cut, then 338° true (N by W ½ W mag.) to the red gas buoy at the upper end, being guided by the buoys.

Then steer 354° true (N mag.) for 5½ miles, being guided by the buoys, to the black buoy 1 mile above Sandy Point. This course leads through the dredged channel off Wades Bay, which is 200 feet wide. From the black buoy 1 mile above Sandy Point steer 12° true (N by E ⅝ E mag.) for Possum Nose (wooded bluff) for 2⅛ miles to a position ¼ mile west-northwestward of a red gas buoy.

Then steer 44° true (NE ⅜ E mag.) for 2¼ miles to the lower end of the dredged cut through Mattawoman Shoals. Steer 38° true (NE ⅛ N mag.) through the cut, being guided by the buoys. From the upper end steer 53° true (NE by E ¼ E mag.) for Hallowing Point to a position 300 yards north-northwestward of the red buoy off Indian Head.

6. **Indian Head to Alexandria.**—From a position 300 yards north-northwestward of the red buoy off Indian Head, steer 84° true (E mag.) for the wharf at Glymont until ¼ mile from it; pass 200 yards off the wharf and steer 39° true (NE mag.) to a position 150 yards westward of the red buoy off Pamunkey Creek. Then steer 347° true (N ⅝ W mag.), passing 150 yards eastward of the black buoy ⅞ mile above Hallowing Point and continuing the course for ⅜ mile past the buoy, then steer 356° true (N ⅛ E mag.) to a position 150 yards westward of the red gas buoy southward of White Stone Point.

Follow the west bank above White Stone Point at a distance of 200 to 250 yards to White Stone Point light, pass 300 yards southward of it and bring it astern on a 74° true (E ⅞ N mag.) course for 2¼ miles to the black buoy off Bryan Point. This course leads through the dredged channel off Marshall Hall which is 200 feet wide. Pass 150 yards southward of the black buoy off Bryan Point and steer 68° true (ENE ⅝ E mag.) to a position 100 yards off the long wharf at Sheridan Point, then steer 50° true (NE by E mag.) for Fort Washington lighthouse. Pass 100 yards off the wharf and bring the lighthouse astern on a 14° true (N by E ¾ E mag.) course to River View.

Pass 200 yards off the wharf at River View and steer 350° true (N ⅜ W mag.) to a position 125 yards westward of the red buoy 1 mile above, then steer 8° true (N by E ¼ E mag.) to the wharf just below Rosier Bluff, heading just clear of the end of the bluff and being guided by the buoys. Pass 100 yards off the wharf and steer 348° true (N ½ W mag.) for 1¼ miles to a position 300 yards eastward of Jones Point lighthouse and westward of a red buoy, then

steer northward, midway between the wharves at Alexandria and the buoys along the eastern side of the channel. Anchorage can be had in the channel between the wharves and the buoys.

7. **Alexandria to Washington.**—Pass 250 yards westward of the end of the abandoned railroad wharf at Marbury Point and steer 15° true (N by E 7/8 E mag.), heading for a prominent building on the south end of the point between Washington Channel and Anacostia River, and following the buoyed channel to abreast the mouth of Anacostia River. The channel is 350 yards wide abreast the railroad wharf and 150 yards wide abreast the steel plant. Above the intersection of Anacostia River and Washington Channel the chart is the guide. Small vessels and motor boats can anchor in the Washington Channel westward of the line of white buoys abreast the wharves of the city. (See "Anchorages" preceding.)

ST. JEROME CREEK

is on the western side of Chesapeake Bay 5 miles north of Point Lookout, and 2½ miles 253° true (W by S mag.) from Point No Point lighthouse. It is shoal and of little importance; some oysters, wood, and farm products are shipped in light-draft vessels, but it is principally used as an anchorage for small craft engaged in oystering and fishing. The channel formerly dredged along the north side is entirely closed, but in 1914 there was a channel with a depth of 3 feet close along the southern shore. The channel is subject to change and is unmarked. There is a store at the landing on Otter Point, just inside the entrance. The general depths in the creek are 4 to 7 feet as shown on the chart. The entrance to the south branch of the creek between Otter Point and Deep Point is nearly bare at low water, and this shoal extends northward of the line joining the points.

PATUXENT RIVER,

on the western side of Chesapeake Bay 87 miles above the entrance and 64 miles below Baltimore, has a depth of 30 feet into the entrance and 23 feet to Benedict, 12 feet to Lower Marlboro, 9 feet to Lyons Creek Wharf, and 7 feet to Bristol Landing, at distances of 18½, 28, 36, and 40 miles, respectively, above Drum Point at the entrance. The mouth of the river forms a secure anchorage for vessels of any draft and is extensively used. Steamers from Baltimore of 8 to 9 feet draft make regular trips to all of the principal wharves as far as Lyons Creek Wharf. The river and its tributaries are also frequented by schooners and a few barges carrying wood products, and in the lower end by vessels engaged in the oystering and fishing industry.

Mill Creek, on the north side 1½ miles westward of Drum Point, has several fish factories and is the center of a large oystering and fishing industry. It has a depth of 22 feet to the entrance, and 12 feet for 1¼ miles above in the main branch and ¾ mile above in the western branch (**Back Creek**).

Solomons Island, on the southwest side of Mill Creek, is the site of a village (Solomons post office) composed mostly of oystermen and fishermen. The cove northward of the island has depths of 10 to 20 feet, and is extensively used as an anchorage. There are several

shipyards and marine railways, the largest capable of hauling out vessels of 200 tons, 125 feet length, and 10 feet draft.

The **approach to Mill Creek** is marked by beacons and buoys. The deepest draft can be taken to the entrance by heading for the fish factories on the eastern side on a 330° true (NNW ⅛ W mag.) course, passing eastward of the two beacons and entering the creek in mid-channel. A draft of 12 feet or more can be taken to the entrance from eastward by following the north shore at a distance of 200 yards, passing northward of a middle ground marked by buoys and covered with oyster stakes. Anchorage can be selected in a depth of 10 to 17 feet, anywhere southward or northeastward of a wooded islet inside the entrance, by giving the islet a berth of 200 yards. Solomons Island is connected with the mainland by a low fixed bridge which prevents navigation around the western end.

Pearsons Landing and post office and **Millstone Landing** are two steamer landings about 2 miles southeastward of Solomons Island.

Town Point is low and bare and has a steamboat landing (Spencers Wharf) and several buildings on the north side.

Mill Creek and **Cuckold Creek** have a common entrance with a depth of 15 feet, 1 mile northwestward of Point Patience. Cuckold Creek has a depth of 12 feet for ¾ mile and 8 feet for a further distance of ¾ mile, and Mill Creek has a depth of 12 feet for ¾ mile and 8 feet for a further distance of ¼ mile. The deepest draft entering are schooners drawing 10 feet. A black buoy on the end of the shoal on the north side at the entrance is the only mark. In approaching the entrance, pass 400 yards southward of the buoy and 600 yards northward of the point south-southwestward of it. The mid-channel is clear above the entrance.

St. Cuthbert Wharf is on the west side 2 miles above Point Patience. Directly opposite on the east side is **Hellens Creek,** which has a depth of 3 feet across the bar at the entrance and 10 feet inside for ¾ mile. It is principally used as a harbor for small boats. The best water favors the eastern side in entering.

St. Leonards Creek, on the northeast side 7½ miles above Drum Point, has a depth of 16 feet into the entrance and 10 feet for 2½ miles above. Steamers from Baltimore make regular landings at two wharves just inside the creek, and schooners load to a depth of 10 feet for a distance of 3 miles above the entrance. The lower end of the creek forms a safe anchorage in any weather in depths of 16 to 23 feet. **Petersons Point light** is the principal guide to the entrance. In entering pass 350 yards eastward of the light and follow a mid-channel course through the mouth. The mid-channel is clear for 2½ miles above.

Sotterley Wharf is on the southwest side of the river westward of the entrance to St. Leonards Creek.

Broome Island is a low bare point marked by Broome Island light. Broomes Island post office is a small village northward of the point. **Island Creek,** on the east side of Broome Island, has a depth of 10 feet for ¾ mile above the entrance, but there are unmarked shoals close to the channel. It is little used except by small local craft.

Jones Wharf is on the south side of the river ⅞ mile west-southwestward of Broome Island light, and **Parkers Wharf** is on the north side 1½ miles north-northwestward of Broome Island light. The

best water in approaching Parkers Wharf is from south-southeastward, the approach being marked by two beacons. Give the western side of Broome Island a berth of 3/8 mile and leave the outer beacon 100 yards on the port hand, the inner beacon the same distance on the starboard hand, then head for the wharf.

Forrest Wharf (Sandgates post office) is on the southwest side of the river 2 5/8 miles above Broome Island light.

Battle Creek, on the north side northward of Forrest Wharf, has a depth of 10 feet for 2 miles above the entrance, and is navigable for small boats for a further distance of about 2 miles. The deepest draft entering are schooners drawing 10 feet. The entrance should be approached on a northeasterly course to avoid unmarked shoal spots on either side. The ruins of a wharf and freight house are on the eastern side at the entrance.

Dukes Wharf is on the south side of **Sheridan Point** 6 miles above Broome Island light. Directly opposite on the southwest side are **Washington** and **Persimmon Creeks**, both shoal and little used.

Trent Hall Wharf is on the southwest side 2 1/4 miles below Benedict. **Trent Hall Creek** and **Indian Creek**, on the west side just below Benedict, have depths of 5 feet in the entrances and 3 feet to near the heads.

Benedict is a village on the western side of Patuxent River 18 1/2 miles above the entrance. A cannery with twin stacks and a church spire are prominent. Schooners of 10 to 17 feet draft sometimes ascend the river to this point. The wharf has a depth of 9 feet at the end; there is a shoal southward of it which can be avoided by approaching the wharf on a northwesterly or westerly course.

Holland Point is a steamer landing directly opposite Benedict.

There are numerous landings on both sides of Patuxent River between Benedict and the head, but the only villages are **Lower Marlboro** on the east side and **Nottingham** on the west side, distant 10 and 15 miles, respectively, above Benedict.

Swanson Creek, on the west side 1 1/2 miles above Benedict, has depths of 2 to 4 feet and is little used.

Hunting Creek, just above on the east side, has a depth of 3 feet across the flats at the entrance and for a distance of 3 miles above. It is frequented by motor boats and lighters.

A railroad bridge having a draw opening 72 feet wide crosses the river 1 mile below Bristol Landing.

Western Branch, entering the river just above the bridge, is not navigable except for a short distance above the mouth.

Upper Marlboro is a village on the railroad, 1 3/4 miles westward of the fixed bridge at the head of navigation on Patuxent River.

Anchorage.—Deep-draft vessels frequently anchor in the mouth of the river for the night. Shelter from westerly winds is found in 3 1/2 to 4 fathoms, from 2 1/4 to 3 1/2 miles southward of Cove Point lighthouse and quite close in to the shore. If seeking shelter from easterly winds, stand into the entrance and anchor in 5 to 10 fathoms in the channel about 1 1/2 miles above Drum Point lighthouse. Good anchorage for light-draft vessels is found close in to the north bank westward of Drum Point lighthouse, taking care not to get aground on the oyster bank, which is marked by buoys. Small local vessels up to 10 feet draft anchor in Mill Creek in the cove behind Solomons

Island, but there is little room to swing at this anchorage. St. Leonards Creek is a safe anchorage for small vessels in any weather. The bottom in the channel as far as Benedict is generally soft and vessels can anchor where convenient.

Supplies.—Gasoline and provisions are obtainable at Solomons, Benedict, and Lower Marlboro, and provisions at Nottingham. There is artesian water near the wharves at Solomons and Benedict. Coal in limited quantities can sometimes be obtained from the fish factories or canneries.

Repairs to hulls of small vessels and minor repairs to machinery can be made at Solomons, but Baltimore is the nearest place for extensive repairs to hulls or machinery.

Pilots can be obtained at Solomons or Benedict. If the directions are closely followed, a pilot is not required below Benedict, but strangers, unless in small boats, should not go above that place without one.

Ice closes the river to near the mouth in severe winters.

Tides.—The mean rise and fall of tides is 1.2 feet at the entrance, 1.6 feet at Benedict, and 2.5 feet at Nottingham.

DIRECTIONS, PATUXENT RIVER.

The entrance is easy of access either day or night for vessels of 24 feet draft without a pilot, and vessels of 28 feet draft can enter by following the directions closely. The channel between the entrance and Benedict is narrow in places but is comparatively straight except off Point Patience, and the most prominent shoals are marked by buoys and lights. Strangers should have little trouble in taking a draft of 15 feet to Sheridan Point and 12 feet to Benedict in the day time with the aid of the chart. Above Benedict the channel is narrow in places and obstructed by shoals and is not sufficiently well marked to be followed by strangers except in small boats.

The most prominent landmark in approaching Patuxent River from southward is **Cedar Point lighthouse** (white tower on red brick dwelling), on the end of a low bare point, and from northward is **Cove Point lighthouse** (white tower) and the high bluffs at Little Cove Point, 1½ miles southward. In the entrance the most prominent marks are **Drum Point lighthouse** (white house on piles) and the fish factories and other buildings at Solomons Island.

To an anchorage inside the entrance.—To enter **from southward**, pass ¾ mile eastward of Cedar Point lighthouse and steer north-northwestward for 1½ miles until Drum Point lighthouse bears 264° true (W mag.); then steer for it on this bearing, passing ⅛ mile or more northward of the black buoy northward of Hog Point. Or **from northward**, pass about 1 mile eastward of Cove Point lighthouse and steer 174° true (S mag.) for 3¾ miles, passing eastward of Little Cove Point shoal buoy; when Drum Point lighthouse bears 264° true (W mag.), steer for it on this bearing. Pass 200 yards or more southward of Drum Point lighthouse and anchor at discretion inside the lighthouse. (See "Anchorages" preceding.) At night red sectors in Drum Point lighthouse cover the shoals of less depth than 18 feet in the approach to the river and on the north and east sides of the anchorage inside the lighthouse.

Drum Point lighthouse to Sotterley Point.—From a position ¼ mile southward of Drum Point lighthouse steer 256° true (W ¾ S mag.) to a position ¼ mile southward of Sandy Point shoal buoy. Round the buoy at this distance and steer 325° true (NNW ½ W mag.) to Town Point. Give Town Point a berth of 400 yards and steer 285° true (WNW ⅛ W mag.) to Point Patience, giving the light on the end a berth of about 200 yards. Then steer 5° true (N by E mag.) to the black buoy ¾ mile above, leaving it 300 yards on the port hand. From this steer 337° true (N by W ½ W mag.) for 1⅛ miles, leaving a red buoy well on the starboard hand and St. Cuthbert Wharf ¼ mile on the port hand. Then steer 316° true (NW ⅝ N mag.) for a little over 2 miles to a position ¼ mile northeastward of Sotterley Point Flats buoy.

Sotterley Point to Benedict.—From a position ¼ mile northeastward of Sotterley Point Flats buoy steer 295° true (NW by W ¼ W mag.) for 1½ miles to Broome Island light. Leave it 250 yards on the starboard hand and steer 305° true (NW ⅜ W mag.) for 3¼ miles to a position ¼ mile southwestward of Battle Creek Shoal light. Then steer 324° true (NNW ⅝ W mag.) for 2¾ miles to Sheridan Point, leaving a red buoy about 200 yards on the starboard hand, a black buoy about 200 yards on the port hand, and Sheridan Point about 200 yards on the starboard hand. Then steer 332° true (NNW mag.) for the twin stacks of a cannery at Benedict. This course leads close to shoals on either side, and strangers should proceed with caution. When up with Benedict light pass westward of it and anchor in the channel between the light and the black buoy off Town Point.

Benedict to the head.—The most difficult part of the channel between Benedict and Lyons Creek wharf is across the broad part of the river 1 mile below Nottingham, where there is a depth of 9 feet in a very narrow channel marked by beacons and a buoy. The best water follows a general mid-channel course across this reach. Above this point there is a depth of 15 feet, and the mid-channel is clear to Lyons Creek wharf.

There is a depth of about 7 feet from Lyons Creek Wharf to **Bristol Landing** (Leon post office), and small boats can go 1¼ miles above to a fixed highway bridge. Some local knowledge is required to keep in the best water above Lyons Creek wharf.

PATUXENT RIVER TO SEVERN RIVER.

The western side of Chesapeake Bay for a distance of 23 miles northward from Cove Point is unbroken by tributaries, and is generally high and wooded. The 5-fathom curve is nowhere more than 1⅝ miles from shore. The outer limit of possible fish traps is marked by a line of black and white buoys.

Governors Run, Dare, and Plum Point Landing are steamer landings 9, 13, and 15 miles, respectively, above Cove Point lighthouse.

Chesapeake Beach is a summer resort 20½ miles above Cove Point. A stack and water tank showing above the trees, and several buildings showing against the trees, are prominent. A long wharf extends to a depth of 11 feet. Gasoline and provisions are obtainable, and there is railroad communication with Washington.

Herring Bay, westward of Poplar Island and 8 miles 232° true (SW by W ¼ W mag.) from Bloody Point Bar lighthouse, is exten-

sively used as an anchorage. A shoal having depths of 2 to 4 feet extends from the north side south-southwestward nearly across the bay, and is marked at its south end by **Parkers Island Shoal light.** There is a depth of 12 feet around the south end. There is good anchorage in westerly weather eastward of the shoal in depths of 15 to 20 feet. Small vessels usually anchor westward of the shoal, where there are depths of 7 to 12 feet, protected against easterly winds to a considerable extent by the shoal outside. Small boats find shelter in **Rockhole Creek** at the northwest end, which has a depth of 2½ feet at the entrance and 3½ feet inside to a highway bridge 1 mile above. Gasoline and provisions are obtainable in the creek. **Fairhaven** is a post office and steamer landing on the west side of Herring Bay. The mean rise and fall of tides is 0.9 foot.

To enter Herring Bay, pass northward of Holland Point Bar buoy and head for Parkers Island Shoal light on a 245° true (WSW ⅜ W mag.) course. Pass 200 yards southward and westward of the light and head for the end of Fairhaven wharf on a north-northwesterly course. Anchorage can be had 100 to 500 yards eastward of the wharf in depths of 10 to 11 feet.

West River, 31 miles below Baltimore and 3 miles southwestward of Thomas Point Shoal lighthouse, has a depth of 15 feet in the entrance, gradually decreasing to 7 feet 4½ miles above. Shoals extend nearly to mid-channel off many of the points. Those near the entrance are marked by buoys, and those above the entrance are sometimes marked by bush stakes. Steamers from Baltimore and Annapolis of 6 feet draft make regular trips to **Galesville (Galloway post office)** and several other wharves in the river. Gasoline and provisions are obtainable at Galesville, and there is a railway for hauling out small motor boats.

Directions, West River.—To enter from southward, bring Bloody Point Bar lighthouse astern on a 307° true (NW ⅛ W mag.) course until Thomas Point Shoal lighthouse bears 11° true (N by E ⅝ E mag.), then steer 284° true (WNW ⅛ W mag.) to Curtis Point Shoal bell buoy, and pass northward and 400 yards westward of it. Or from northward, pass eastward and southward of Thomas Point Shoal lighthouse and bring it astern on a 234° true (SW by W ⅜ W mag.) course, passing 500 yards westward of Curtis Point Shoal bell buoy. From here head southwestward, passing 100 yards southeastward of buoy No. 2, then steer 255° true (W ¾ S mag.) for 2 miles, and then be guided by the chart and the bush stakes.

Rhode River, on the north side of West River, has a depth of 10 feet for 1¾ miles above the entrance. Passenger steamers make landings at three wharves. There is a railway on the creek capable of hauling out boats of 4 feet draft and 40 feet length. **Cadle Creek,** on the north side, has a depth of 4 feet to the post village of **Mayo** near the head, where gasoline and provisions are obtainable. A shoal extends 400 yards southwestward from **Dutchman Point,** on the northeast side at the entrance to Rhode River, and vessels should favor the southwest side in entering. Above the entrance the mid-channel is clear if the points be given a good berth.

South River, just westward of Thomas Point Shoal lighthouse, has a narrow channel with a depth of 15 feet for 7 miles above the

entrance and 9 to 12 feet into the tributaries. The principal shoals for a distance of 4 miles above the entrance are marked by buoys. A highway drawbridge crosses the river 6 miles above the entrance. Between the hours of one hour before sunrise and one hour after sunset the draw will be opened on signal, if no person or vehicle is then in the way, for all vessels whose masts permanently remain standing or which have masts that may be unstepped, but which are 20 feet or more in height and 5 inches or more in diameter. The signal is three blasts of a whistle or horn, to be answered from the bridge by three blasts if the bridge can be opened immediately, or one blast if the bridge can not be opened immediately.

Edgewater and **Riverview** are post villages near the bridge. Steamers from Baltimore of 6 to 8 feet draft make regular trips to the principal landings in the river, and these are the deepest draft entering. Gasoline and provisions are obtainable near the head.

Directions, South River.—From southward, a 315° true (NW ⅝ N mag.) course with Bloody Point Bar lighthouse astern will lead to buoy No. 4. Or from northward, pass ½ mile southeastward of Thomas Point Shoal lighthouse, and when 300 yards southward of Thomas Point Shoal buoy steer 271° true (W ⅝ N mag.). Pass 300 yards southward of buoy No. 2 and then steer 306° true (NW ¼ W mag.) to buoy No. 4. Pass westward of buoy No. 4 and northeastward of buoy No. 1, then steer northwestward, being guided by the chart, and give the points a berth of at least 400 yards.

Thomas Point Shoal extends 1¼ miles southeastward from the point, and is marked by **Thomas Point Shoal lighthouse** (white house on piles) and a black buoy.

SEVERN RIVER AND ANNAPOLIS HARBOR.

Severn River, on the west side of Chesapeake Bay 124 miles above the entrance and 26 miles below Baltimore, is the approach to Annapolis, the capital of Maryland and the site of the United States Naval Academy. The cove at the entrance to the river, known as **Annapolis Roads,** has depths of 18 to 45 feet and is extensively used as an anchorage. The river is frequented by many small local craft and by small naval vessels as far as Annapolis, the deepest draft being 16 feet and usual draft not exceeding 12 feet. There is little business by water above Annapolis except in small boats seldom exceeding 6 feet in draft.

A channel 30 feet deep and 180 feet wide has been dredged to the Naval Academy at Annapolis, and had a depth of about 27 feet in 1915. The dredged channel is marked by nun buoys on the northeast side and can buoys on the southwest side, and the 18-foot curve on the southwest side is marked by spar buoys as far as Annapolis. The river has a natural channel with a depth of 18 feet for 7 miles above Annapolis and 6 feet for 2 miles farther. The channel above Annapolis is only partially marked, but is broad and easily followed with the aid of the chart.

Tolly Point, on the south side of the entrance to Severn River, is wooded and has no prominent marks. **Tolly Point Shoal** extends 1 mile southeastward from the point and is marked by a gas buoy on the end. There is a slough through the shoal, ⅝ mile west-northwest-

ward of the buoy, through which boats of 6 feet draft pass, but it is unmarked and strangers should not attempt to use it.

Greenbury Point Shoal extends southward and southeastward from Greenbury Point, and is marked by **Greenbury Point Shoal lighthouse** (white house on piles) and a row of red buoys along the southwest side. The 18-foot curve lies 250 yards southwestward of the lighthouse, and there are depths of 6 feet and less for 400 yards west-northwestward of it.

Back Creek, a tributary of Severn River on the southeast side of Eastport, has a depth of 9 feet in the entrance and 12 feet inside, shoaling to 7 feet near the head. The entrance is very narrow and has extensive shoals on either side. The creek is used as a harbor for small boats.

Eastport is a small town just southward of Annapolis, with which it is connected by a bridge. It has a shipyard and a railway for hauling out vessels of 60 tons and 7 feet draft.

Annapolis is the site of the **United States Naval Academy,** which occupies the entire northeastern part of the city between Spa and College Creeks. The two inclosed basins and the entire water front on the northeast side and for a distance of ⅜ mile on the southeast side are a part of the Naval Academy. The steamboat landing and private wharves are on the northwest side of Spa Creek, between the Naval Academy grounds and the bridge across the creek. **Market Slip,** 250 yards below the bridge, is ⅛ mile long and 40 yards wide and has a depth of 8 feet to near the head. It is open to the public and extensively used by small craft. The mouth of Spa Creek below the bridge has depths of 10 to 13 feet and is extensively used as an anchorage. Gasoline, provisions, coal, and water can be obtained at Annapolis, and there are machine shops for ordinary repairs to motors. Storm warnings are displayed. Annapolis is connected with Baltimore and Claiborne by steamer.

Spa Creek is crossed by a highway bridge just above the wharves having a center pier draw, each opening 38 feet wide with a head-room of 7 feet at high water when closed. The bridge is opened at all times between sunrise and sunset on a signal of three blasts, and the operating machinery is accessible to vessel captains at other times. Favor the southeast side in approaching the draw to avoid a shoal on the northwest side. The creek has a depth of 8 feet for ¾ mile above the bridge and the mid-channel is clear.

College Creek, on the northwest side of Annapolis, has a depth of 11 feet in the entrance and 8 feet to near the head. It is crossed by three bridges, all having draw openings, the least width of opening being 38 feet. The draws are opened at all times between sunrise and sunset on a signal of three blasts of a whistle or horn. The best water in entering leads along the south side to near the lower bridge.

Weems Creek, 1½ miles above Annapolis, has a depth of 12 feet for 1 mile above the entrance and 6 feet to the head. It is crossed by a highway bridge having a center pier draw, each opening 21 feet wide.

Round Bay, an expansion of Severn River 4 miles above Annapolis, has depths of 17 to 22 feet.

Anchorage.—Deep-draft vessels anchor in Annapolis Roads off the entrance in depths of 20 to 45 feet, sheltered from westerly winds.

There is good anchorage in the river northeastward of the Naval Academy in a depth of 21 feet, and 30 feet in the dredged anchorage basin, which is often occupied by naval vessels made fast to the mooring buoys. Small vessels and motor boats usually anchor in the mouth of Spa Creek, where there are depths of 10 to 13 feet.

Bridges.—Two bridges cross Severn River just above Annapolis. The lower, a highway bridge, has a center-pier draw, each opening 60 feet wide, with a headroom of 4 feet at high water when closed. The second, an electric railway bridge, has a center-pier draw, each opening 60 feet wide, with a headroom of 5.7 feet at high water when closed. Both bridges are opened at any time of day or night on a signal of three blasts, unless a train is approaching or expected.

Pilots.—Local boatmen who are competent pilots will be found near the entrance if desired.

Ice seldom interferes with navigation except in severe winters, and then only for a limited time.

Tides.—The mean rise and fall of tides is 0.9 foot and is greatly influenced by winds. The tidal currents seldom exceed ½ knot in strength.

DIRECTIONS, SEVERN RIVER.

The following directions are for vessels of 16 feet draft to Annapolis in the daytime. Strangers, unless of light draft, should not attempt to enter at night.

From southward.—From the outer end of the dredged channel, lying ½ mile northeastward of Tolly Point Shoal gas buoy, steer 316° true (NW ¾ N mag.) in the dredged channel, leaving the buoys at a distance of 30 yards, until westward of Greenbury Point Shoal lighthouse and 30 yards northeastward of buoy No. 9. Then steer 333° true (N by W ¾ W mag.) for ¾ mile until southwestward of buoy No. 14; on this course the lighthouse wharf, in front of a group of white houses, will be a little on the starboard bow. From buoy No. 14 a 305° true (NW ¼ W mag.) course will lead to the dredged anchorage basin off the Naval Academy.

From northward.—Pass eastward and ¼ mile southward of Hackett Point Shoal buoy No. 33 and steer 244° true (WSW ¼ W mag.) with Greenbury Point Shoal lighthouse well on the starboard bow, and heading for buoys Nos. 5 and 6 until in the dredged channel, which leads between the buoys. This course leads through an area of possible fish traps. Then steer 316° true (NW ¾ N mag.) in the dredged channel and follow the directions in the preceding paragraph to Annapolis.

SEVERN RIVER TO PATAPSCO RIVER.

The cove between Greenbury Point and Hackett Point has depths of 10 to 14 feet in the north end. The channel at the entrance is narrow and leads between extensive flats, and is marked on the eastern side by a red buoy. The cove and the creeks at the head are frequented by motor boats and small vessels carrying farm and wood products. **Mill Creek** has a depth of 10 feet at the entrance in a very narrow unmarked channel and 8 feet to near the head. **White Hall Creek** has a depth of 12 feet at the entrance and 7 feet to near the head; the channel at the entrance is narrow and crooked

and is usually marked by a post or bush stake. **Crabbing Point Creek** has a very narrow entrance, with a depth of about 2 feet, and deeper water inside.

Sandy Point lighthouse is a red dwelling on brown cylindrical base. Deep-draft vessels should pass 1/8 mile or more eastward of it.

Magothy River, westward of Baltimore lighthouse, has a depth of 13 feet at the entrance and for a distance of 5½ miles above, but has many shoal spits and middle grounds of less depth close to the channel. The usual draft of boats using it is 3 to 5 feet and deepest draft 10 feet. There are no wharves except for small craft. **Deep Creek,** on the south side just inside the entrance, has a depth of 7 to 9 feet in mid-channel and is sometimes used as an anchorage for small craft. **Mountain Point,** on the north side at the entrance, is a high, wooded bluff with a bare sandy point outside of it.

The entrance to Magothy River is narrow and marked by buoys. **Approaching the entrance from northward,** a 226° true (SW ¾ W mag.) course from buoy No. 3C on the Craighill Channel will lead ¾ mile westward of Baltimore lighthouse and to the buoys at the entrance. **Approaching from southward,** strangers should pass eastward of Sandy Point lighthouse and give the shore on the southwest side a berth of ½ mile until up to the red buoy at the entrance. Either course leads through an area of possible fish traps. Pass 100 yards southward of the buoy and steer northwestward into the river, passing northward of the black buoy. There are no marks above the entrance, but strangers should have no trouble in taking a draft of 6 feet for 5 miles by keeping in mid-channel and giving the points a good berth.

Baltimore lighthouse, on the western side at the entrance of the dredged channel leading to Baltimore, is a white octagonal house on brown pier.

PATAPSCO RIVER AND BALTIMORE HARBOR.

Patapsco River, on the west side of Chesapeake Bay 136 miles above the entrance, is the approach to the city of Baltimore. The river is 3½ miles wide at the mouth, but the entrance is obstructed by extensive shoals. A channel 35 feet deep and 600 feet wide has been dredged from the 35-foot depth southward of the entrance of the river to Fort McHenry, at the entrance of the basin at Baltimore, the total length of the dredged channel being 16 miles. **Craighill** and **Cutoff Channels** lead through the shoals southward of the entrance to the river, and **Brewerton** and **Fort McHenry Channels** lead from the mouth of the river to Fort McHenry. The channels have been widened at the turns and two anchorage basins 600 feet wide and 35 feet deep have been dredged on the southwest side of the Fort McHenry Channel.

Bodkin Point, on the south side at the entrance, is low and covered with scattered trees. A chimney in Bodkin Creek is prominent. A shoal extends northward from the point to the edge of the dredged channel.

Bodkin Creek, just westward of Bodkin Point, has a depth of 11 feet at the entrance and 7 to 9 feet inside for a considerable distance into all of its three branches. The channel at the entrance is very

narrow and leads between extensive shoals. It is marked by buoys as far as the fork, and the narrowest part of the channel at the entrance is also usually marked by bush stakes. The chimney of a garbage disposal plant on the point between **Main Creek** and **Back Creek** is prominent. The draft of boats using the creek does not usually exceed 6 feet, and strangers should not enter with a greater draft. From the black spar buoy at the outer end of Rock Point Shoal a 136° true (SE ⅝ S mag.) course for 2½ miles will lead to the outer buoy. In entering, be guided by the buoys and bush stakes, leaving them at a distance of about 25 yards.

North Point, on the north side of Patapsco River at the entrance, is wooded and marked by a large and a small water tank. A pleasure park just eastward of the entrance to Shallow Creek is marked by a pier with pavilion at the end.

Old Road Bay, just westward of North Point, has a depth of 7 to 14 feet. A rock, nearly bare at low water, near the middle of the entrance is marked by a horizontally striped buoy, and above this point there are no marks. **North Point Creek** and **Jones Creek**, emptying into the bay from northward, have depths of 6 to 8 feet, but are unmarked and frequented only by small produce and pleasure boats. The bridges crossing both creeks near their entrances have draw openings 40 feet wide.

Sparrows Point, a town on the north side 2¼ miles west-northwestward of North Point, is the site of large iron and steel works and a shipbuilding plant. Several factory buildings and many chimneys are prominent. A channel, dredged to a depth of 26 feet and marked by buoys, leads to the wharves on the south side on a 354° true (N ⅛ E mag.) course. Channels have also been dredged to several wharves on the west side. Sparrows Point is the terminus of a railroad.

Bear Creek, just westward of Sparrows Point, has a depth of 12 feet for 3½ miles above the entrance. The principal shoals for a distance of 1½ miles above the entrance are marked by buoys. There are no marks above, and shoals extend for a considerable distance from many of the points. The creek is frequented principally by small produce and pleasure boats. There are no wharves except for small boats. Two bridges, each having center-pier draws, cross the creek just above the entrance; the least headroom at high water when closed is 5 feet. A highway bridge having a draw opening crosses the creek 2¼ miles above. **Humphreys Creek**, a tributary of Bear Creek just above the lower bridges, has a depth of 13 feet in the entrance and 7 feet in mid-channel for 1¼ miles. Boats entering Bear Creek from northwestward should pass between Fort Carroll and the red buoy ¼ mile east-northeastward, then head for the eastern end of the bridges until abreast of a black buoy, then head for the draws. Or, from southward, a 9° true (N by E ⅜ E mag.) course from gas and bell buoy No. 12B will lead to the draws.

Rock Creek, on the south side of Patapsco River 4 miles above Bodkin Point, has a depth of 11 feet to near the head, except at the narrows westward of Fairview, where the channel has a depth of 8 feet and width of only 75 to 100 feet. The channel at this point is marked by buoys, and the mid-channel is clear above. A channel has been dredged 7 feet deep and about 50 feet wide through the shoal off **Fairview**, about ⅛ mile eastward of the buoys marking the

natural channel, and is marked by a black buoy on the eastern side, but strangers are advised to enter by the natural channel. **White Rocks,** on the eastern side of the entrance to the creek, show about 15 feet above high water, and are prominent when entering from eastward. Boats of 6 feet or more draft should pass northward of them. The creek is frequented by passenger steamers from Baltimore drawing 7½ feet, and many pleasure boats in summer. To enter Rock Creek from northwestward a 160° true (S by E ⅛ E mag.) course from the black gas buoy at the intersection of Brewerton and Fort McHenry Channels will lead to the red buoy on the western side at the entrance. From there favor the western shore to the narrows and be guided by the buoys, leaving them close-to.

Stony Creek, 1 mile northwestward of Rock Creek, has a depth of 10 to 14 feet to near the head, and the same depth to near the head of Nabbs Creek, the principal tributary. The entrance is obstructed by shoals, the one extending westward from **Stony Point** having several rocks bare at all times. The channel around the western end of this shoal has a depth of 15 feet and width of 70 yards and is marked by buoys. Above this point the mid-channel is clear to the head. Steamers from Baltimore of 6 to 7½ feet draft are the deepest entering. The creek has several landings, and is frequented by many pleasure boats in summer. A highway bridge having a center-pier draw, each opening 50 feet wide, with a headroom of 6 feet at high water, crosses it ¾ mile above the entrance.

Fort Carroll is a stone and concrete structure with Fort Carroll light (white structure) on the southwest side. The center of Fort McHenry Channel leads 400 yards southwestward of the light.

Hawkins Point is marked by a large building in ruins and a water tank.

Curtis Bay and Curtis Creek, on the southwest side of Patapsco River 1¾ miles west-northwestward of Fort Carroll, are the approach to large coal and oil wharves and several industrial plants at **South Baltimore,** and to the Coast Guard depot on Arundel Cove. A channel 250 feet wide and 30 feet deep, with a turning basin at the head, has been dredged from the main channel of Patapsco River across Curtis Bay to the wharves at South Baltimore, where are located the coal piers of the Baltimore & Ohio Railroad, having a depth of 30 feet alongside, and several other wharves with depths of 25 feet. The channel is marked by buoys on each side.

Curtis Creek has a natural depth of 20 feet to abreast the entrance of Arundel Cove, 1¾ miles above South Baltimore, and 12 feet for a farther distance of 2 miles into Marley Creek. A highway bridge having a center pier draw, with a headroom of 9 feet at high water eastward of the draw, crosses the creek ¾ mile above the head of Curtis Bay. The channel above Curtis Bay has ample width and is easily followed with the aid of the chart. Shoals extend southeastward from **Ferry Point** on the north side of Cabin Branch, and northwestward from **Walnut Point** just below the bridge; except at these points the mid-channel is clear for 3 miles above Curtis Bay.

Cabin Branch, on the west side of Curtis Creek just above South Baltimore, has a depth of 14 feet to a drawbridge ⅜ mile above the entrance. There are depths of 14 to 18 feet at the industrial wharves on the north side. In entering, vessels should favor the southeast

side of Curtis Creek until southeastward of Cabin Branch, and enter on a northwesterly course to avoid shoals on the north side at the entrance.

Arundel Cove is the site of the Coast Guard depot. There is a depth of 17 feet at the wharf just outside the cove, and 12 feet to the wharves inside. The entrance to the cove is marked by several buoys.

To enter Curtis Bay, pass southward of gas buoy No. 7 M, and steer 267° true (W ⅜ N mag.) in the Curtis Bay channel, leaving the buoys at a distance of 40 yards; the coal piers and a brick chimney at South Baltimore will be ahead on this course. Anchorage can be had eastward or east-northeastward of the coal piers in depths of 24 to 30 feet, being careful to give the north shore a berth of 300 yards, or in mid-channel southward of the coal piers in depths of 23 to 26 feet. If bound above South Baltimore, pass midway between **Sledds Point** and the ends of the coal piers, favor the eastern side of Curtis Creek until past Ferry Point, then the western side to the bridge. Pass through either side of the draw and eastward of the red buoy just southward of it, and follow a general mid-channel course above.

Colgate Creek, on the north side of Patapsco River northeastward of Curtis Bay, has a depth of 6 feet in a narrow channel to a fixed bridge ¾ mile above the entrance. A bridge having a draw opening 30 feet wide and a headroom of 8.6 feet crosses the creek at the entrance. The draw will be opened on a signal of three blasts at any time between 6 a. m. and 6 p. m. from December to March, inclusive, and at any time between 6 a. m. and 10 p. m. during the remainder of the year. **Point Breeze,** on the west side at the entrance, is a pleasure park, and has several prominent buildings. The best water in entering Colgate Creek leads eastward of a horizontally striped buoy, and follows the eastern shore at a distance of about 250 yards from abreast **Dundalk** (marked by a brickyard and black water tank) to the first bridge.

The **Northwest Branch** of Patapsco River, also known as **The Basin,** forms the main part of Baltimore Harbor. The entrance leads between Fort McHenry on the west and Lazaretto Point on the east. **Fort McHenry** is on a grassy point, marked on the east side by Fort McHenry lighthouse (steel skeleton tower), and **Lazaretto Point** is marked by Lazaretto Point lighthouse (white cylindrical tower).

Northwest Branch has depths of 20 to 35 feet in the eastern end and 24 feet to the head, with a few areas of less depth near the shores. The best water favors the southwest side from the entrance to Locust Point, and the northeast side from Locust Point to the head. There are anchorages on the northeast side between Lazaretto Point and Fells Point and on the south side westward of the Baltimore & Ohio Railroad wharves at Locust Point, the anchorage limits being marked by white buoys. There are depths of 16 to 35 feet at the principal wharves. The Baltimore & Ohio Railroad wharves, extending from Fort McHenry northwestward for ¾ mile, have depths of 20 to 35 feet, and the Pennsylvania Railroad wharves, northward of Lazaretto Point, have depths of 27 to 31 feet. The wharves along the western side at the head of the harbor are used by passenger and freight steamers to points on Chesapeake Bay. The wharves

from the northwest corner of the harbor eastward to Jones Falls are municipal wharves and have depths of 24 feet alongside, the three easterly ones being public wharves and used for the discharge of lumber, sea food, and produce.

Middle Branch of Patapsco River, also called **Spring Garden Channel**, extends from southward of Fort McHenry, westward and northward for a distance of 3 miles. It has been improved by dredging a channel 27 feet deep and 100 feet wide from the Fort McHenry Channel to near the head of navigation, widened at the turns and with a turning basin 400 feet square at the head. Privately dredged channels lead from the main channel to many of the wharves. The channel is marked by buoys on both sides; those on the south side are on the edge of the dredged channel, and some of those on the north side are a considerable distance from the edge of the channel. To follow the dredged channel, vessels should pass close to the black buoys. Many of the channels leading to the wharves are also marked by buoys. The principal wharves have depths of 11 to 31 feet, the deepest draft being found at the Western Maryland Railroad coal wharves (**Port Covington**), northeastward of the lower bridge. The channel is used by many barges, large schooners, and steamers, the deepest draft being 26 feet.

Spring Garden Channel is crossed by three bridges. **Light Street Bridge**, 1⅝ miles above Fort McHenry, has a center-pier draw, each opening 83.6 feet wide, with a headroom of 6 feet at high water when closed; the north opening is the one generally used by vessels on account of the sharp bend in the channel at this place. There is a higher opening underneath the fixed part northward of the draw, which is generally used by motor boats without masts. Hanover Street Bridge, ⅜ mile above Light Street Bridge, has a draw opening 150 feet wide and a headroom of 34 feet at high water. **Western Maryland Railroad bridge**, 1 mile above Light Street Bridge, has a center-pier draw, each opening 83.5 feet wide, with a headroom of 8 feet at high water when closed.

The courses in the dredged channel of Middle Branch are as follows: 280° true (WNW ½ W mag.) from Fort McHenry Channel for a distance of 1⅜ miles, with a prominent yellow chimney at the western end of the third bridge a very little on the starboard bow; 223° true (SW ⅜ W mag.) for ⅝ mile to Light Street Bridge, with the gray house in the center of the draw a little on the starboard bow; westward through the bridge; 314° true (NW ½ N mag.) for ⅞ mile, passing through the Hanover Street Bridge and to a point ⅛ mile southward of the railroad bridge; and 6° true (N by E ⅛ E mag.) through the bridge and to the head of the channel.

Pilots.—Pilotage for the port of Baltimore is compulsory for foreign vessels, vessels from a foreign port, and all vessels sailing under register, except American vessels laden either in whole or in part with coal or coke mined in the United States. Pilotage fees are given on page 119.

Anchorage.—The anchorage limits in the harbor of Baltimore are prescribed by law and it is the duty of the harbor master to carry out its provisions. Vessels can find good anchorage in 18 to 24 feet on either side of Fort McHenry Channel above Fort Carroll, keeping at least 300 feet outside of the dredged channel marked by buoys.

Two buoyed anchorage basins, each 600 feet wide, 5/8 mile long, and 35 feet deep, have been dredged along the southwest side of the Fort McHenry Channel. The lower one extends from a point westward of Fort Carroll to the channel leading to Curtis Bay, and the upper lies southward of Lazaretto Point and southeastward of the entrance to the channel leading into Middle Branch.

Three anchorage areas are prescribed in Northwest Branch, and are marked by white buoys at the corners.

Anchorage No. 1, lying westward of the Baltimore & Ohio Railroad wharves at Locust Point, is southward of a line from the west corner of Shaws coal pier to the northeast corner of Beacham & Bro. shipyard. No vessel is allowed to anchor within 300 feet of any pier fronting this anchorage.

Anchorage No. 2, lying eastward of Fells Point, is northeast of a line from the foot of Fell Street to the coal wharf foot of Ninth Street, and west of a line from Obers Wharf to corner of Canton company bulkhead. No vessel is allowed to anchor within 300 feet of any pier fronting this anchorage.

Anchorage No. 3, lying northward of Lazaretto Point, is northeastward of a line from Fell Street to coal pier foot of Ninth Street, westward of a line from Baltimore Dry Dock Co. Wharf to the elevator at foot of Sixth Street, and southward of a line from Baltimore Copper Co. bulkhead to Obers Wharf.

Supplies.—All kinds of supplies are obtainable in Baltimore Harbor. Coal in unlimited quantities can be obtained from wharves equipped for rapid coaling or from lighters, and water can be obtained from the wharves or from water boats.

Repairs.—There are facilities at Baltimore for repairs to hulls of vessels of any size, and large machine and boiler shops for all kinds of repairs to machinery. For capacity of the largest dry docks and railways see page 24.

Storm warnings of the United States Weather Bureau are displayed from the American Building and from the Anchorage Building, corner of Broadway and Thames Street.

A **United States Branch Hydrographic Office** is established at the customhouse. Bulletins are posted here giving information of value to seamen, who are also enabled to avail themselves of publications pertaining to navigation and to correct their charts from standards. No charge is made for this service.

Ice.—Baltimore Harbor and Patapsco River are frozen over during severe winters, but steamers and ice boats keep the dredged channels open so that vessels assisted by steam can always enter the harbor. The smaller tributaries of Patapsco River are often closed by ice for extended periods. Ice in the main channel is most often met with in the vicinity of Seven Foot Knoll lighthouse, where ice packs are of frequent occurrence.

Tides.—The mean rise and fall of tides is 1.1 feet.

Regulations for passing dredges.—Steamers passing dredges engaged in improving the channels shall not have a speed greater than 6 statute miles an hour, and their propelling machinery shall be stopped when abreast of the dredges.

Vessels drawing less than 12 feet of water must keep outside of the buoys marking the ends of mooring lines of dredges.

Vessels must not anchor on the ranges of stakes or other marks placed for the guidance of dredges, nor in such a manner as to obstruct the channel for other vessels.

Dredges and operating plant in the prosecution of the work, must not obstruct any part of the channel unnecessarily.

Vessels must not run over or disturb stakes or other marks placed for the guidance of dredges.

The position of breast and stern anchors of the dredges shall be marked by buoys plainly visible to passing vessels.

While vessels are passing the dredges in the channel all lines running across the channel from the dredges on the passing side must be entirely slacked.

Speed regulations.—No vessel shall move in the harbor at a greater rate of speed than 7 nautical miles an hour westward of a line from Hendersons Wharf (Fells Point) to the foot of Hull Street (Locust Point), and 9 nautical miles an hour eastward of said line, and no vessel shall move in the Patapsco River or tributaries within a distance of 300 feet from any pier or bulkhead at a greater rate of speed than 8 nautical miles an hour.

Quarantine for the port of Baltimore is in accordance with State laws and the quarantine regulations of the city of Baltimore, and is in charge of the health officers of the port. The quarantine station is at Leading Point. Vessels subject to inspection should come to anchor in the quarantine anchorage off the point until granted pratique. The national quarantine regulations are the minimum requirements.

DIRECTIONS, PATAPSCO RIVER AND BALTIMORE HARBOR.

Directions from Chesapeake Bay entrance to the entrance of the dredged channel leading to Baltimore are given on page 125. Directions from Chesapeake City to Baltimore are given on page 261.

The dredged channels are well marked by buoys and lighthouses and by lighted ranges. The buoys are generally arranged in pairs to mark both sides of the channel, and gas buoys are used to mark the turns. The buoys marking the Craighill Channel are distinguished by the letter C after the number, the Cutoff Channel by the letter K, the Brewerton Channel by the letter B, and the Fort McHenry Channel by the letter M.

Shoals with little depth lie on both sides of the Craighill and Cutoff Channels, and strangers should follow the dredged channel unless in small boats. The natural channel of the river outside the dredged channel, from the upper end of Cutoff Channel to Baltimore, has depths of 15 to 24 feet; shoals make out from many of the points and are usually marked by buoys. Strangers of 10 feet or more draft should follow the dredged channels.

The following directions lead in the 35-foot dredged channel to the entrance of Northwest Branch (the Basin) at Baltimore. Deep-draft vessels should not attempt to enter at night without a pilot.

From the gas and bell buoy at the southern end of Craighill Channel steer 0° true (N ⅝ E mag.) on the Craighill Channel range, and follow the buoys which mark the edges of the dredged channel. When up with gas and bell buoy No. 9C steer 341° true (N by W

⅛ W mag.) and follow the black buoys which mark the western edge of the widened part of the dredged channel until up with gas and bell buoy No. 5K; or vessels can continue on the Craighill Channel range to gas buoy No. 2K, at the intersection with the Cutoff Channel range.

Then steer 329° true (NNW ⅛ W mag.) on the Cutoff Channel range, following the buoys and passing over ¼ mile westward of Seven-Foot Knoll lighthouse. **Cutoff Channel range** shows 400 yards westward of a large and a small water tank on North Point, and about midway between the houses at the outer end of North Point Wharf and the trees at the inner end. When up with gas and bell buoy No. 13K steer 310° true (NW ⅛ N mag.) in the widened part of the channel until up with gas and bell buoy No. 3B; or vessels can continue on the Cutoff Channel range to gas buoy No. 14K, at the intersection with the Brewerton Channel range.

Then steer 291° true (NW by W ½ W mag.) on the Brewerton Channel range and follow the buoys which mark the edges of the dredged channel until up with gas and bell buoy No. 12B. **Brewerton Channel range** shows between the ruins of a large building and a water tank on Hawkins Point; neither light structure is prominent by day. From gas and bell buoy No. 12B steer 307° true (NW ⅛ W mag.) in the widened part of the channel to gas and bell buoy No. 4M; or vessels can continue on the Brewerton Channel range until abreast gas buoy No. 1M. Then steer 320° true (NW by N mag.) for Fort McHenry lighthouse, and follow the buoys which mark the sides of the Fort McHenry Channel to Lazaretto Point. Above this point the chart is the guide.

EASTERN SHORE, CAPE CHARLES TO CHESCONESSEX CREEK.

The eastern side of Chesapeake Bay from the entrance northward to the south end of Pocomoke Sound is idented by numerous small creeks, most of them obstructed by bars at the entrances. The creeks are frequented by many small craft engaged in oystering and fishing and the transportation of produce, and many of them by passenger steamers engaged in the bay trade. Strangers seldom enter except in small boats. The shore is low and without prominent natural landmarks except Butlers Bluff, about midway between Fisherman Island and Old Plantation Flats lighthouse, which shows bare, bluff faces when viewed from the bay. Cape Charles, Harborton, and Onancock are the principal towns, and there are numerous other post villages and landings. Fish weirs are numerous in season but are prohibited in water more than 18 feet in depth.

The whole of the northern point of the entrance to Chesapeake Bay is generally known as **Cape Charles.** It includes Smith Island, Fisherman Island, The Isaacs, and the south point of the mainland.

Smith Island and **Cape Charles lighthouse** are described under "Coast from Cape Henlopen to Cape Charles," on page 105.

Fisherman Island is low. Several low buildings, a water tank, and a flagstaff of the national quarantine station are on the northwest side. There is a wharf in front of the quarantine station.

The Isaacs is a bare marshy island marked by a shanty in the center.

The south point of the mainland is low and bare on the extreme south end but high and wooded back of the point.

Fisherman Inlet is described under "Inside waters, Cape Henlopen to Cape Charles," on page 118.

Old Plantation Creek, 2½ miles southward of the town of Cape Charles and 1½ miles eastward of Old Plantation Flats lighthouse, nas a depth of 1½ feet across the bar at the entrance and for a distance of 2 miles above, and is frequented by local boats of 3½ feet draft at high water. The channel is narrow, and there are many bars and middle grounds, which usually show discolored. It is usually marked by bush stakes but is difficult without local knowledge. The best water across the flats is about ⅜ mile southward of the mouth. The opening in the thick woods at the mouth, and a shanty on an island inside the mouth, are the only marks visible from outside.

Cherrystone Inlet, on the eastern side of Chesapeake Bay 9 miles northward of Fisherman Island, is the approach to the town of Cape Charles and to several small creeks farther north. It is marked by **Old Plantation Flats and Cherrystone lighthouses** (both white houses on piles) and by several other lights and buoys. The mean rise and fall of tides is 2.3 feet.

A **channel** 16 feet deep and 200 feet wide has been dredged across the bar a little northward of Old Plantation Flats lighthouse, and northward along Cherrystone Inlet to the entrance of Cape Charles Harbor. In 1915 there was a depth of 14 feet in the entrance to the harbor. The channel is exposed to westerly winds but is partially protected by the flats westward, and is seldom too rough for entrance by motor boats. Owing to the limited space in the channel and harbor, small boats are sometimes exposed to injury by the steamers and tows. The tidal currents set across the entrance to the channel south of Cherrystone lighthouse, but follow the general direction of the channel above. Ice does not interfere with navigation. For regulations for passing dredges see "Hampton Roads."

Cape Charles is the terminus of the New York, Philadelphia, & Norfolk Railroad and is connected with Old Point Comfort and Norfolk by passenger steamers. It has a large trade carried in steamers, car floats, and barges, mostly between Cape Charles and Norfolk, and is also an important shipping point for sea food and produce brought here in motor boats and small vessels. Gasoline and provisions are obtainable, and there is water on the wharf.

Cape Charles Harbor is an artificially dredged basin, 300 yards long and 200 yards wide, on the south side of the town. A jetty extends 1,600 feet westward from the north side of the entrance. The harbor is owned by the railroad company, but is open to general navigation. In 1915 it had a depth of 14 feet in the entrance, 13 feet at the wharf on the north side, and 15 feet through the center to the car-float slips at the eastern end. There was a depth of about 12 feet at the coal elevator at the eastern end of the bulkhead along the south side, but the southwest side of the harbor was shoal, having depths of 5 to 8 feet. Steamers and small boats load and discharge at the wharf on the north side, and motor boats make fast to the bulkhead on the south side and at the eastern end. Small craft seeking shelter in the harbor should anchor so as not to interfere with the steamers, tugs, and barges of the railroad company.

Cherrystone Inlet has a depth of 8 feet for 3 miles **above the entrance of Cape Charles Harbor**, above which the depths are 2 to 4 feet. It is used by fish steamers up to 10 feet draft as far as the fish factory on **Cherrystone Island**, and by local oyster and produce boats above, their draft seldom exceeding 6 feet. The channel is marked by lights to Cherrystone Island, and is sometimes marked by bush stakes above, but the channel is narrow and difficult without local knowledge. Boats of 3 feet draft can cross the bar at low water into Cherrystone Inlet anywhere between the outer end of the north jetty at Cape Charles Harbor and Cherrystone Island, but the bar between Cherrystone Island and **Wescott Point** is often bare at low water.

Kings Creek, east-southeastward of Cherrystone Island, has a depth of 3½ feet across the bar at the mouth and for 1 mile above, and is frequented by boats of 2 to 5 feet draft. There is a long wharf with a house on the end on the south point at the entrance, and an incompleted bridge just inside, with a single clear opening 22 feet wide. There is a shoal, bare at low water and sometimes marked by bush stakes, on the north side outside the entrance. The best water in entering leads from Cherrystone Island southeastward to within 300 yards of shore, then northeastward close along the end of the wharf on the south side, and then favors the north side to the opening in the bridge. There is a railway on the creek capable of hauling out boats of 40 feet length and 4 feet draft.

Directions, Cherrystone Inlet.—Cherrystone Inlet can be entered from southward, eastward of Old Plantation Flats, with a depth of 16 feet, and there is a depth of 12 feet across the bar anywhere between Old Plantation Flats lighthouse and a point ½ mile northward.

The dredged channel across the bar is marked by a lighted range (three-pile structures with white slatted daymarks) and has a 53° true (NE by E ¼ E mag.) trend, leading 520 yards northwestward of Old Plantation Flats lighthouse. Having crossed the bar on the range, steer 19° true (NNE ¼ E mag.) for the white light (red structure) on the south side of the entrance to Cape Charles Harbor in range with the white light on a post with slatted daymark on the middle of the north jetty. This course leads westward of a red buoy, 180 yards eastward of a black bell buoy, and to a position 120 yards eastward of a light on a pile structure ⅜ mile south of Cherrystone lighthouse. Then steer 6° true (N by E mag.), passing eastward of a white light on a black pile structure abreast of Cherrystone lighthouse, and midway between the light (red structure) on the east side, and the light (single pile with black daymark) on the west side, just southward of the end of the north jetty. Then turn eastward for the entrance to the harbor, passing midway between the light on the end of the north jetty and the red buoy southward. Pass 70 yards southward of the light near the inner end of the north jetty and enter the harbor in mid-channel.

Hungers Creek, on the eastern side of Chesapeake Bay 8 miles northward of Cape Charles, has a depth of about 4 feet in a narrow channel for 2 miles above the mouth. It is entered through a narrow channel which commences in front of a large red-roofed house 2½ miles southward of the mouth of the creek, and follows close along

the eastern shore to the mouth. There is a shoal, bare in places at low water, along the western side of the channel. The channel is usually marked by bush stakes but requires local knowledge. The flats are covered by marsh grass in summer. The creek has no wharves, but there are several landings from which produce is shipped in boats of 2 to 5 feet draft.

The Gulf, emptying into the channel leading to Hungers Creek, has a depth of about 1 foot to near the head and is little used. There are no wharves.

Mattawoman Creek, emptying into Hungers Creek from eastward, has a depth of about 4 feet for 1 mile in a narrow crooked channel, and 2 feet to the head of navigation. The best water in entering lies close along the eastern shore, northward and eastward of an island marked by two shanties.

Nasawaddox Creek, on the eastern side of Chesapeake Bay 12½ miles northward of the town of Cape Charles, has a depth of 4 feet across the bar at the entrance and deeper water inside for several miles. The channel at the mouth is marked by buoys, but is changeable, and the buoys can not always be depended upon. The channel above the entrance is narrow and unmarked, the flats on each side are nearly bare at low water, are covered by marsh grass in summer, and are usually well defined. The creek is frequented by local craft of 5 feet or less draft. The landings are **Bayford**, 1½ miles above the entrance, and **James** and **Stewarts Wharves**, on opposite sides of the creek 4 miles above the entrance. There is a depth of 4 feet to the upper wharves. There is a store and post office at Bayford and gasoline is obtainable. The mean rise and fall of tides is 1.8 feet.

Church Creek, on the south side of Nasawaddox Creek, has a depth of about 2 feet to the head and is little used.

Warehouse Creek, on the south side of Nasawaddox Creek, has a depth of 3 feet to within 1 mile of the post village of **Franktown**. The best water leads close around the point on the east side at the entrance.

Occohannock Creek, on the eastern side of Chesapeake Bay 18 miles above the town of Cape Charles, has a depth of 5 feet across the bar at the entrance, 6 feet inside to **Shields Wharf** and post office 5½ miles above the entrance, and 3 feet for a further distance of ½ mile to a fixed bridge. Steamers from Baltimore drawing 5 to 7 feet make regular trips to four wharves in the creek, and they are the deepest draft entering. The channel across the bar at the mouth is marked by buoys and bush stakes, but is narrow and changeable, and difficult without local knowledge. The channel above the entrance is also narrow and difficult, but the ends of the shoals are usually marked by bush stakes. There is a store at **Concord Wharf**, on the south side 2 miles above the entrance, and a post office and store at **Davis Wharf**, on the north side 4 miles above the entrance; gasoline is obtainable here and there is artesian water on the wharf. **Morley Wharf** is directly opposite. In approaching the creek, a clump of trees on the north side standing well away from the main woods is the only landmark. There is a grassy islet on the north side, just outside the mouth. The mean rise and fall of tides is 1.8 feet.

Craddock Creek, just northward of Occohannock Creek, has a depth of 3 feet across the flats at the entrance and 4 or 5 feet inside to near the head. The best water lies along the south shore in approaching the entrance and along the north side of the creek in entering, then in mid-channel to the head. There are no commercial wharves.

Nandua Creek, on the eastern side of Chesapeake Bay 9 miles southward of Watts Island lighthouse, has a depth of 7 feet in a dredged channel across the flats at the mouth, the same depth in a natural channel to **Cedar View Wharf**, 2¾ miles above, and 5½ feet to the post village of **Nandua**, 4 miles above the mouth. It is navigable for a farther distance of 1 mile, but is shoal and little used. Steamers from Baltimore of 5½ to 7 feet draft make regular landings at Cedar View Wharf and Nandua. The channel across the flats at the entrance is narrow and shifting and is marked by buoys, and by bush stakes maintained by the steamboat company. The flats usually show discolored water. The bend in the channel westward of Cedar View Wharf and the approach to Nandua Wharf are also generally marked by bush stakes. There is a store at Nandua at which some provisions are obtainable. The only landmark in approaching the entrance is a prominent clump of pine trees standing clear on the south side. The mean rise and fall of tides is 1.7 feet. In entering, strangers should be guided by the buoys and bush stakes, but local knowledge is required to carry the best water.

Butchers Creek, 2 miles northward of Nandua Creek, has a depth of 2 feet at the entrance and deeper water inside. There are no wharves, and the creek is little used.

Pungoteague Creek, on the eastern side of Chesapeake Bay 7 miles southward of Watts Island lighthouse, has a depth of 11 feet to the town of **Harborton**, 4 miles above the mouth, and 6 feet to **Boggs Wharf**, 5 miles above the mouth, above which it shoals rapidly. Steamers from Baltimore of 6 to 8 feet draft make regular trips to these landings and to **Evans Wharf**, on the north side ½ mile eastward of Harborton. There is a fish factory at Harborton, to which steamers of 10 feet draft go. Gasoline and provisions are obtainable at Harborton. The channel as far as Harborton is crooked, but is well marked by buoys and lights. Posts, upon which lights are maintained during the fishing season, are maintained by the fish factory owners in places. The mean rise and fall of tides is 1.7 feet.

The best water in approaching the entrance is from southwestward, eastward of the black can buoy off the mouth of Nandua Creek, but a depth of 7 feet can be carried across the flats at the mouth, heading for **Pungoteague Creek light** (black cylindrical tower) on any course eastward of 140° true (SE by S mag.). In entering, pass 200 yards southward and eastward of Pungoteague Creek light and steer northeastward for **Hack Neck Shoal light** (red pile structure), passing 100 yards westward and northward of it. Then steer 72° true (E by N mag.), passing southward of a black buoy, and continue the course with the next buoy well on the starboard bow until ¼ mile from it; then steer eastward, passing close northward of the buoy. Then steer 105° true (ESE ⅛ E mag.) for ⅝ mile, passing close southward of the next buoy. The course then leads 75°

true (E ¾ N mag.) for ⅜ mile, passing close northward of the next buoy, and then follows a general mid-channel course to Harborton. The channel between Harborton and Boggs Wharf is marked by bush stakes, but is narrow and difficult without local knowledge.

There is a depth of about 4 feet at high water from Pungoteague Creek to Onancock Creek, close along shore eastward of the marshy islands between them, but the channel is difficult without local knowledge.

Onancock Creek, on the eastern side of Chesapeake Bay 4 miles 149° true (SSE ¼ E mag.) from Watts Island lighthouse, has a depth of 7 feet to the town of **Onancock**, at the head of navigation 5½ miles above the mouth. Steamers from Baltimore drawing 7 feet make regular trips to Onancock, and to **Finneys Wharf** on the south side, and **Poplar Cove Wharf** on the north side, 1 and 2¼ miles, respectively, below Onancock, and these are the deepest draft entering. Finneys Wharf is on the eastern side of a point having a shoal making northward from it and must be approached from eastward. Gasoline and provisions are obtainable at Onancock. The mean rise and fall of tides is 1.7 feet.

The channel across the flats at the entrance of Onancock Creek has been dredged 8 feet deep and 200 feet wide, and had a depth of 7 feet in 1915. The entrance as far as the point of marsh on the north side is marked by **Onancock Creek light** (black pile structure) and by buoys and bush stakes. The channel in 1914 led close southward of the light at the entrance, then east-southeastward for ¾ mile, then east-northeastward for ½ mile to the point on the north side (marked by a shanty), approximately as shown on the chart. Above the entrance the channel is crooked and narrow in places and is marked by beacons maintained by the steamboat company, red on the south side of the channel and black on the north side. Strangers of about 5 feet draft should be able to go to Onancock with the aid of the chart and the aids.

Chesconessex Creek, 3½ miles 118° true (SE by E mag.) from Watts Island lighthouse, has a depth of 12 feet for 2½ miles above the entrance between the shoals, 5 feet for a further distance of 1 mile to the village of **Chesconessex**, and 2 to 3 feet for ¾ mile above Chesconessex. The creek is frequented by many small local boats and an occasional schooner up to 7 feet draft to Chesconessex. The channel has ample width at the entrance, gradually contracting to a narrow slough at Chesconessex, and has extensive flats on each side. The entrance is marked by buoys, and the channel above is sometimes marked by bush stakes at the turn, but is difficult without local knowledge. Strangers should be guided by the chart and the aids. Some provisions are obtainable at Chesconessex. The mean rise and fall of tides is 1.7 feet.

Pompeo Creek, on the north side of Chesconessex Creek, northwestward of **Tobacco Island**, has a depth of 6 feet for 2 miles above its junction with Chesconessex Creek; it has no wharves, and is frequented only by small local boats. A draft of 3 feet at high water can be taken from the head around the eastern side of Tobacco Island into Chesconessex Creek.

is on the eastern side of Chesapeake Bay, 48 miles northward of the entrance. Extensive flats occupy most of the sound, though a channel, wide and deep at the south end and shoal at the north end, leads from southward to the entrance of Pocomoke River, the most important tributary. The sound is separated from Tangier Sound on the western side by a string of marshy islands and large shoals, marked near their southern end by **Watts Island lighthouse** (white cylindrical tower). The shores of the sound are low and there are no prominent natural landmarks. The most prominent shoals along the main channel are marked by buoys from the entrance to the mouth of Pocomoke River. The sound is frequented by many local oyster and fishing boats, by steamers from Baltimore, and by a few schooners and barges, the deepest draft being 9 feet. Small boats can enter through Broad Creek. The mean rise and fall of tides is about 2 feet.

Watts Island is marshy and sparsely wooded and has no prominent marks. The channel through the flats northward of it has a depth of 3 feet and is sometimes marked by bush stakes, but is difficult without local knowledge.

Little Fox Island consists of a group of bare, marshy islands. Great Thoroughfare, northward of Little Fox Island, has a depth of 4 feet at high water and is sometimes used by local boats, but is difficult without local knowledge.

Great Fox Island is low and marked by a single prominent poplar tree. There is a group of small red oyster houses on the eastern side.

Cedar Straits, northward of Great Fox Island, has a depth of 3½ feet at high water through a narrow unmarked channel, and is little used even by local boats.

Deep Creek is a shallow, unimportant creek on the southeast side of Pocomoke Sound. The main entrance between the shoals is 3½ miles east-northeastward of Watts Island lighthouse. It has a depth of 7 feet for 5 miles above the main channel of Pocomoke Sound to the mouth of the creek, through a crooked channel with extensive flats on each side, and 2 feet to the head of the creek. There are no wharves, and it is used only by small local boats, many of which come from Hunting Creek through **the Notch**, good for a draft of 3 feet at high water. The channels are not marked and are difficult without local knowledge.

Hunting Creek, on the southeast side of Pocomoke Sound, has a depth of 7 feet to the mouth of **Bagwell Creek**, 2 miles above the mouth, and 4 feet to the wharf at the post village of **Hopkins**, on the southern branch. It is frequented by many small local boats and a few schooners, the deepest draft being 7 feet. The approach to the creek from the main channel of Pocomoke Sound leads eastward along the south side of **Guilford Flats** for 3½ miles, then southward for 1½ miles to the mouth. and is marked by Guilford Flats light and several buoys. In entering, approach the light on a northeasterly course to avoid a 6-foot spot ¼ mile westward of it, pass ¼ mile southward of the light and steer 82° true (E ⅛ N mag.) for 1⅝ miles until ⅜ mile past buoy No. 1, then steer 158° true (S by E ⅜ E mag.) for 1¾ miles to the buoys at the entrance. Above the entrance the mid-channel is clear for about 1 mile, above which it is narrow

and is usually marked by posts with arms or by bush stakes, but is difficult without local knowledge.

Guilford Creek is 2½ miles northeastward of the mouth of Hunting Creek, with which it has a common approach from the main channel of Pocomoke Sound. There is a depth of 7 feet to the entrance and 2 to 5 feet inside. There are no wharves, and it is frequented only by local boats of 2 to 4 feet draft. The channel is marked by a buoy at the entrance and sometimes by bush stakes above.

Messongo Creek, on the eastern side of Pocomoke Sound, southward of Saxis Island, has a depth of 6 feet for 5 miles above its junction with the main channel of Pocomoke Sound, shoaling gradually to about 1 foot at the post village of **Marsh Market,** 2½ miles above. The creek is frequented only by small local boats. It is marked by buoys at the entrance. To enter, pass ½ mile north-northwestward of Guilford Flats light and steer 53° true (NE by E ¼ E mag.) for 3 miles to the first buoy. Above the buoys the mid-channel is clear to the head.

A draft of 2½ to 3 feet at high water can be taken from the mouth of Messongo Creek, northwestward through **Starling Creek** to the south end of the village of Saxis, and many local boats frequently use this passage. The cove at the northwest end of Starling Creek has a depth of 1 to 2 feet and is much used as an anchorage by small boats.

Saxis, a village on **Saxis Island,** at the northeast end of Pocomoke Sound, is the center of a considerable oystering and fishing industry. Steamers between Baltimore and Pocomoke River make landings at a pier ⅜ mile offshore abreast the town, communication being had with the shore by small boats. There is a wharf on the western side of the town which can be reached only at near high water. Gasoline and provisions are obtainable.

Pocomoke River, at the northeast end of Pocomoke Sound, has a depth of 4½ feet across the flats at the mouth (called **the Muds**), though the bottom is very soft and vessels run with their keels 1 to 1½ feet in the mud. The river is navigable for vessels to the town of Snow Hill, 25 miles above the mouth. After passing the Muds the channel has ample depth and width and is easy of navigation for a distance of 20 miles, above which it has been improved by dredging to a depth of 9 feet and width of 100 to 130 feet as far as Snow Hill, with several cut-offs. The channel in the upper end is unmarked, is narrow and crooked, and some local knowledge is required to carry the best water. The water is fresh above Rehoboth and can be used in boilers.

There is considerable trade on the river in steamers and some schooners and barges, the deepest draft being 7 or 8 feet. Steamers from Baltimore make regular landings as far as Snow Hill. The mean rise and fall of tides is about 2.2 feet at the entrance, 2.8 feet at Pocomoke City, and 3 feet at Snow Hill, but is considerably affected by the winds. Freshets cause a rise of 1 to 5 feet at Snow Hill but are not dangerous.

To enter Pocomoke River, pass midway between Saxis Pier and the black buoy westward of it and steer north-northeastward for ½ mile, then northeastward for 1¼ miles to the red buoy at the western edge of the Muds. Pass northward of this, northward of a red buoy on

the end of a shoal extending ½ mile northward from **Pig Point**, southward of a black buoy on the end of a shoal extending ½ mile south-southwestward from **Williams Point**, then steer northeastward, passing close eastward of the black buoy eastward of the end of Williams Point, and follow the shore closely for ⅜ mile until up with a white house, then gradually work off to midstream where the river contracts. Above the entrance the mid-channel is clear to within 5 miles of Snow Hill.

Shelltown is a post village on the west side of Pocomoke River, 2 miles above Williams Point. There is a store and gasoline is obtainable.

Rehoboth is a post village on the west side, 9 miles above the entrance.

Pocomoke City is a town with railroad communication, 17 miles above the mouth. All kinds of supplies are obtainable, and there is a railway capable of hauling out vessels of 200 tons, 125 feet length, and 7 feet draft. Two bridges cross the river at this point. Both have center pier draws, with openings 64 feet wide in the lower bridge and 62 feet wide in the upper. The best water leads through the western opening in both bridges.

Snow Hill is a town with railroad communication, 25 miles above the mouth of the river. It has considerable trade in steamers and schooners up to 7 feet draft. A fixed bridge having a headroom of 4 feet at high water crosses the river just above the wharves, and the river is navigable for 2 miles above for any boats that can pass under the bridge. The town is connected with Baltimore by steamer.

Marumsco Creek, at the northern end of Pocomoke Sound, 2½ miles north-northeastward of Saxis Pier, has a depth of 2 feet for 1 mile above the mouth, and is little used.

East Creek, 2½ miles northward of Saxis Pier, has a depth of 1 to 2 feet and is little used.

Apes Hole Creek, 4 miles west-northwestward of Saxis Pier, has a depth of 2 feet to the head. There are small wharves on the northwest side at which small boats from the north end of Pocomoke Sound make landings for Crisfield, 2 miles northwestward.

Broad Creek, a crooked thoroughfare connecting the north end of Pocomoke Sound with Little Annemessex River, has a depth of 2 to 6 feet and width of 100 to 130 feet in a channel at present being dredged to 6 feet, and is extensively used by local boats. There is an oyster house on the east side at the southern entrance, and one in mid-channel just inside the entrance.

DIRECTIONS, POCOMOKE SOUND.

The following directions are good for vessels of 10 feet draft to Tunnel Island gas and bell buoy and 7 feet to Saxis Pier.

From southward.—From Old Plantation Flats lighthouse to the entrance of Pocomoke Sound, give the shore a berth of 2 miles or more, and when Watts Island lighthouse (white tower in clump of trees) is made, head for it on a 27° true (NE by N mag.) course until 3 miles from it and ¾ mile south-southwestward of buoy No. 1, on the northwest side at the entrance.

From northward.—Pass westward and ½ mile southward of buoy No. 12 and steer 105° true (ESE ⅛ E mag.) for 8½ miles, passing

¾ mile southward of buoy No. 1, on the western side at the entrance of Tangier Sound, and to a position ¾ mile south-southwestward of buoy No. 1, on the northwest side at the entrance.

From Pocomoke Sound entrance to Pocomoke River entrance.—From a position ¾ mile south-southwestward of buoy No. 1, steer 60° true (NE by E ⅞ E mag.) to the black buoy 1¼ miles south-southeastward of Watts Island lighthouse, leaving it ⅜ mile on the port hand; then steer 34° true (NE ⅜ N mag.) for 2¾ miles to the red buoy westward of Beach Island, leaving it 250 yards on the starboard hand, and then 20° true (NNE ⅜ E mag.) for 1¾ miles with a black buoy a little on the port bow. Pass ¼ mile eastward of it and steer 4° true (N ⅞ E mag.) to Tunnel Island gas and bell buoy.

Pass close to Tunnel Island gas and bell buoy and steer 17° true (NNE ⅛ E mag.) for ⅞ mile, passing well westward of a red buoy, then steer 32° true (NE ⅝ N mag.); pass 300 yards eastward of buoy No. 7 and continue the course for 1 mile past the buoy. Then steer 60° true (NE by E ⅞ E mag.) for 3½ miles, with Saxis Pier a little on the starboard bow to a position midway between the pier and the black buoy westward of it.

TANGIER SOUND,

on the eastern side of Chesapeake Bay, with its southern entrance about 48 miles above the entrance to the bay, is 30 miles long and 3 to 5 miles wide. It forms the approach to several important tributaries, and is frequented by bay steamers and schooners, the deepest draft being 12 feet and usual draft 6 to 8 feet. It is also frequented by a large number of boats engaged in the oystering and fishing industry. The sound is separated from Chesapeake Bay by a row of marshy islands and flats, through which several thoroughfares lead.

The main entrance is from southward and is marked by **Tangier Sound lighthouse** (white house on piles) and **Watts Island lighthouse** (white tower). A broad and deep channel leads from the south end to the tributaries at the north end. It is bordered by extensive flats, but the most prominent dangers are marked by buoys and lights, and the channel is easily followed by day with the aid of the charts. In the tributaries local knowledge or a pilot is necessary. The sound is also entered by vessels through Hooper and Kedges Straits, and by small boats from Pocomoke Sound through Broad Creek and Little Annemessex River.

The islands and thoroughfares on the east side, from Watts Island northward to Cedar Straits, are described under "Pocomoke Sound."

Tangier Island is low, sparsely wooded in the center, and bare on the north and south ends. A church spire near the center is prominent. There is a village (**Tangier post office**) in the center of the island and several smaller settlements, all composed of people engaged in oystering and fishing. Steamers from Baltimore make landings at a detached pier in the center of the cove at the south end of the island, with which there is communication with the shore by small boats. Just northward of the pier is a long wharf.

There are depths of 7 feet at the pier and wharf and this depth can be carried to them from anywhere eastward. The usual landing

for small boats is on the southwest side of the cove near the center of the island, westward of the large island on the east side. The wharf can be reached only at high water. The cove has depths of 1 to 2½ feet and is extensively used as an anchorage. There is a depth of 1 foot into it from southward and 2 feet from northward, the northern entrance being generally used. In entering from northward the best water leads midway between a small islet and a crab house 400 yards westward of it, then southward for 400 yards, then southwestward in mid-channel through the entrance. Gasoline and provisions are obtainable on the island, and there is communication with Crisfield by motor boat and steamer.

The **flats between Tangier Island and Smith Island** are usually bare at low water, and there is no thoroughfare through them except for small boats at high water.

Smith Island is the name applied to a large group of marshy islands separated by narrow thoroughfares; none of the islands are connected by bridges, and travel is entirely by boat. **Tylerton, Ewall,** and **Rhodes Point** are three small post villages on the island, all on the interior channels. All of the people are engaged in the oystering and fishing industry. There are stores at all of the villages, and gasoline is obtainable.

A draft of 5 feet at low water can be carried from Tangier Sound to Tylerton from southward. The best water leads across the flats about 1⅞ miles southward of **Horse Hammock Point** (marked by two shanties). In entering, head for **Herring Island** (marked by three shanties) on a west-southwesterly course until ½ mile from it, then follow the slough northward along Tylers Creek to Tylerton. The channel is sometimes marked by bush stakes, but is difficult without local knowledge. A channel has also been dredged 4 feet deep and 25 feet wide from Tangier Sound through **Big Thoroughfare** and **Tylers Ditch** to Tylerton. It is usually marked by bush stakes, but is difficult to follow without local knowledge. There are several thoroughfares, navigable by small boats at high water, leading from the interior of Smith Island westward into Chesapeake Bay, but local knowledge is necessary to follow them.

Little Annemessex River, on the eastern side of Tangier Sound, 13 miles northward of the entrance, is the approach to the town of **Crisfield,** a railroad terminus and important shipping point for sea food. It is frequented by a large number of boats of 2 to 6 feet draft engaged in the oystering and fishing industry, by steamers from Baltimore drawing 6 to 8 feet, and by some schooners, the deepest draft being 12 feet. A channel has been dredged 12 feet deep and 425 feet wide from the entrance to Somers Cove lighthouse, and the same depth and 266 feet wide to the steamboat wharf, and an anchorage basin 10 feet deep has been dredged above the steamboat wharf. The channel is marked by lights and buoys and is easily followed. **Janes Island lighthouse,** at the entrance, is a white house on piles. A fish factory and stack on the north point at the entrance are prominent. The mean rise and fall of tides is 1.9 feet.

Directions, Little Annemessex River.—From the perpendicularly striped bell buoy steer 52° true (NE by E ⅛ E mag.) with Great Point light a very little on the starboard bow, and leave a black buoy about 100 yards on the port hand. Leave Great Point light

about 75 yards on the starboard hand, and when past it steer about E (mag.), keeping buoy No. 4 on the starboard bow; when nearly up to this buoy stand so as to leave it 75 yards on the starboard hand. Then steer 113° true (SE by E ⅜ E mag.) for ¼ mile, and then steer 95° true (E by S mag.) with buoy No. 6 (which will be seen southward of Somers Cove lighthouse) a little on the starboard bow; leave this buoy 50 yards on the starboard hand and steer 44° true (NE ½ E mag.), so as to leave buoys Nos. 8 and 10 about 50 yards on the starboard hand and buoy No. 3 about 50 yards on the port hand. When abreast of buoy No. 10 head for the end of the steamboat wharf (marked by large freight house).

Anchorage at Crisfield can be had in a depth of 10 feet in the anchorage basin, the western limit being 150 yards westward of the end of the steamboat wharf and 120 yards westward of the end of the ice factory wharf (marked by triple stacks). Small boats make fast to the wharves or anchor anywhere outside the channel. There are depths of 7 to 12 feet in the cove on the south side of the steamboat wharf, and 4 to 8 feet in the basin eastward of the drawbridge at the eastern end of the cove, which is considerably used as an anchorage. The bridge has a draw opening 24 feet wide. The river above the wharves at Crisfield has a depth of 2 to 5 feet and is used only as an anchorage for small craft. Gasoline and provisions, and coal in limited quantities, are obtainable, and there is water on the wharves. There is a marine railway capable of hauling out vessels of 125 tons, 6 feet draft, and 100 feet length, and machine shop for ordinary repairs to motors.

Big Annemessex River, on the eastern side of Tangier Sound, 5 miles northward of Janes Island lighthouse, has a depth of 8 feet for 5½ miles above the mouth and 4 feet for a further distance of 2 miles, above which it is shoal. The river is frequented by small oyster and fishing boats and some schooners, the deepest draft being 8 feet. The mean rise and fall of tides is about 2 feet. **Fords Wharf** is on the north side, at the foot of a road 1½ miles from the post village of **Fairmount**. A depth of 6 feet can be taken to it. Two white buildings on the wharf are prominent. There is a wharf and some oyster and crab packing houses on the south side of **Jones Creek**, and a small village (**Coburn Landing**) on the east side of **Coburn Creek**, where there is a store and gasoline is obtainable.

The entrance to Big Annemessex River is marked by a light on the north side and by buoys. There are no marks above the entrance, and shoals make off for a long distance from many of the points. **To enter**, pass ⅜ mile southward of the light and steer 90° true (E ½ S mag.) for ¾ mile to a position midway between buoys Nos. 1 and 2, then steer 77° true (E ⅝ N mag.) for 2¼ miles until the white buildings on Fords Wharf bear north-northwestward, distant ½ to ¾ mile, then bring them astern on a south-southeasterly course and be guided by the chart.

Manokin River, on the eastern side of Tangier Sound, 17 miles northward of Tangier Sound lighthouse and eastward of Kedges Straits, is navigable to **Princess Anne**, a town on the railroad, 14 miles above the main channel of Tangier Sound. There are several small villages and landings in the tributaries in the lower end, and this part is frequented by many local fishing and oyster boats. The upper

end has some trade in small boats and schooners, the deepest draft being 7 feet. The mean rise and fall of tides is about 2.5 feet.

The entrance is broad, but is obstructed by extensive shoals. The main channel, entering along the southeast side, is narrow and crooked and has ample depth at the entrance, gradually shoaling to 7 feet at **Locust Point**, 9 miles above. It is well marked by buoys and lights to within 3 miles of Locust Point. For a distance of 2 miles above Locust Point a channel 6 feet deep and 100 feet wide has been dredged, but is subject to considerable shoaling. The dredged channel is sometimes marked by bush stakes, but leads between mud flats nearly bare at low water and is difficult to follow without local knowledge. From the upper end of the dredged channel the river has a depth of 5 feet or more in mid-channel to **Dashiells Wharf**, ¾ mile below Princess Anne, above which it is shoal.

Inverness is a post village on the south side of Manokin River between **Broad** and **Wolf Trap Creeks**. **Champ** is a post village a little northward of Locust Point.

Little Island Channel, entering Manokin River along the northwest side, has ample depth, but a middle ground having a depth of 5 feet must be crossed to reach the main channel of Manokin River. It is buoyed but is narrow and crooked, and difficult without local knowledge.

Little Island is low and marked by a single tree on the west end and oyster houses on the north end.

Deal Island, on the eastern side of Tangier Sound between Manokin and Wicomico Rivers, is the center of a considerable oystering and fishing industry. Deal Island at the north end and **Wenona** at the south end are post villages. Steamers from Baltimore make landings at a long wharf at the north end, which has a depth of 7 feet at the end. The flats between the end of the wharf and the main channel of Tangier Sound have depths of 10 to 14 feet and are used as an anchorage by small local vessels. The island is connected with the mainland by a fixed bridge. Gasoline and provisions are obtainable at Wenona or Deal Island, and there is a railway at Wenona capable of hauling out boats of 40 tons, 50 feet length and 5 feet draft.

Lower Thoroughfare, between Little Island and the south end of Deal Island, has been improved by dredging a channel 80 feet wide and 6 feet deep from westward to the wharf at Wenona, widened to 180 feet in the upper ¼ mile to form an anchorage. From the entrance buoys the channel leads to buoy No. 3, then east-northeastward, with the oysterhouse on the north end of Little Island a little on the port bow, until 180 yards from the island, and then northward with the wharf a little on the port bow. There is a depth of 1 foot around the northeast end of Little Island.

Laws Thoroughfare, between Deal Island and the mainland, has a depth of 2 feet from southward as far as the cove eastward of the northern end of the island, but navigation from northward is obstructed by a fixed bridge having a headroom of 3 feet at high water and a depth underneath it of 1 foot at low water.

Kedges Straits is described under a separate heading on page 222.

South Marsh, on the north side of Kedges Straits, is a low marsh with scattered clumps of trees and no buildings except a few oysterhouses.

Holland Island is low and sparsely wooded and has a prominent church spire. There is a village on the island (Hollands Island post office) composed entirely of oystermen and fishermen. The small wharves on the eastern side can be reached through Holland Straits. There are stores, but supplies are usually obtained from Deal Island, with which there is communication by motor boat.

Holland Straits, leading between Holland and Bloodworth Islands on the west and north and South Marsh on the south, is seldom used all of the way through, but is considerably used by local oyster and fishing boats from both ends as far as Holland Island. The usual draft using it is 2 to 5 feet and the deepest draft 8 feet. It has a depth of 11 feet from southward to abreast Holland Island and 4 feet from Holland Island northward and eastward into Tangier Sound. The channel is narrow in places and unmarked, and is difficult without local knowledge. **Spring Island** is low and marked by a shanty and a single tree on the north end.

Bloodworth Island is a marsh with scattered clumps of trees and has a few oyster and crab houses on the eastern side. There are no prominent marks. The waters surrounding it are frequented by many small local boats.

Wicomico River, emptying into the northeast end of Tangier Sound, is navigable for a distance of 20 miles above the entrance to the town of Salisbury. It is frequented by regular steamers drawing 6 to 8 feet and many freight schooners, the deepest draft being 10 feet. The lower end is also frequented by oyster and fishing boats.

The entrance is 1½ miles wide and is obstructed by extensive shoals, through which a narrow, crooked channel with a least depth of 8 feet leads. It is marked by **Great Shoals lighthouse** (white house on piles) and by buoys as far as Mount Vernon, 7½ miles above its junction with the main channel of Tangier Sound; but the channel is difficult, the buoys are often towed under at the strength of the tidal current, and strangers of a deeper draft than 6 feet are advised to take a pilot. Strangers of a less draft can enter with the aid of the chart and the buoys. A pilot can be obtained at Deal Island or in the vicinity of the mouth. The mean rise and fall of tides is 2.5 feet at the entrance and 3 feet at Salisbury. The water is fresh above White Haven and can be used in boilers.

To enter Wicomico River, pass 300 yards northward of buoy No. 10 and steer 67° true (ENE ½ E mag.), with Great Shoals lighthouse well on the starboard bow, for 3½ miles to buoy No. 2, passing well southward of a horizontally striped buoy. From buoy No. 2 steer 95° true (E by S mag.) with Great Shoals lighthouse a little on the port bow, and round it at a distance of 150 yards; then steer 45° true (NE ⅝ E mag.) for 600 yards to buoy No. 5, passing close to a 5-foot spot on the southeast side. Above this point the chart is the guide.

From Mount Vernon to within 2 miles of Salisbury the river has a depth of 10 feet or more and ample width. From there to Salisbury the channel has been improved by dredging to a depth of 9 feet, with a turning basin of the same depth 360 feet wide and 650 feet long at the upper end. There are extensive flats bare at low water between Mount Vernon and Salisbury, but they are covered by marsh grass in summer. Ice usually forms on the river as far

down as White Haven. In ordinary winters the channel is usually kept open by the regular steamers, except for short periods of time, but in severe winters it is often closed to navigation for extended periods. Vessels entering Wicomico River encounter strong tidal currents setting across the channel at the mouth of Monie Bay, and in winter heavy ice from it is a source of danger.

Dames Quarter is a post village on the south side of Wicomico River, just inside the mouth.

Monie Bay, a cove on the south side of Wicomico River, just inside the mouth, has a depth of 5 feet in the entrance and 3 feet in mid-channel to the head. It is frequented only by small local boats. Monie and Little Monie Creeks at the head are unimportant.

Mount Vernon is a small village on the south side of Wicomico River, 3 miles above Great Shoals lighthouse. **Mount Vernon Wharf**, at which the steamers land, is 1½ miles east-northeastward of the village.

White Haven is a post village on the north side of Wicomico River, 6½ miles above Great Shoals lighthouse. It has several oyster-packing houses and is frequented by many oyster and fishing vessels. Gasoline and provisions are obtainable, and there is a marine railway capable of hauling out vessels of 150 tons, 75 feet length, and 6 feet draft.

Wicomico Creek, on the south side of Wicomico River, 8½ miles above Great Shoals lighthouse, is navigable for small craft for several miles, and is sometimes used by motor boats and small schooners to the farm landings. In entering the creek the best water leads northward of a shoal making northward from the south side of the entrance, then southward of an islet in the mouth.

Salisbury, at the head of navigation on Wicomico River, has considerable trade in the regular steamers, and in schooners up to 10 feet draft. The river forks at the south end of the town. The north branch has been dredged 9 feet deep and 100 feet wide to a milldam ⅜ mile above the fork, with a turning basin at the head. It is crossed by a drawbridge just above the fork having a clear width of 30 feet. The east branch has been dredged by private enterprise, 80 feet wide and 9 feet deep, to the head of navigation ½ mile above the fork. It is crossed by two drawbridges having a least clear width of 40 feet. All kinds of supplies are obtainable at Salisbury, and there is a railway capable of hauling out vessels of 175 tons, 125 feet length, 5 feet draft forward and 10 feet aft, and shops for ordinary repairs to motors. Regulations prescribed for the bridges crossing both forks of the river at Salisbury require that they shall be opened to all vessels unable to pass under them within 3 minutes after a signal of 3 blasts at any time between 6 a. m. and 9.30 p. m., except between 6.30 and 7 a. m., 12 m. and 1 p. m., and 6 and 6.30 p. m., when they will remain closed.

Nanticoke River is described under a separate heading on page 223.

Fishing Bay, at the north end of Tangier Sound, has a depth of 12 feet in a narrow partially marked channel to **Fishing Point**, 6 miles above the entrance, and 7 feet can be carried anywhere in mid-channel to this point. Above Fishing Point the bay shoals rapidly to 3 feet in the upper end. **Elliott** is a post village on Fishing Point. A white oyster house with iron stack on the end of the point is prominent.

Pilots for Fishing Bay and the tributaries at the head can be had at Bishop Head or Fishing Point.

Blackwater River, at the northern end of Fishing Bay, has a depth of about 2 feet at the mouth and deeper water inside. It is said to be navigable for 15 miles or more, and is used by small vessels carrying produce and canned goods.

Transquaking River, emptying into the northern end of Fishing Bay, has a depth of about 2 feet at the entrance and deeper water inside for about 6 miles to a fork. The northern branch is called Transquaking River and the eastern branch **Chicacomico River;** both are said to be navigable for several miles and are frequented by small vessels carrying produce.

Hooper Strait is described under a separate heading on page 225.

DIRECTIONS, TANGIER SOUND FROM SOUTHWARD.

The general direction of the tidal currents is north and south, following the channel and diverging slightly off the entrances of the tributaries and straits. The velocity is greatly influenced by the force and direction of the wind. In the fall and winter long-continued northerly winds may lower the water as much as 2 feet below the normal, and this is important to vessels passing through Kedges and Hooper Straits and into Crisfield Harbor.

The following directions will lead in a depth of 15 feet or more to the junction of Nanticoke and Wicomico Rivers.

Entrance to Janes Island lighthouse.—Head for Tangier Sound lighthouse (white house on piles) on any course between 3° true (N ⅞ E mag.) and 45° true (NE ½ E mag.). Pass ¼ mile eastward of it and steer 14° true (N by E ¾ E mag.) for 4½ miles to a position ¼ mile eastward of buoy No. 1C, and then steer 358° true (N ⅜ E mag.) for 2¾ miles to a position ½ mile westward of Great Fox Island Shoal buoy. Then steer 11° true (N by E ½ E mag.) for 3⅞ miles, until ¾ mile west-northwestward of Janes Island lighthouse and ¼ mile westward of Janes Island Shoal buoy.

Janes Island lighthouse to Sharkfin Shoal lighthouse.—When Janes Island lighthouse bears east-southeastward, distant ¾ mile, steer 28° true (NE by N mag.) for 2½ miles and leave buoy No. 3 about 500 yards on the port hand. When the buoy is ½ mile distant on the port quarter, steer 327° true (NNW ⅜ W mag.), with Somers Cove lighthouse astern, for 4 miles to a position ⅜ mile westward of buoy No. 6. From here steer 341° true (N by W ⅛ W mag.) for 3 miles to a position ⅜ mile westward of buoy No. 8, and then steer 0° true (N ½ E mag.) for 5 miles, to a position ½ mile westward of buoy No. 10 and ¾ mile southeastward of Sharkfin Shoal lighthouse.

KEDGES STRAITS,

connecting Tangier Sound and Chesapeake Bay between Smith Island and South Marsh, has a least depth of 10 feet, and is used by many vessels of 6 to 9 feet draft bound from northward to points on Tangier Sound southward of Manokin River. It is marked by **Holland Island Bar lighthouse** (white house on piles) and **Solomons Lump lighthouse** (white house on pier) and by buoys, and is easy of navi-

gation by day with the aid of the chart. The islands adjacent to it are low and present no prominent marks. The mean rise and fall of tides is 1.7 feet, but the range is considerably affected by winds, easterly winds raising the water, and northwesterly winds lowering it sometimes as much as 2 feet below the normal. Floating ice in the winter makes the navigation of the straits dangerous, tugs from Baltimore being often employed to tow local vessels through the ice.

DIRECTIONS, KEDGES STRAITS.

These directions are good for a draft of 9 feet in the daytime when the water is not low.

From southward.—Steer for Holland Island Bar lighthouse on any bearing eastward of 354° true (N mag.) until Solomons Lump lighthouse bears anything southward of 84° true (E mag.). Then steer 62° true (ENE mag.) until Holland Island Bar lighthouse bears 284° true (WNW ¼ W mag.), passing northward of a black and white perpendicularly striped buoy.

From northward.—Give the islands north of the entrance a berth of 2 miles, and pass at least 1 mile westward of Holland Island Bar lighthouse and ½ mile southward of it, then steer 89° true (E ½ S mag.) until Holland Island Bar lighthouse bears 284° true (WNW ¼ W mag.).

When Holland Island Bar lighthouse bears 284° true (WNW ¼ W mag.), steer 104° true (ESE ¼ E mag.), keeping it on the bearing astern, and pass 250 yards northward of buoy No. 2, ¼ mile northward of Solomons Lump lighthouse, well northward of the horizontally striped buoy northward of the lighthouse, and 250 yards southward of buoy No. 1. Continue the course for 3 miles past Solomons Lump lighthouse and 2 miles past buoy No. 1, when the vessel will be in the channel of Tangier Sound.

NANTICOKE RIVER,

emptying into the northern end of Tangier Sound, has a depth of 9 feet to the town of Seaford, Del., at the head of navigation 36 miles above the mouth, and has considerable trade in steamers and schooners. The deepest draft entering is 12 feet and this draft is taken to Seaford at high water. Steamers from Baltimore make landings at the principal wharves as far as Seaford. Ice forms on the river in winter, but in ordinary winters the channel is kept open during most of the time by the regular steamers. Spring freshets do not interfere with navigation. Pilots can be obtained at Deal Island or Roaring Point.

The river from the **mouth to Wetipquin Creek**, a distance of 8 miles, is wide and is obstructed by extensive shoals, most of which are marked by buoys, but some local knowledge is required to keep in the best water. The channel has a least depth of 20 feet for 5 miles to Ragged Point. Between Ragged Point and Wetipquin Creek is an extensive middle ground with channels on either side. The main channel is on the western side and has ample width and a least depth of 9 feet, and should be used by strangers. The channel eastward of the middle ground has a depth of 7 feet and is used by

the regular steamers, but is narrow and difficult. It is sometimes marked by local aids maintained by the steamboat company.

From the mouth of **Wetipquin Creek to Sharptown**, 28 miles above the mouth, the river has ample width and depth and is easily followed, the mid-channel being clear. From **Sharptown to Seaford** there is a least depth of 9 feet, and the channel is narrow and difficult in places, and is unmarked. For a distance of 1¾ miles below Seaford a channel has been dredged 9 feet deep and 100 feet wide, with a turning basin at the head. The water is fresh above Vienna and can be used in boilers.

Sandy Point, on the west side, at the entrance, is marked by a prominent clump of trees.

Nanticoke is a post village on the east side, 3½ miles above Clay Island Shoal light. **Nanticoke Wharf**, on the south side of Roaring Point ¾ mile from Nanticoke, is visited by the regular steamers.

Bivalve is a post village on the east side, 6½ miles above Clay Island Shoal light. Steamers drawing 7 feet make landings at the wharf, but there is a shoal westward and northward of it, and local knowledge is necessary to carry this draft to the wharf.

Wetipquin Creek, on the east side, 8 miles above Clay Island Shoal light, has been improved by dredging a channel 9 feet deep and 120 feet wide from Nanticoke River to the wharf at the post village of **Tyaskin**, on the south side, just inside the mouth. A turning basin of the same depth has been dredged off the wharf. Gasoline and provisions are obtainable. The channel was marked in 1914 by bush stakes on the south side. The course in the channel is 136° true (SE ⅝ S mag.), heading for the white buildings on the wharf.

Wetipquin is a post village on the east side of Nanticoke River, 1½ miles above Wetipquin Creek. **Sandy Hill Landing** is at the foot of the road ½ mile from Wetipquin.

Quantico Creek, on the east side, 13 miles above Clay Island Shoal light, is shoal at the mouth, but is navigable for several miles and used by small boats to the farm landings and mills near the head.

Rewastica Creek, on the east side, just above Quantico Creek, is navigable for small boats for several miles, but is little used.

Vienna is a village and railroad station on the west side, 22 miles above the mouth. A railroad bridge having a center pier draw, each opening 60 feet wide, crosses the river at this point.

Riverton is a post village on the east side, just below the junction of Nanticoke River and Marshyhope Creek.

Marshyhope Creek (northwest fork of Nanticoke River) empties into the river 26 miles above the mouth. It has a depth of 6 feet for 14 miles above the mouth to within ½ mile of the town of **Federalsburg**, the upper 4¼ miles having been improved by dredging to a depth of 6 feet and width of 60 feet, with a turning basin at the head. The creek has some trade in small vessels, the deepest draft being 8 feet. The lower part is easy of navigation, but the upper end is difficult without local knowledge. **Brookview** is a post village 5 miles above the mouth, and there are several other small villages. Two bridges with draw openings 60 feet wide cross the creek between the mouth and Federalsburg.

Sharptown is a town on the east side of Nanticoke River, 28 miles above the mouth. It has several mills and canneries and consider-

able trade in schooners and steamers. There is a ship yard, and a marine railway capable of hauling out vessels of 1,000 tons, 200 feet length, 7 feet draft forward and 13 feet aft. A bridge having a center pier draw, each opening 75 feet wide with a headroom of 4 feet at high water when closed, crosses the river at Sharptown.

Broad Creek, emptying into Nanticoke River from eastward 3½ miles above Sharptown, has been improved by dredging a channel 8 feet deep and 70 feet wide to the head of navigation at **Laurel**, a town on the railroad 6½ miles above the mouth. Laurel has several mills and considerable trade in schooners and other vessels, the deepest draft being 9 feet. A railroad bridge, having a draw opening 40 feet wide and a height of about 21 feet when closed, crosses the creek at the lower end of the town. The dredged channel extends 230 yards above the railroad bridge, and small boats can go to a milldam ¼ mile above.

Bethel is a village on Broad Creek, 2½ miles below Laurel. It has a marine railway capable of hauling out vessels of 100 tons and 6 feet draft. A highway bridge having a draw opening 58 feet wide crosses the river at Bethel.

Seaford is a town on Nanticoke River, 36 miles above the mouth. It has several mills and canneries and considerable trade in steamers and schooners, the deepest draft being 12 feet. A railroad drawbridge, having a center pier draw with one opening 60 feet wide and a headroom of 4 feet at high water when closed, crosses the river near the lower end of the town. There is a strong cross current through the bridge. The dredged channel extends for 600 yards above the railroad bridge, to a highway drawbridge having a single opening 30 feet wide. There is a depth of about 7 feet for 1½ miles above the highway bridge, and small boats can go to a milldam about 5 miles above the bridge, but there is little business above Seaford. There are marine railways at Seaford, the largest capable of hauling out vessels of 400 tons, 12 feet draft, and 200 feet length. Gasoline and provisions are obtainable and there is water on the wharves.

Tides.—The mean rise and fall of tides is 2.5 feet at the entrance, 3 feet at Vienna, 2.6 feet in Marshyhope Creek, 3 feet at Laurel, and 3.4 feet at Seaford.

HOOPER STRAIT,

the most northerly entrance to Tangier Sound, leads between Hooper Island and **Bishop Head** on the north and Bloodworth Island on the south. It is used by all of the vessels from northward to the tributaries in the north end of Tangier Sound. It has a depth of 12 feet in a narrow crooked channel, but there are shoals with little depth close to it, and it is seldom used by vessels of a greater draft than 9 feet, the deepest draft usually passing through at high water. It is marked by Hooper Strait and Sharkfin Shoal lighthouses and by buoys, and strangers should be able to enter in the daytime by following the directions closely. The mean rise and fall of tides is 1.7 feet at Hooper Strait lighthouse and 2.2 feet at Sharkfin Shoal lighthouse. The tidal currents have considerable velocity, and in winter sailing vessels are in danger from running ice.

DIRECTIONS, HOOPER STRAIT.

From southward.—From a position 1 mile southeastward of Point Lookout lighthouse, make good a 37° true (NE ⅛ N mag.) course for 14 miles. Or, from a position 2½ miles westward of Holland Island Bar lighthouse, make good a 7° true (N by E ⅛ E mag.) course for about 9 miles. Or, from the red buoy 5 miles westward of Holland Island Bar lighthouse, make good a 27° true (NE by N mag.) course for 9½ miles. Or, with Point No Point lighthouse bearing 236° true (SW by W ½ W mag.), steer 56° true (NE by E ½ E mag.) about 9 miles from the lighthouse. When Hooper Strait lighthouse bears 73° true (E by N mag.) steer for it.

From northward.—Standing down the bay, pass ¾ mile westward and southwestward of Hooper Island lighthouse, and steer 118° true (SE by E mag.) for 5 miles until Hooper Strait lighthouse bears 73° true (E by N mag.).

When Hooper Strait lighthouse bears 73° true (E by N mag.), steer for it on this bearing, giving the southern end of Hooper Island a berth of over ¾ mile and leaving a red buoy ⅜ mile on the starboard hand. Pass 300 yards southward of the lighthouse and steer 115° true (SE by E ¼ E mag.) for 1 mile to buoy No. 4. Leave it about 250 yards on the starboard hand and steer 126° true (SE ¼ E mag.), passing 200 yards southward of a bell buoy. From this buoy steer 61° true (ENE mag.) for 1⅝ miles, passing northward of two red buoys; from the second buoy steer 99° true (ESE ⅝ E mag.) for 1 mile to a horizontally striped buoy, passing northward of it. From this buoy a southeasterly course for ¾ mile will lead to the main channel of Tangier Sound.

HONGA RIVER TO LITTLE CHOPTANK RIVER.

Honga River, on the eastern side of Chesapeake Bay, north of the western end of Hooper Strait, has a depth of 18 feet in a narrow crooked channel, marked by lights and buoys, for 11 miles above the mouth, above which it shoals rapidly to a depth of 2 to 4 feet at the head. Light-draft vessels should have no trouble in going to the head of the buoyed channel with the aid of the chart. It is frequented by regular steamers in the lower end, and local oyster and produce boats to the head, the deepest draft being 8 feet. The mean rise and fall of tides at the entrance is 1.6 feet.

Fox Creek, on the eastern side of Honga River, 3 miles above the mouth, has a depth of 8 feet to **Wingate Point Wharf**, at which steamers from Baltimore land. The channel is marked by buoys at the bends, and sometimes by bush stakes maintained by the steamboat company. **Wingate** is a post village 1 mile from the wharf.

Hooper Island consists of a row of three low islands separating Honga River from Chesapeake Bay. The islands are connected with the mainland and with each other by highway bridges, the two northern bridges having draw openings, and the southern one being fixed. **Applegarth** is a post village at the southern end. **Hoopersville** is a post village near the center of the middle island; steamers from Baltimore drawing 7 feet make landings at the wharf. The thoroughfare between the northern and middle islands is crossed by a drawbridge, and is navigable by small boats at low water.

Fishing Creek is a post village near the center of the northern island.

Tar Bay is a shallow bay between **Barren Island** and the northern end of Hooper Island. A very narrow, crooked channel leads from Chesapeake Bay across Tar Bay northward of Barren Island, and through Fishing Creek into the northern end of Honga River. It has a depth of about 4 feet, is marked by two lights and by bush stakes, and is considerably used by small local craft, but local knowledge is necessary to follow it. The lights form a range for the approach, and in entering the first is left to starboard and the second to port. Fishing Creek is crossed by a drawbridge.

Golden Hill is a post village at the northern end of Honga River, and can be reached by boats of 2 feet draft at low water.

A draft of 3 or 4 feet at high water can be carried from the northern end of Honga River through **Great Marsh Creek, Lower Keene Broad,** and **Upper Keene Broad** into Slaughter Creek, a tributary of Little Choptank River, but the passage should not be attempted by strangers. It is crossed by two fixed bridges having a headroom of about 4 feet at high water. This thoroughfare can be entered from Chesapeake Bay through a narrow thoroughfare about 3 miles northward of the northern end of Tar Bay; the entrance has a depth of about 3 feet at high water and is crossed by a fixed bridge having a headroom of about 4 feet at high water.

LITTLE CHOPTANK RIVER,

on the eastern side of Chesapeake Bay, 4½ miles southward of Sharps Island, is frequented by steamers from Baltimore and many local boats, the deepest draft being 9 feet. The river is obstructed by shoals, but has a depth of 14 feet in a narrow, crooked channel for 8 miles above the mouth and 6 feet for a considerable distance into most of the tributaries. Some of the shoals are marked by buoys, but strangers may have trouble in taking a greater draft than 6 feet above the mouth of Slaughter Creek. The channels in the principal tributaries are usually marked by bush stakes, but are narrow and crooked and difficult without local knowledge.

Oyster Bay, on the south side of Little Choptank River, just inside the entrance, has a depth of 3 feet in mid-channel to near the head, but is little used. There is a depth of 1 foot at low water through the thoroughfare between **James Island** and the mainland. James Island is subject to rapid erosion.

Slaughter Creek, on the south side of Little Choptank River, has been improved by dredging a channel 7 feet deep and 100 feet wide across the bar at the entrance, and has a depth of 6 feet in a narrow channel to the post village of **Taylors Island,** 2½ miles above the entrance. It is used by regular steamers and schooners up to 7½ feet draft. The dredged channel is marked by buoys and by bush stakes maintained by the steamboat company. There are also bush stakes above the entrance, but local knowledge is required to keep in the channel. A drawbridge having a clear opening 25 feet wide crosses the creek at Taylors Island; the creek shoals rapidly above the bridge, though small boats can pass through into Honga River at high water (see p. 226). Gasoline and provisions are obtainable at Taylors Island.

Brooks Creek, on the north side of Little Choptank River, has a depth of 6 feet in a narrow unmarked channel to within ¾ mile of the head. It is frequented only by small local craft.

Hudson Creek, on the north side of Little Choptank River, 6½ miles above the entrance, has a depth of 7 feet to near the head. Regular steamers drawing 6 feet go to **Speddens Wharf** near the head, ½ mile from the post village of **Hudson**. The channel is generally marked by bush stakes, but is difficult without local knowledge.

Madison Bay, on the southeast side, opposite Hudson Creek, has general depths of 6 to 8 feet, and about 2 feet to the post village of **Madison** at the head.

Fishing Creek, on the south side of Little Choptank River, 8 miles above the entrance, has a depth of 6 feet in a narrow channel for 4 miles above the mouth. There are no wharves on the creek, but it is extensively used by boats bound to Church Creek, the principal tributary. The channel is marked by buoys and bush stakes.

Church Creek, emptying into Fishing Creek, 2½ miles above the entrance, has a depth of 7 feet to **Milton Wharf**, near the post village of **Woolford**, 1½ miles above the mouth, and 3 feet for a farther distance of ½ mile to the foot of a road ½ mile from the post village of **Church Creek**. It is used by regular steamers and schooners of 6 feet draft as far as Milton Wharf.

Phillips, Beckwiths, Carey, and **Lees Creeks**, tributaries of Little Choptank River above the entrance of Fishing Creek, have no commercial wharves and little business by water except in small local boats.

Anchorage.—There is good anchorage in a depth of 12 to 18 feet in the bight between James Island and Hooper Point, if the shores be given a berth of ½ mile or more.

Supplies.—Gasoline, provisions, and water are obtainable at Taylors Islands, Madison, Woolford, and Church Creek.

Tides.—The mean rise and fall of tides in Little Choptank River is 1.5 feet.

Directions, Little Choptank River.—To enter from southward, pass westward of buoy No. 16F and steer north-northeastward for Sharps Island until ½ mile westward of James Point Shoal buoy No. 2, keeping outside the 4-fathom curve to avoid an area of possible fish traps. Pass close northward of buoy No. 2 and steer 114° true (SE by E ¼ E mag.) to buoy No. 4. Pass northward and well eastward of it and steer southward to buoy No. 3. Give it a good berth and steer southeastward, being guided by the chart, or take a pilot.

Vessels entering Little Choptank River from northward usually pass eastward of Sharps Island. To enter, follow the directions for entering Choptank River from northward to Blackwalnut Point Shoal light, then bring it astern on a 180° true (S ⅝ W mag.) course to the black buoy, 1¼ miles westward of Hills Point. Then steer 129° true (SE mag.) for 2 miles to buoy No. 4, passing southward of a black bell buoy. Then follow the directions in the preceding paragraph.

CHOPTANK RIVER,

on the eastern side of Chesapeake Bay 102 miles above the entrance and 43 miles below Baltimore, is navigable for a distance of 55 miles above the entrance, to the town of Greensboro. The river and its

tributaries are frequented by many oyster and fishing boats and steamers and schooners engaged in the bay trade, the usual draft of boats being 5 to 8 feet and the deepest draft 15 feet.

Channels.—The main entrance to Choptank River leads southward and eastward of Sharps Island. It has a least depth of 28 feet and is broad and easy of access. The channel northward of Sharps Island lighthouse has a least depth of 16 feet, and is used by all vessels from northward bound to or from Choptank or Little Choptank Rivers. The northern entrance is marked by buoys and lights, but should not be entered by strangers of a greater draft than 12 feet.

The main channel of Choptank River has a depth of 25 feet to Cambridge, 17 miles above Sharps Island, 12 feet for a further distance of 28 miles to within 3 miles of the town of Denton, and 8 feet to Denton. From Denton to Greensboro, 7 miles above, the river has been improved by dredging a channel 8 feet deep and 75 feet wide.

Steamers from Baltimore make regular landings at all the principal wharves on the river as far as Denton, 48 miles above the mouth, and at landings in Tred Avon River and La Trappe and Tuckahoe Creeks. There is railroad communication at Oxford, Easton, Cambridge, Denton, Greensboro, and Hillsboro.

Sharps Island, a low island marked by a single house, lies in Chesapeake Bay off the entrance, and Sharps Island lighthouse (brown tower on pier), 1 mile north-northwestward of Sharps Island, is the principal guide to the entrance. The island is subject to rapid erosion.

Tilghman Island, on the north side of the entrance to Choptank River, is the center of a large oystering and fishing industry. There are three post villages on the island—**Fairbank,** near the southern end, and **Avalon** and **Tilghman,** near the northern end. The western side is subject to rapid erosion. **Blackwalnut Cove,** at the southern end of Tilghman Island, has a general depth of 2 feet to Fairbank at the head, and is extensively used as an anchorage by small craft.

Tilghman Island Harbor, on the eastern side of the island, has a depth of 10 feet to the steamboat wharf at Avalon, and 5 to 8 feet between the steamboat wharf and the oyster-packing wharf 400 yards northward of it. Steamers from Baltimore drawing 8 feet make regular trips to the wharf, and the harbor is also frequented by many local boats of 3 to 7 feet draft. The approach to the steamboat wharf is marked by buoys and by a lighted range on the wharf. In entering, leave buoy No. 1, 100 to 400 years on the port side, buoy No. 2, 80 yards on the starboard side, then head for the end of the wharf.

Knapps Narrows, at the northern end of Tilghman Island, has a depth of 3½ feet at high water. The channel is usually marked by bush stakes, but is difficult without local knowledge. It is crossed by a fixed bridge having a headroom of 4 feet at high water.

Harris Creek, on the north side of Choptank River, just inside the entrance, has a depth of 12 feet in a narrow, crooked channel for 5½ miles above the mouth, 6 feet for a further distance of 2 miles, and 1 foot to **McDaniel** railroad station at the head. It is frequented by oyster and produce boats, and small craft bound to the railroad station at McDaniel. The channel is marked by buoys for 3 miles above the mouth, above which the mid-channel is clear if the points be given

a good berth. **Sherwood** is a post village on the west side, 4 miles above the entrance.

Tripps Bay, on the south side of the entrance to Choptank River, 4½ mile east-southeastward of Sharps Island, is shoal and little used, except by small oyster and fishing boats.

Broad Creek, on the north side of Choptank River, 7 miles northeastward of Sharps Island, has a depth of 18 feet for 5 miles above the mouth and 6 feet to near the heads of most of the tributaries. There is a depth of 3 feet to **St. Michaels**, a town with railroad communication and with its main water front on Miles River. The creek is frequented only by local oyster and produce boats and boats bound to St. Michaels. The channel is marked by buoys at the entrance, and some local knowledge is required to keep in the best water above. **Balls Creek**, on the west side, just inside the entrance, has a depth of 6 feet to the head; the entrance is narrow and is usually marked with posts and barrels on each side; **Neavitt Wharf** is on the south side, just inside the entrance, and **Neavitt** is a post village at the head.

Irish Creek, just eastward of the entrance to Broad Creek, has a depth of 8 feet in the entrance and 6 feet to near the head. The entrance is narrow and is usually marked by bush stakes, but is difficult without local knowledge. The creek is frequented only by small local craft.

Tred Avon River, on the north side of Choptank River, 9 miles above Sharps Island, has a depth of 16 feet for 5 miles above the mouth and 12 feet for a further distance of 2 miles, above which it has been improved by dredging a channel 8 feet deep and 150 feet wide to **Easton Point**, 1 mile from the town of **Easton**. Steamers from Baltimore drawing 8 feet make regular trips as far as Easton Point, and many schooners and motor boats also frequent the river. **Choptank River lighthouse** (white house on piles) is in mid-channel off the entrance. A draft of 12 feet at low water can be taken into the entrance on either side of the lighthouse by giving it a berth of 400 yards or more, but the channel eastward of the lighthouse is the wider and deeper. There are no marks above the entrance except bush stakes maintained by the steamboat company, and the channel in the upper end is difficult without local knowledge.

Oxford is a town on the east side of Tred Avon River, 1½ miles above the entrance. There is a depth of 15 feet at the wharves on the north side of the town and 6 to 9 feet at the railroad wharf at the south end. The town has railroad communication. Storm warnings are displayed here. **Town Creek**, on the eastern side of Oxford, has a depth of 8 feet in mid-channel for ¼ mile above the entrance and is extensively used as an anchorage by local craft. There is a railway on the creek capable of hauling out boats of 3 feet draft forward and 5 feet aft.

Bellevue is a village on the west side of Tred Avon River, ¾ mile northward of Oxford. Several oyster-packing houses are prominent. There is a depth of 8 feet at the wharf.

Double Mills is a steamer landing on the western side, 3 miles above Oxford.

Island Creek, 1¼ miles eastward of Choptank River lighthouse, has a depth of 6 feet in a narrow unmarked channel through the entrance,

and this depth can be taken to near the head. The best water favors the eastern side at the entrance.

Lecomptes Bay, on the south side of Choptank River, 3 miles above Choptank River lighthouse, has a depth of 8 feet to **Travers Wharf**, a steamer landing at the south end. The point on the west side at the entrance is marked by a windmill on a red water tank.

La Trappe Creek, on the north side of Choptank River, 3½ miles above Choptank River lighthouse, has been improved by dredging a channel 11 feet deep and 150 feet wide across the bar at the entrance, and 8 feet deep and 75 feet wide to the head of navigation at **Trappe Landing**, 3 miles above the mouth, with a turning basin at the head. It is frequented by regular steamers and schooners up to 9 feet draft. The channel is marked by two lights at the entrance and a buoy just inside the entrance. In entering, leave the outer light 100 feet on the port side, the inner light 100 feet on the starboard side, then follow a mid-channel course to the head. **Trappe** is a post village 1½ miles from Trappe Landing.

Dickinsons Bay, just eastward of **Howells Point**, has depths of 3 to 5 feet and is little used.

Cambridge, a town on the south side of Choptank River, 17 miles above the mouth, has considerable trade in bay steamers and schooners and is the center of a large oystering and fishing industry. The deepest draft going to the town is 13 feet.

Cambridge Harbor is a creek ⅔ mile long on the eastern side of the town. A channel has been dredged to a depth of 12 feet from Choptank River to the railroad wharf on the eastern side of the harbor, 400 yards above the entrance to the creek. The width is 150 feet, widened to 400 feet abreast the steamboat wharf on the western side of the entrance to the creek. The entire area of the creek outside the 12-foot channel has been dredged to a depth of 8 feet as far as a drawbridge just above the railroad wharf, and a channel of this depth has been dredged for 600 yards above the bridge. The bridge is a center-pier draw, each opening 45 feet wide, with a headroom of 5 feet at high water when closed. The entire harbor is considerably congested by small boats during the oyster season.

The channel into Cambridge Harbor is marked by buoys and a lighted range. There is a strong current across the channel on both ebb and flood. To enter, bring the bell buoy astern on a 245° true (WSW ⅜ W mag.) course, following the range to the steamboat wharf (marked by red wharf house). The front range is on a white box and is plainly visible by day a little to the left of the steamboat wharf, but the rear range is not conspicuous by day. A good day range is to keep a church spire in the town midway between the two chimneys of an old house on the shore; the spire shows only a little above the trees at the outer end of the dredged channel, and disappears at the inner end. Pass 50 yards southeastward of the steamboat wharf and enter the creek in mid-channel.

Bolingbroke Creek, on the north side of Choptank River, 1¾ miles eastward of Cambridge, has a depth of 3 feet across the bar at the mouth and 6 feet inside to the head. There are no wharves except for small boats.

Warwick River, on the east side of Choptank River, 5 miles above Cambridge, has been improved by dredging a channel 10 feet deep

and 100 feet wide from Choptank River to **Secretary Landing**, a post village at the head of navigation 1 mile above the mouth, and had a depth of 9 feet in 1915. It is frequented by many local craft and by regular steamers of 8 feet draft, but the channel is marked only by bush stakes and is difficult without local knowledge.

Cabin Creek, on the east side of Choptank River, 7 miles above Cambridge, has a depth of 6 feet for ¾ mile above the mouth and 2 feet for a further distance of ¾ mile. There are no wharves and it is frequented only by a few grain schooners and small local craft.

Hunting Creek, on the east side of Choptank River, just below the village of Choptank, has a depth of 4 feet in the entrance and about 2 feet to near the post village of **Ellwood**, 2½ miles above the entrance. It is little used.

Choptank is a village on the east side of Choptank River, 10½ miles above Cambridge. It is visited by steamers from Baltimore, and schooners, the deepest draft being 10 feet. **Windy Hill** is a steamboat landing on the west side of the river, 1 mile above Choptank.

A railroad bridge, having a center pier draw with one clear opening 60 feet wide, crosses the river 7 miles above Choptank. A highway bridge having a center pier draw, each opening 60 feet wide, with a headroom of 3 feet at high water when closed, crosses the river ¾ mile above; the eastern opening is the one generally used. **Dover Bridge** is a steamboat landing on the west side, just below the highway bridge.

Tuckahoe Creek, on the west side of Choptank River 41 miles above the mouth, has a depth of 8 feet to **Waymans Wharf**, 8½ miles above the entrance. The channel from Waymans Wharf to **Rolphs Landing**, 1 mile above, has been improved by dredging to a depth of 8 feet and width of 50 feet, and there is a depth of about 1 foot at low water and 3 feet at high water to **Hillsboro**, a town on the railroad 1¾ miles above Rolphs Landing. Steamers from Baltimore drawing 9 feet go to Waymans Wharf, and there is little business above, except in small motor boats. The channel is not marked and is crooked and difficult in places without local knowledge. The flats are covered with marsh grass in summer. A highway bridge having a single draw opening 39.6 feet wide crosses the creek 1 mile above the entrance.

Two Johns and **Williston** are small settlements on the east side of Choptank River, 1¾ and 2¼ miles, respectively, above Tuckahoe Creek.

Denton is a town on the east side of Choptank River 48 miles above the mouth. There is a depth of 8 feet to the town and the deepest draft going to it are steamers from Baltimore and schooners up to 9 feet draft. **West Denton** is on the west side of the river opposite Denton, and all of the wharves are on that side. Two drawbridges cross the river at Denton; the lower, a highway bridge, has a single lift opening 50 feet wide and 4 feet headroom at high water, and the upper, a railroad bridge, has a center-pier draw, both openings about 50 feet wide, with a headroom of 4 feet at high water.

Greensboro is a town at the head of navigation 7 miles above Denton. It has some trade in a freight steamer and schooners, the deepest draft being 8½ feet.

Pilots.—There are no regular pilots for Choptank River, but a pilot for the lower end of the river or the tributaries can be obtained

from Tilghman Island, and for the upper end from Cambridge. Pilots for the tributaries can also usually be obtained near their entrances.

Supplies.—Coal and water can be obtained on the wharves at Cambridge, and coal in limited quantities at Oxford and Denton. Gasoline and provisions are obtainable at Tilghman Island, Oxford, Cambridge, Secretary Landing, Choptank, Denton, and Greensboro, and there are stores at several other places where some supplies are obtainable.

Repairs.—There are machine shops at Cambridge and several railways, the largest capable of hauling out vessels of 150 tons, 100 feet length, 4 feet draft forward and 7 feet aft. There is a railway at Oxford for hauling out vessels of 150 tons, 90 feet length, 3 feet draft forward and 5 feet aft.

Tides.—The mean rise and fall of tides is 1.3 feet at the entrance, 1.9 feet at Cambridge, and 2.5 feet at Denton. The water is fresh above Choptank and can be used in boilers.

DIRECTIONS, CHOPTANK RIVER.

The western limit of fish traps on the eastern side of the bay between Bloody Point Bar lighthouse and the southern end of Hooper Island is the 5-fathom curve. A lane approximately ½ mile wide at the inner end and ¾ mile at the outer end is kept clear of fish traps in the channel leading northward of Sharps Island; the northeastern limit is a line from buoy No. 1 to Blackwalnut Point Shoal light, and the southwestern limit is a line leading to Sharps Island Northeast Shoal buoy (horizontally striped) on a 137° true (SE ¾ S mag.) bearing. The deepest draft that can be safely taken into the entrance through this lane is 10 feet. Between the entrance to Little Choptank River and Cooks Point, the western limit of fish traps is a line drawn from the black buoy 1¼ miles westward of Hills Point, to the red buoy 1¼ miles southeastward of Sharps Island, thence to buoy No. 1 B, eastward of Blackwalnut Point. The southern limit between the entrances of Harris Creek and Tred Avon River is the 21-foot curve.

The channel is marked by buoys and lights from the mouth to the town of Choptank 27½ miles above, and is easily followed with the aid of the chart. There are no marks above Choptank, but the mid-channel is clear to the mouth of Tuckahoe Creek, and the channel is easily followed if the points be given a good berth. Between the mouth of Tuckahoe Creek and Greensboro the channel is narrow and crooked and is difficult without local knowledge.

The following directions are for vessels of 12 feet draft to Cambridge. Vessels of a deeper draft should take a pilot. If bound above Cambridge, take a pilot or be guided by the chart.

From southward.—From Sharps Island gas and bell buoy steer 50° true (NE by E mag.) to the red buoy on the middle ground eastward of Sharps Island, passing eastward of Sharps Island south end buoy. Pass close westward of the middle ground buoy, and steer 82° true (NE ½ N mag.) with Cooks Point Shoal buoy well on the starboard bow, and pass ½ mile westward and ¼ mile northward of it; the black buoy 2 miles east-southeastward of Blackwalnut Point is ahead on this course.

From northward.—From Poplar Island Shoal gas and bell buoy, steer 159° true (S by E ¼ E mag.), with Sharps Island lighthouse ahead until 1¼ miles from it, then steer 117° true (SE by E mag.), leaving Sharps Island lighthouse ¾ mile on the starboard hand to a position 300 yards southward of Blackwalnut Point Shoal light; the outer 1¼ miles of this course leads across an area of possible fish traps. Then steer 71° true (ENE ⅞ E mag.) for 2 miles to a position ¼ mile northward of Cooks Point Shoal buoy.

Cooks Point to Cambridge.—From Cooks Point Shoal buoy, steer 86° true (E ¼ S mag.) for Choptank River lighthouse until ⅝ mile from it, then steer 123° true (SE ½ E mag.) for 3 miles, leaving the lighthouse ⅜ mile on the port hand, the red buoy off Castlehaven 250 yards on the starboard hand, and continuing the course for 1¼ miles past the buoy. Then bring Chlora Point astern on a 152° true (S by E ⅞ E mag.) course for 1½ miles, passing westward of the black buoy ¾ mile northwestward of Howells Point, and continuing the course for ½ mile past the buoy until the end of Horn Point bears 281° true (WNW ⅜ W mag.). Then bring it astern on a 101° true (ESE ⅜ E mag.) course to the black buoy southeastward of Howells Point. Pass southward of this and steer 97° true (ESE ¾ E mag.) to a position 300 yards north-northeastward of Hambrooks Bar light; from here a 139° true (SE by S mag.) course will lead eastward of the red buoy eastward of Hambrooks Bar, and to the bell buoy at the entrance of the channel to Cambridge. Anchorage can be had in the channel or on the flats off the town.

EASTERN BAY AND MILES RIVER.

Eastern Bay, on the eastern side of Chesapeake Bay, 34 miles below Baltimore, is the approach to Miles River and several less important tributaries, and to the towns of Claiborne and St. Michaels. It is frequented by a large number of oyster and fishing boats and schooners carrying grain and produce. Regular steamers go to Claiborne, just inside the entrance. The deepest draft of boats entering the bay is 13 feet, and this draft is taken above St. Michaels.

The bay is obstructed by extensive shoals, but a broad channel with a least depth of 30 feet leads through it to the mouths of most of the tributaries. The channel is well marked by buoys and lights through Eastern Bay and Miles River to a drawbridge 5½ miles above St. Michaels, and strangers should have little trouble in following the channel with the aid of the chart to near the bridge. The other tributaries are not well marked, and are seldom entered by strangers except in small craft. The shores are low and present no prominent marks. Pilots for Eastern Bay and tributaries can be obtained from Claiborne, or from local boats which can always be found working in the bay.

The **main entrance** to Eastern Bay, between the south end of Kent Island and Poplar Island, has a broad and unobstructed channel with ample depth. **Bloody Point Bar lighthouse** (brown cylindrical tower) is the principal guide to the entrance. Vessels of 6 feet draft can also enter through Poplar Island Narrows, and boats of 3½ feet draft at high water through Kent Island Narrows.

Poplar Island, on the south side of the main entrance to Eastern Bay, is low and sparsely wooded and has no prominent marks.

Valliant is a post office on the island. **Poplar Island Harbor,** on the eastern side, has a depth of 5 feet in the entrance, and there is secure anchorage inside in a depth of 3 to 7 feet.

Poplar Island Narrows, between Poplar Island and the mainland, has a depth of 9 feet, but there are unmarked shoals with little depth close to the channel, and 6 feet is the deepest draft using it. To enter, give the western side of Tilghman Island a berth of ⅝ mile to Popular Island Narrows light, pass 250 yards eastward of it and steer 7° true (N by E ¼ E mag.) to a position ¼ mile westward of the horizontally striped buoy off Haddaway Cove, then steer north-northeastward, giving the eastern shore a berth of at least ½ mile to Claiborne.

Haddaway Cove, 2 miles eastward of Poplar Island, has a depth of 6 feet in mid-channel to **Lows Wharf** at the head. Steamers from Baltimore drawing 6 feet make regular trips to Lows Wharf, and the cove is extensively used as an anchorage by local craft. To enter, pass 100 yards southward of the horizontally striped buoy on the north side of the entrance, and steer for the end of the wharf on a 96° true (ESE ⅞ E mag.) course. **Sherwood** is a post village ½ mile from the wharf.

Claiborne is a village and summer resort on the southeast side of Eastern Bay, 5 miles eastward of Bloody Point Bar lighthouse. It is the terminus of a railroad to **Ocean City,** Md., and intermediate points; steamers from Baltimore and Annapolis make connections with the trains. There is a railroad pier extending 800 feet west-southwestward from the shore, and a jetty extending 750 feet west-southwestward from the end of the pier. A channel has been dredged 12 feet deep and 300 feet wide, east-northeastward along the south side of the jetty to the end of the pier, and 12 feet deep and 195 feet wide along the south side of the pier for a distance of 500 feet from the end; in 1915 there was a depth of 10 feet to the head of the channel. There is a short wharf 250 feet southward of the railroad pier, to which a privately dredged channel 12 feet deep leads. Gasoline and provisions are obtainable and there is water on the wharf.

In entering, pass northward and eastward of buoy No. 2A, and steer southeastward to the gas and bell buoy. Pass 75 feet westward and southward of this and steer east-northeastward for the end of the pier.

Cox Creek, on the north side of Eastern Bay and the southeast side of Kent Island, has a depth of 10 feet for 5 miles above **Long Point** on the western side at the entrance, and 6 feet for some distance into the three tributaries at the head. It is frequented by oyster boats and schooners carrying produce and grain, the deepest draft being 8 feet. There are several farm landings, but no villages. The shoals are unmarked and local knowledge is required to avoid them.

Crab Alley Bay, on the north side of Eastern Bay 2½ miles northward of Tilghmans Point, has a depth of 21 feet into the entrance and 6 feet to near the head of navigation in both branches. The shoals are unmarked and local knowledge is required to avoid them. **Bodkin Island,** on the western side, is thickly wooded and has no buildings visible. **Parsons Island,** on the eastern side, is sparsely

wooded, giving it a ragged appearance, and has an unpainted barn showing clear of the woods and a white house visible at times.

Kent Island Narrows, a narrow slough connecting the northern end of Eastern Bay with Chester River between Kent Island and the mainland, has a depth of 2½ feet at low water and is extensively used by local craft up to 3½ feet draft. It is crossed by two drawbridges, a railroad bridge having a single clear opening 38 feet wide and a highway bridge having a single clear opening 44 feet wide. There is a railroad station at the bridges (**Narrows Station**) from which considerable sea food is shipped. Gasoline is obtainable here. The signal for both bridges is three blasts of a whistle or horn, to be answered by three blasts from the bridges if they can be opened immediately, or one blast if they can not be opened immediately. The draws will be opened at all times between one hour before sunrise and one hour after sunset unless a train is approaching or passing. There is a depth of 6 feet from Eastern Bay to the northern end of the narrows, but there are shoals at its outlet into Chester River. The channel is narrow in places and is usually marked at its northern end by bush stakes.

To enter Kent Island Narrows from Eastern Bay, pass ½ mile eastward and northeastward of Parsons Island, sparsely wooded and marked by a house and barn, and steer for the buildings at the narrows on a 353° true (N mag.) course until abreast of **Hog Island** (marshy and bare of trees). From Hog Island steer eastward to the mouth of **Marshy Creek** and then northward, 100 yards off the point on the north side, and favor the eastern side to the bridges. From the bridges favor the eastern side of the narrows to the northern end, then steer about E by N (mag.), passing 100 yards northward of **Long Point**, marked by a clump of pine trees ¼ mile from the end.

Tilghmans Creek, on the eastern side of **Tilghmans Point**, has a depth of 10 feet in the entrance and 11 to 13 feet inside and is extensively used as a harbor for small local vessels. The entrance is very narrow and is marked by buoys.

Greenwood Creek, on the eastern side of Eastern Bay 2¾ miles east-northeastward of Tilghmans Point, has a depth of 6 feet for 2 miles above the mouth. The best water leads along the eastern shore in approaching the entrance.

Miles River, the most important tributary of Eastern Bay, has a depth of 18 feet to abreast the town of St. Michaels 6 miles above Tilghmans Point, 9 feet to a drawbridge 5½ miles above St. Michaels, and 6 feet for a further distance of 2 miles. The river has considerable trade carried in small boats, freight steamers, and schooners, the deepest draft being 13 feet. The channel is well marked by lights and buoys as far as the bridge, and strangers should have little trouble in following the channel with the aid of the chart to within 1½ miles of the bridge, above which some local knowledge is necessary.

Wye River is on the north side of Miles River 2½ miles southeastward of Tilghmans Point. The river has several branches, which are frequented by small local boats and grain and produce schooners up to 9 feet draft. There are several farm landings on the creek. The main entrance is eastward of **Herring Island** (a small spot of marsh and sand nearly submerged at high water) and has ample depth and width. There is also a depth of 9 feet across the shoal

⅜ mile northward of Herring Island. The entrance is marked by buoys. There are no marks above, but strangers should have no trouble by keeping in mid-channel and giving the points a good berth.

The river forks 2 miles above Herring Island. The north branch (Wye River) has a depth of 13 feet for 3 miles above the fork to the western end of Wye Narrows, and 8 feet for a further distance of 3 miles. The eastern branch (**Wye East River**) has a depth of 12 feet for 5 miles above the fork, to the eastern end of Wye Narrows. **Wye Narrows**, connecting Wye East River with Wye River, has a least depth of 7 feet. It is crossed by an unused bridge having an opening 40 feet wide, which is left open, and a highway drawbridge with a single opening 47 feet wide and a headroom of 5 feet at high water.

Woodland Creek, just eastward of the mouth of Wye River, can be entered only by small boats at high water, and is not used.

St. Michaels, a town with railroad communication on the southwest side of Miles River, 14 miles above the entrance to Eastern Bay, is the center of a large oystering and fishing industry. Gasoline and provisions are obtainable, and there is a railway capable of hauling out vessels of 80 tons, 7 feet draft aft and 4 feet forward. The long wharf on the north side of the entrance to the harbor has a depth of 6 feet at the end and is marked by red oyster houses. The short wharf on the north side of the inner harbor, known as the steamboat wharf, has a depth of 7 feet and is marked by white wharf houses. There is a depth of 10 feet in midharbor to near the head. To enter, pass eastward and southward of the red buoy ¾ mile northeastward of the wharves, and bring the southern end of Fairview Point (thickly wooded) astern on a 240° true (SW by W ⅞ W mag.) course, heading for the red houses on the wharf. Pass 60 yards southeastward of the ends of the wharves in entering the inner harbor.

Leeds Creek, on the northeast side of Miles River 1 mile eastward of St. Michaels, has a depth of 8 feet in mid-channel to the small village of **Tunis Mills**, 2½ miles above the entrance. Schooners of 6 to 8 feet draft go to Tunis Mills. The channel at the entrance is marked by buoys, and above the entrance the mid-channel is clear.

Hunting Creek, on the north side of Miles River 3 miles above St. Michaels, has a depth of 8 feet for 1½ miles above the entrance, but is little used. There are no marks, but the mid-channel is clear.

The **highway drawbridge** crossing Miles River 5½ miles above St. Michaels, has a lift opening 40 feet wide, with a headroom of 6 feet at high water underneath the fixed span.

Tides.—The mean rise and fall of tides is 1.2 feet at Poplar Island and 1.3 feet at St. Michaels.

DIRECTIONS, EASTERN BAY AND MILES RIVER.

From southward.—From Poplar Island Shoal gas and bell buoy, steer for Bloody Point Bar lighthouse on a 21° true (NNE ½ E mag.) course for 2⅛ miles, until the northern end of Poplar Island bears 100° true (ESE ½ E mag.), then steer 54° true (NE by E ⅝ E mag.) for 7¾ miles, passing ¼ mile southward of the black

buoy southeastward of Kent Point, ¼ mile northward of the red buoy off the entrance to Claiborne, and 100 yards southward of the black buoy 1½ miles westward of Tilghmans Point. Then steer 49° true (NE by E mag.) to Tilghmans Point Shoal buoy, and round it at a distance of ¼ mile.

From northward.—Round Bloody Point Bar lighthouse at a distance of ½ mile and steer 108° true (SE by E ¾ E mag.) to a position ¼ mile southward of the black buoy southeastward of Kent Point, then steer 54° true (NE by E ⅜ E mag.) and follow the directions in the preceding paragraph.

Tilghmans Point to St. Michaels.—From a position ¼ mile northeastward of Tilghmans Point Shoal buoy, steer southeastward for ⅞ mile to a black buoy; pass close westward of it, and steer 169° true (S ⅜ E mag.) for 2 miles, heading for Herring Island Shoal light and passing eastward of a horizontally striped buoy and 100 yards eastward of a red buoy. Pass 250 yards westward of the light and steer southeastward for ½ mile to a red buoy. Leave it 100 yards on the starboard hand and steer 149° true (SSE ⅛ E mag.) for 1⅛ miles, to a red buoy northward of Deep Water Point. Leave this 100 yards on the starboard hand and follow the buoyed channel to the entrance of St. Michaels Harbor, passing 200 yards westward of Fairview Point light and 100 yards eastward of a red buoy. Good anchorage can be had in the channel off St. Michaels, southward or southwestward of the red buoy. To enter the harbor see the description of St. Michaels preceding.

CHESTER RIVER,

on the east side of Chesapeake Bay 21 miles below Baltimore, is navigable for a distance of 40 miles above the entrance, and is the approach to the railroad terminus at Love Point, and the towns of Queenstown, Centerville, Chestertown, and Crumpton, and many landings. It is frequented by steamers from Baltimore and schooners carrying grain and produce, besides many smaller boats, the deepest draft being 13 feet.

The main entrance to Chester River is from northward, and leads between the northern end of Kent Island and East Neck Island. **Love Point lighthouse** (white house on piles) is the principal guide to the entrance. The entrance has a depth of 24 feet in a narrow channel, and the width of the channel with a depth of 18 feet is 1 mile. The river can also be entered by small boats through Kent Island Narrows.

The main channel of Chester River has a depth of 18 feet for 22 miles above Love Point lighthouse to within 4 miles of Chestertown, 11 feet to Chestertown, and 7 feet for a farther distance of 8 miles to Crumpton. The river above Crumpton has been improved by dredging a channel 6 feet deep and 60 feet wide for a distance of 5 miles to within ¾ mile of the town of Millington, but the channel is subject to considerable shoaling. There is a depth of 1 foot at low water and 3½ feet at high water to Millington.

Steamers from Baltimore make regular trips to all landings on the river as far as Crumpton and connect with the trains at Love Point. There is railroad communication at Love Point, Kent Island Narrows, Queenstown, Centerville, Chestertown, and Millington.

Love Point, at the north end of Kent Island, is a summer resort and the terminus of a railroad to **Lewes** and **Rehoboth**, Del. There are two long wharves; the southern wharf is the landing for steamers from Baltimore making connection with the trains.

Stevensville is a town on the railroad 3 miles southward of Love Point, and **Chester** is a village and railroad station 1½ miles eastward of Stevensville.

Macum and **Piney Creeks**, on the northeast side of Kent Island, are shoal and used only as anchorages for small local craft.

Kent Island Narrows is described on page 236.

Jackson Creek, on the south side of Chester River 1¼ miles eastward of Kent Island Narrows, has a depth of 4 feet to the wharf at the south end and is used as an anchorage by oyster boats. The channel is marked by buoys.

Winchester Creek, 1¼ miles eastward of Long Point, has a very narrow entrance nearly bare at low water, and a depth 5 to 8 feet inside. It is used as an anchorage by local craft. **Winchester** (Fords Store post office) is a village and railroad station ¼ mile from the head of the creek.

East Neck Island, on the east side of Chester River at the entrance, is sparsely wooded, the only prominent mark being a clump of trees on the end of **Hail Point** at the southeast end. **Bogles Wharf** is a steamboat landing on the east side. **East Neck Island Narrows**, at the northern end, has a depth of about 1 foot, is crossed by a fixed bridge, and is little used.

Queenstown Harbor, on the southeast side of Chester River, 7½ miles above Love Point lighthouse, has been improved by dredging a channel 10 feet deep and 200 feet wide across the bar at the entrance, and has a depth of 8 to 11 feet off the wharves and 7 feet for ¾ mile above. The dredged channel is marked by buoys and lights, the outer light forming a range with a light on the northern wharf for the outer end of the dredged channel. There are three wharves at **Queenstown**, the northern one marked by a grain elevator and the southern by red freight houses. Steamers from Baltimore make regular trips to the wharves.

To enter Queenstown Harbor, pass between the buoys at the entrance and steer 128° true (SE mag.), with the outer light in range with a light on the south gable of a low wharf house about 125 feet to the right of the grain elevator. Follow this course to the outer light leave the two lights 100 feet on the port hand, then head for the wharves.

Tilghman Creek, on the eastern side of Chester River, 1 mile northward of Queenstown Harbor, has a depth of 1½ feet across the bar close along the western end of the island in the mouth, and 6 to 8 feet inside. It is seldom entered.

Reed Creek and **Grove Creek** have a common entrance on the eastern side of Chester River, 12 miles above Love Point lighthouse. There is a depth of 10 feet in the entrance, 8 feet in Reed Creek for 1 mile above the fork, and 6 feet in Grove Creek for ½ mile above a very narrow entrance. Schooners of 6 to 8 feet draft enter the creeks, but the channels are not marked and local knowledge is necessary. A house and barn on the east side at the entrance are prominent.

Corsica River, on the east side of Miles River 13 miles above Love Point lighthouse, has a depth of 7½ feet to Centerville Landing, 5

miles above the entrance and ¾ mile from the town of Centerville. The river for a distance of 1 mile below Centerville Landing has been improved by dredging a channel 8 feet deep and 100 feet wide. The shoalest place is off **Town Bar Point**, just inside the entrance, where the channel is narrow and has a depth of 7½ feet. There are buoys to mark the principal shoals and the river is easy of navigation as far as the beginning of the dredged channel, above which there are no marks and navigation is difficult without local knowledge.

To enter, pass westward and ¼ mile northeastward of the red buoy on the south side at the entrance, and steer 106° true (ESE mag.) to the red buoy off Town Bar Point. Pass close northward of the buoy and follow a general mid-channel course, giving the points a good berth, to the beginning of the dredged channel just above Fort Point. From here the best water leads 200 feet off the end of Sycamore Point and the same distance off the ends of the two points on the south side above Sycamore Point, then southward along the wharves.

Centerville, ¾ mile from Centerville Landing, has railroad communication. Gasoline can be obtained at the wharves and provisions from the town.

Church Creek, on the west side of Chester River at the eastern end of East Neck Island Narrows, has a depth of 4 feet in the entrance and 6 feet inside to near the head, but is little used.

Greys Inn Creek, on the west side of Chester River 12 miles above Love Point lighthouse, has a depth of 8 feet to a small settlement on the western side 2½ miles above the entrance. It is frequented by schooners up to 8 feet draft. There are shoals on both sides at the entrance, and a middle ground 1 mile above. These can be avoided by passing close eastward of the black buoy off the entrance, and heading for the end of the wharf at **Spring Point**, on the south side, on a 315° true (NW ⅝ N mag.) course until ¼ mile from it, and then shaping the course to pass 50 yards off the wharf. There are no marks above the entrance, but the mid-channel is clear above Spring Point.

Langford Creek, on the northwest side of Chester River 12 miles above Love Point lighthouse, has a depth of about 12 feet across the bar at the entrance, and deeper water to the fork 2½ miles above. **East Fork** has a depth of 10 feet for 3 miles and 6 feet for a farther distance of 1½ miles, and **West Fork** a depth of 10 feet for 2¾ miles and 6 feet for a farther distance of ¾ mile into either of the two branches at the head. There are no villages on Langford Creek or its tributaries, but there are several farm landings, from which produce and grain are shipped in motor boats and schooners. The principal shoals in the creek as far as the fork are marked by buoys, and strangers of 6 feet or less draft should have no trouble in following the channel with the aid of the chart. There are no marks above the fork. An unmarked shoal extends from **Cacaway Island**, at the fork, southwestward to mid-channel, and above this the mid-channel is clear in both branches if the points be given a good berth.

Cliffs Point, on the northwest side of Chester River 1½ miles northeastward of the entrance to Corsica River, is marked by a symmetrical clump of trees on the end and a wharf on the east side, at which steamers from Baltimore land. There is a depth of 8 feet

at the wharf and the best water in approaching it is from southward, passing a little eastward of the black buoy off the point. Steamers also make landings at **Upper Spaniard Point Wharf**, opposite Cliffs Point, and at numerous other wharves between that point and Chestertown.

Southeast Creek, on the east side of Chester River 21 miles above Love Point lighthouse, has a depth of 4 feet in the entrance and 3 feet for 2 miles above to within 300 yards of a landing at the fork, 2 miles from the village of **Church Hill**. It is used by motor boats and a few small vessels of 3 to 5 feet draft. The best water in entering is along the north side. **Island Creek**, on the south side ½ mile above the entrance, has a depth of 3½ feet in the entrance and 6 feet inside to a bridge 2 miles above.

Chestertown is a town on the west side of Chester River 26 miles above Love Point lighthouse. It is visited by regular steamers and schooners up to 10 feet draft. A drawbridge having a center pier draw, the east opening 52 feet wide and the west opening 38 feet wide, crosses the river here.

Morgan Creek, on the northwest side of Chester River 2 miles above Chestertown, has a narrow crooked channel with a depth of 6 feet for 2¾ miles above the mouth. The channel at the mouth is a narrow slough leading between flats nearly bare at low water, and is usually marked by bush stakes. Above the entrance the midchannel is clear. The creek is crossed by a drawbridge ¾ mile above the mouth. It is entered by schooners of 5 to 7 feet draft.

Crumpton, on the south side of Chester River 34 miles above Love Point lighthouse, is visited by regular steamers and schooners, the deepest draft being 8 feet. A drawbridge having a center pier draw, either opening 35 feet wide with a headroom of 4 feet at high water, crosses the river here.

Millington, a village and railroad station at the head of navigation on Chester River 40 miles above the mouth, can be reached only by small motor boats and has little business by water. Boats of 5 feet draft can go to within ¾ mile of the town at low water.

Supplies.—Gasoline and provisions can be obtained at Queenstown, Centerville, Chestertown, and Crumpton. There is water on the wharf at Chestertown, and coal in limited quantities can be obtained there.

Towboats are used only during the fruit season.

Pilots.—There are no regular pilots for Chester River or tributaries but many of the local boatmen are competent pilots. Strangers bound above Corsica River or into any of the tributaries should take a pilot, making signal for one while below Queenstown, or coming to anchor in the entrance of the tributaries with signal set until one comes off from shore.

Ice.—The river is usually closed to navigation for extended periods during ordinary winters. During mild winters the channel is kept clear by the regular steamers during most of the time.

Tides.—The mean rise and fall of tides is 1.1 feet at the entrance, 1.3 feet at Queenstown, 1.9 feet at Chestertown, and 2.4 feet at Crumpton. The water is fresh above Chestertown and can be used in boilers.

DIRECTIONS, CHESTER RIVER.

The channel is marked by buoys as far as Crumpton. From the mouth to the entrance of Corsica River, 13 miles above, the channel has ample width and is easily followed. From Corsica River to Chestertown the channel is narrow in places, and there are unmarked shoals close to it. Strangers of a greater draft than 6 feet are advised to take a pilot if going above Corsica River. Between Chestertown and Crumpton the channel is very narrow in places, with broad flats on either side nearly bare at low water. It is marked by buoys but is difficult without local knowledge; the channel is more easily followed at low water. There are no marks above Crumpton and local knowledge is required.

The following directions are for vessels of 15 feet draft to Queenstown Harbor and 10 feet draft to the entrance of Corsica River:

From southward.—Pass ¾ mile eastward of Sandy Point lighthouse and bring it astern on a 45° true (NE ⅝ E mag.) course, until Love Point lighthouse bears 111° true (SE by E ½ E mag.), then steer 85° true (E ⅛ S mag.) to a position ⅜ mile northward of Love Point Shoal buoy, and pass ¼ mile eastward of it. On this course both ebb and flood currents have a southerly set.

Vessels of 10 feet or less draft can pass anywhere between Love Point Shoal buoy and the lighthouse, being careful to give the lighthouse a berth of ¼ mile when southeastward of it; and vessels of 5 feet or less draft can cross the shoal anywhere from 200 yards to ½ mile southwestward of the lighthouse. The entire shoal is an area of possible fish traps and strangers are advised to pass northward of Love Point Shoal buoy.

From northward.—Pass ⅜ mile westward of the red buoy 1¾ miles westward of Swan Point, and steer 147° true (SSE ⅜ E mag.) for 4⅜ miles, with Love Point lighthouse well on the starboard bow, to a position ¼ mile eastward of Love Point Shoal buoy.

From entrance to Queenstown.—From a position ¼ mile eastward of Love Point Shoal buoy, steer 187° true (S by W ¼ W mag.) to a position ¼ mile westward of buoy No. 1, then steer 145° true (SSE ½ E mag.) for 2 miles to a position 300 yards northeastward of buoy No. 4. From buoy No. 4 steer 121° true (SE ⅝ E mag.) for 2 miles, passing well southward of a black buoy and 400 yards southward of buoy No. 5. From here a 64° true (ENE ¼ E mag.) course will lead to the buoys at the entrance to Queenstown Harbor.

Queenstown to Corsica River entrance.—From a position ⅜ mile westward of the red buoy at the entrance to Queenstown Harbor, steer 340° true (N by W ⅛ W mag.) for 2¾ miles, passing ¼ mile eastward of the black buoy off Hail Point, and to a position 200 yards westward of the red buoy westward of Piney Point. Then steer 30° true (NE ¾ N mag.) for 2¼ miles to a position 150 yards southeastward of a horizontally striped buoy, and then steer 45° true (NE ⅝ E mag.) for the end of Cliffs Point, until up with the red buoy on the south side of the entrance to Corsica River.

SWAN CREEK AND ROCK HALL HARBOR.

Swan Creek is on the eastern side of Chesapeake Bay, 5 miles northeastward of Love Point lighthouse. The approach, which is also the approach to Rock Hall Harbor, is from southward, eastward

of Swan Point Bar. It has a depth of 10 feet to **Deep Landing (Gratitude post office)** on the east side of the entrance to the creek, and 6 feet for 1¼ miles above in a narrow unmarked channel. The channel is marked by buoys as far as Deep Landing, to which point steamers from Baltimore of 6½ to 8 feet draft make regular trips. A channel 10 feet deep has been dredged across Swan Point Bar about ⅜ mile southward of Swan Point. The channel is subject to rapid shoaling, and strangers are advised to use the main entrance around the south end of Swan Point Bar.

Rock Hall Harbor, on the eastern side of the approach to Swan Creek, has been improved by dredging a channel 12 feet deep and 150 feet wide to **Rock Hall Wharf** at the head of the harbor, but no further work is being done and the channel has shoaled to a depth of about 8 feet and is not marked. The harbor is used by many motor boats and small vessels of 3 to 6 feet draft. **Rock Hall** is a village ½ mile eastward of the wharf.

Huntingfield Creek, just southward of Rock Hall Harbor, has depths of 1 to 3 feet and is used only as an anchorage for small craft.

Tavern Creek, just eastward of Swan Point, has a depth of 2½ feet on the bar at the entrance and 6 feet inside for ½ mile. The best water in entering leads along the western side of Little Neck Island.

To enter Swan Creek from southward, pass westward and northward of the red buoy ⅝ mile northeastward of Love Point lighthouse and bring the lighthouse astern on a 33° true (NE ½ N mag.) course to the black buoy at the southeast end of Swan Point Bar. Or from northward, pass westward of the red buoy 1¾ miles westward of Swan Point and the black bell buoy 2½ miles northward of Love Point lighthouse, and steer south-southeastward until Love Point lighthouse bears 213° true (SW ½ S mag.), then bring it astern on a 33° true (NE ½ N mag.) course, which will lead to the black buoy on the southeast end of Swan Point Bar.

Passing eastward of this buoy a 344° true (N ¾ W mag.) course for 1¾ miles will lead to a position westward of the red buoy on the south side of the entrance to Rock Hall Harbor. To enter Rock Hall Harbor, pass 300 yards northward of the red buoy and steer 55° true (NE by E ½ E mag.) in the dredged channel, heading for the white houses on the wharf. Or to go to Deep Landing, from a position westward of the red buoy, steer 358° true (N ½ E mag.) for 1 mile, passing eastward of a black buoy and westward of a red buoy; then head north-northeastward for the end of the wharf.

CHESAPEAKE BAY ABOVE PATAPSCO RIVER.

Chesapeake Bay extends for 30 miles above the entrance of Patapsco River to the mouths of Northeast and Susquehanna Rivers. It is frequented by passenger and freight steamers and tugboats and barges from Baltimore to landings on the tributaries, besides many vessels bound through the Chesapeake & Delaware Canal, the approach to which is through Elk River and Back Creek. The usual draft of boats frequenting this part of the bay is 5 to 8 feet and the deepest draft 12 feet. All of the tributaries in the upper end of the bay are usually closed to navigation by ice for extended periods during the winter. There are no regular pilots, but local boatmen

can usually be obtained at the entrances of the tributaries who are competent to act as pilots. **Towboats** can be obtained from Baltimore.

There are extensive shoal areas in the northern end of the bay, many of them having fish weirs on them in season. Many of the shoals northward of Pooles Island are rocky and should be avoided even by small craft. A broad **channel**, with a least depth of 18 feet and well marked by buoys, leads along the eastern side of the bay from Chester River entrance to the mouth of Elk River. The northern end of this channel above Pooles Island is used by all vessels bound to the tributaries at the upper end; the part southward of Pooles Island is used mostly by vessels through the Chesapeake & Delaware Canal, bound to and from points southward of Baltimore. But most of the business in the upper end of the bay is to and from Baltimore, and the generally used route leads from the eastern end of Brewerton Channel, east-northeastward to the gas buoy southward of Pooles Island, northeastward in the channel along the eastern side of Pooles Island until on the Pooles Island range, then eastward across the middle ground on the range into the main channel. The least depth by this route is 12 feet, but it leads close to 10 and 11 foot spots. Directions from Chesapeake City to Baltimore and southward are given under "Inside Route, New York to Norfolk." on page 261.

Fish weirs are prohibited at a greater distance from shore than 800 yards, northward of Gunpowder River on the western side and Sassafras River on the eastern side. Between Gunpowder River and the channel leading to Baltimore on the western side, and between Sassafras River and Tolchester Beach on the eastern side, they are prohibited in water exceeding 20 feet in depth.

Tolchester Beach is a pleasure park on the eastern side of Chesapeake Bay, 5 miles north-northeastward of Swan Point and 7¼ miles, 77° true (E ½ N mag.), from Craighill Channel range front light. It is connected with Baltimore by steamer in summer. With local knowledge a draft of 10 feet can be taken across the shoals from the eastern end of Brewerton Channel northward of Craighill Channel range front light to the wharf, but strangers should not follow this route with a greater draft than 6 feet. It leads across an area of possible fish traps.

Fairlee Creek, on the eastern side of Chesapeake Bay, 2¾ miles east-southeastward of Pooles Island, has a depth of about 4 feet across the bar at the entrance and for 1¾ miles above. It is frequented only by produce boats of 3 to 5 feet draft. The entrance is very narrow and has very strong tidal currents. There are no marks for entering.

Worton Creek, on the eastern side of Chesapeake Bay, 3½ miles eastward of Pooles Island, has a depth of 9 to 12 feet in the broad bight at the mouth, and 7 feet in the creek to **Buck Neck Landing**, 1½ miles above the entrance. The channel is narrow in the upper part of the creek and is unmarked. Steamers from Baltimore of 6 to 7 feet draft make regular trips to Buck Neck Landing and to **Worton Manor (Gales Wharf)**, on the northeast side, at the entrance. The channel off Worton Manor affords good anchorage in easterly winds for vessels of 10 feet or less draft.

Still Pond, a bight on the eastern side of Chesapeake Bay, 6 miles above Pooles Island, has depths of 8 to 11 feet, and is a safe anchor-

age for small craft in easterly winds. **Stillpond Creek,** emptying into the bight from eastward, has a depth of 1½ feet across the bar at the entrance and 6 feet inside for some distance. **Church Creek,** emptying into the bight from southward, has a depth of 3 feet in the entrance and deeper water inside. Both creeks are used by small produce boats. There is a wharf 1½ miles northeastward of Still Pond from which considerable grain and produce are shipped.

Sassafras River, on the eastern side of Chesapeake Bay, 10 miles above Pooles Island, is the approach to the towns of Betterton, Fredericktown, and Georgetown, and has considerable trade in steamers, schooners, and barges, the deepest draft being 10 feet. It has a depth of 12 feet to Fredericktown, 8½ miles above **Grove Point** on the north side at the mouth, 8 feet for a farther distance of 1½ miles to **Wilson Point Wharf,** and 5 feet to a landing 1 mile above. The channel is broad and straight for a distance of 3 miles above Betterton, above which it is crooked and narrow in places, but the principal shoals are marked by buoys as far as Fredericktown, and strangers of 6 feet or less draft should have no trouble in following the channel with the aid of the chart. Strangers of deeper draft should take a pilot at Betterton. The channel above Fredericktown is narrow in places and unmarked, and is difficult without local knowledge. The mean rise and fall of tides is 1.9 feet at Betterton and 2.3 feet at Georgetown.

Betterton is a summer resort on the south side of Sassafras River, 2¼ miles eastward of Howell Point. It is connected with Baltimore, Havre de Grace, and Philadelphia by steamer. There are depths of 11 feet at the outer ends of the two steamboat wharves and the approach is clear. The buildings on the shore and wharves are prominent. Gasoline and provisions are obtainable.

Lloyds Creek, on the south side of Sassafras River, 2 miles east-southeastward of Betterton, has depths of 1 to 3 feet inside and is seldom entered. It is separated from Sassafras River by a low sand spit.

Turner Creek, on the south side of Sassafras River, 4½ miles above Betterton, has a depth of 7 feet to a landing at the foot of a road just inside the mouth, and 6 feet in a narrow channel for ½ mile above. Some produce is shipped from here in schooners and barges. The entrance is narrow and unmarked.

Back Creek, on the north side of Sassafras River, 6 miles above Betterton, has a depth of 7½ feet in the entrance, and 5 feet in a narrow unmarked channel for 1½ miles above. It is little used.

Island Creek, on the south side of Sassafras River, 7½ miles above Betterton, has a depth of 6 feet in a narrow unmarked channel for ½ mile above the entrance. There are no wharves and little business by water.

Fredericktown and **Georgetown** are towns on opposite sides of Sassafras River, 9½ miles above Betterton. They are connected by a highway bridge having a center pier draw, each opening 45 feet wide, with a headroom of 5 feet at high water. The towns are connected with Baltimore by steamer, and are visited by tug boats and barges up to 10 feet draft. Boats of 7 feet draft carrying produce and fertilizer go 2½ miles above at high water. Gasoline and provisions are obtainable at both places. There are depths of 7 feet at the wharves at Fredericktown and 12 to 18 feet at Georgetown.

Pond Creek and **Pearce Creek**, 3½ and 5 miles, respectively, northeastward of the entrance to Sassafras River, can be entered only by small boats at high water and are not used.

Elk River, emptying into the head of Chesapeake Bay from northeastward, 16 miles above Pooles Island, is important as the approach to the western end of the Chesapeake & Delaware Canal. There is also some business to **Elkton**, a town at the head of navigation on Elk River, 14½ miles above the mouth. It has a depth of 16 feet for 7 miles to the mouth of Back Creek, and 7 feet for a farther distance of 6½ miles to the intersection of Elk and Little Elk Rivers, 1 mile below Elkton. Channels 7 feet deep and 80 feet wide have been dredged for a distance of 1,200 feet above the fork, in Elk River, and 2,000 feet above the fork, in Little Elk River to a fixed bridge at the head of navigation; in 1915 dredging was in progress by private enterprise to extend the 7-foot depth in Elk River to the mills at Elkton. The upper end is subject to rapid shoaling.

The channel in Elk River from the mouth to Back Creek is broad and easily followed. Above Back Creek it is crooked and narrow in places. It is marked by buoys for a distance of 3½ miles above the mouth of Back Creek, above which it leads between flats, bare at low water and covered by marsh grass in summer. Strangers should have no trouble in taking a draft of 5 feet at low water to the junction of Elk and Little Elk Rivers with the aid of the chart. Above that point local knowledge is necessary. The mean rise and fall of tides is 2.1 feet at the entrance and 2.6 feet at Elkton Landing.

Turkey Point, on the west side, at the entrance to Elk River, is a sparsely wooded bluff with abrupt slopes on the south end. The most prominent mark is Turkey Point lighthouse, a white tower on the highest part of the bluff.

Bohemia River, on the east side of Elk River, 4 miles above the entrance, has a depth of 7 feet for 3¾ miles to the junction of Little Bohemia and Great Bohemia Creeks and 6 feet for a distance of 1½ miles in **Little Bohemia Creek** and 2½ miles in **Great Bohemia Creek**. A highway drawbridge crosses the river ½ mile below the fork. The channel is broad and easily followed for a distance of 2 miles above the entrance, above which it is narrow and crooked, and difficult without local knowledge. The river and the creeks at the head are frequented by grain and produce boats, the deepest draft being 9 feet and usual draft 3 to 6 feet.

Town Point Wharf is on the eastern side of Elk River, 5½ miles above the entrance. Steamers between Baltimore and Philadelphia make regular stops. There is a depth of 10 feet at the end.

Back Creek is the approach to the western end of the Chesapeake and Delaware Canal at Chesapeake City, and is described on page 255. Directions for Back Creek and Elk River are given on page 261.

Elkton, at the head of navigation on Elk River, is on the main line of the Pennsylvania Railroad. It has several industrial plants and considerable trade in schooners and barges up to 8 feet draft, which go to the intersection of Elk and Little Elk Rivers and discharge their cargoes on lighters to a draft of 5 feet, the deepest draft that can ordinarily be taken to the town at high water. Gasoline, provisions, water, and coal in limited quantities are obtainable. A fixed bridge having a clear headroom of 9 feet at high water crosses

the river at Elkton. Motor boats lay just above and below the bridge in a depth of 3 to 5 feet, and there is no navigation above.

Northeast River empties into the northern end of Chesapeake Bay 5 miles north-northeastward of Turkey Point. The approach to the river leads westward of Turkey Point and between the western side of **Elk Neck** (high and thickly wooded) and the extensive flats westward. There is a depth of 12 feet to the mouth of the river, and 7 feet anywhere in mid-channel for a distance of 3½ miles above the mouth, above which there are mud flats nearly bare at low water, through which a channel has been dredged to the town of Northeast. In 1914 the dredged channel had shoaled to a depth of 2½ feet at the lower end and was marked by posts at the entrance, upon which lights are sometimes maintained by local people. Above the posts the channel is well defined by the marsh on each side. The mean rise and fall of tides is 2.5 feet.

Charleston is a village and railroad station on the western side of Northeast River 2½ miles above the entrance.

Northeast, a town with railroad communication at the head of navigation on Northeast River 4½ miles above the entrance, is frequented only by small local craft, the deepest draft being 5 feet, which can be taken to the town only at a good high water. Gasoline and provisions are obtainable and there is a railway capable of hauling out boats of 40 feet length and 4 feet draft.

To enter Northeast River, pass ¼ to ½ mile westward of Turkey Point and follow the high wooded shore northeastward to the entrance, passing ¼ mile westward of the points. The river is clear anywhere in mid-channel from the entrance to the beginning of the dredged channel. Pass close to the posts marking the entrance to the dredged channel, then follow the main stream in mid-channel to the wharves at Northeast.

A channel leads from the entrance of Northeast River westward, close along the north shore, to the mouth of Susquehanna River at Havre de Grace. It has ample depth except at the eastern end, where the depth is 3 feet, and the western end, where the depth is 5 feet. The shoalest part of the flats is covered with marsh grass, which serves to mark the channels. The position and depth of the channel is subject to considerable change by the freshets and ice gorges from the Susquehanna River. In 1914 the best water in entering from Northeast River led 200 yards southeastward and southward, and 100 yards southwestward of Carpenter Point, then followed the north shore closely until ¾ mile westward of the point on the west side of **Principio Creek**, then led westward for the wharves at Havre de Grace.

Susquehanna River, emptying into the head of Chesapeake Bay from northwestward, is the approach to the towns of Havre de Grace and Port Deposit. The approach to the river is a narrow channel leading between broad flats nearly bare at low water, and has been improved by dredging to a depth of 15 feet and width of 200 feet as far as Havre de Grace, but is subject to considerable shoaling; in June, 1915, it had a least depth of 13½ feet. There is a depth of 11 feet from Havre de Grace to the head of navigation at Port Deposit. The channel as far as Havre de Grace is marked by Fishing Battery and Havre de Grace lighthouses and by buoys. There are no marks above but the channel is easy of navigation.

Ice gorges and freshets are of frequent occurrence in Susquehanna River during the breaking up of the ice in the spring, the water at Port Deposit sometimes rising to a height of 15 to 18 feet above the normal high water, and causing considerable damage. The position and depth of the channels are subject to considerable change through these causes. The river is usually entirely closed to navigation for a period of about three months in winter. The mean rise and fall of tides is 2.1 feet.

Fishing Battery lighthouse, 350 yards eastward of the dredged channel near the lower end, is a light on a white dwelling, with another building and a few trees near it and a large area of marsh grass around it.

Havre de Grace, on the western side, at the entrance to Susquehanna River, is on the main line of the Pennsylvania and Baltimore & Ohio Railroads, and is connected with Betterton and Baltimore by steamer. There are depths of 6 to 10 feet at the wharves. Gasoline, provisions, water, and coal in limited quantities are obtainable.

A **rock** with a depth of 5½ feet over it, and marked by a red and black horizontally striped buoy at its southern end, lies ⅛ mile off the wharves at Havre de Grace and about ¼ mile below the lower bridge. The generally used channel for vessels bound through the bridges leads about 100 yards eastward of the buoy. There are said to be several rocks between this rock and the wharves westward, which require local knowledge to avoid.

Three **bridges** cross Susquehanna River in the vicinity of Havre de Grace. The lower one, a highway bridge ¾ mile northward of Havre de Grace lighthouse, has a center pier draw across the channel on the western side of Garrett Island, each opening 100 feet wide, with a headroom of 26 feet at high water when closed. The bridge is fixed on the eastern side of Garrett Island and has a headroom of 26 feet at high water.

The **Pennsylvania Railroad bridge,** 150 feet above the highway bridge, has a center pier draw across the channel on the western side of Garrett Island, each opening 100 feet wide with a headroom of 52.4 feet at high water when closed. The bridge is fixed on the eastern side of Garrett Island and has a headroom of 52.4 feet at high water. The east opening in both draws is generally used by vessels bound north and the west opening by vessels bound south. A towboat is stationed at Havre de Grace by the railroad company to assist sailing vessels through the bridges.

The **Baltimore & Ohio Railroad bridge,** ¾ mile above the Pennsylvania Railroad bridge, is fixed on both sides of Garrett Island and has a headroom of 87 feet at high water. The main channel leads through the second opening from the western side of Garrett Island.

Perryville is a town on the eastern side of Susquehanna River, opposite Havre de Grace. A draft of about 10 feet at low water can be carried from the main channel off Havre de Grace, across the middle ground anywhere from 200 yards to ½ mile southward of the lower bridge, into the channel leading to Perryville, and this is the course usually followed by all vessels bound to Perryville that can pass under the lower bridges. Vessels which can not pass under the lower bridges must pass westward and northward of Garrett Island, then southward to the town.

Garrett Island, just above Havre de Grace, is high and wooded, with no prominent marks.

Port Deposit is a town on the northeast side of Susquehanna River, 3½ miles above Havre de Grace. It has railroad communication and is connected with Baltimore by steamer. There is a depth of 11 feet to abreast the town, and 6 to 9 feet at the wharves. Gasoline and provisions are obtainable. The deepest draft of vessels going there are tugboats and barges up to 12 feet draft carrying stone from the quarries in this vicinity. Small boats can go a short distance above Port Deposit, but the channel is obstructed by rocks and should not be attempted by a stranger.

Directions, Susquehanna River.—These directions are good for a draft of 10 feet to Havre de Grace:

Passing 200 yards northeastward of the black and white perpendicularly striped buoy 1¼ miles westward of Turkey Point lighthouse, steer 320° true (NNW ⅞ W mag.), heading for Fishing Battery lighthouse, for 2½ miles until about 200 yards eastward of the black buoy off Locust Point. Pass 50 yards northward of the buoy and steer 267° true (W ⅜ N mag.) for ½ mile, with the red buoy on the eastern side of the entrance to the dredged channel well on the starboard bow until southward of it, then haul north-northwestward, passing 50 yards westward of the buoy, and follow the dredged channel northward for 3 miles, passing 350 yards westward of Fishing Battery lighthouse and leaving the buoys at a distance of about 60 yards. There is marsh grass on the shoalest part of the flats on both sides. From the first buoy above Fishing Battery lighthouse to the upper end of the buoyed channel, Havre de Grace lighthouse will be a little on the port bow. Pass 300 yards eastward of the lighthouse and, if bound to Havre de Grace, keep 100 yards off the ends of the wharves.

If bound to Port Deposit, from abreast Havre de Grace lighthouse steer northward to the red and black horizontally striped buoy marking a 5½-foot rock ⅛ mile off the wharves, pass 100 yards eastward of the buoy and then head for the draw in the lower bridge. From the second bridge, follow the western shore of Garrett Island at a distance of about 225 yards to the upper bridge, pass through the middle of the second opening from the western side of Garrett Island, and steer 6° true (N by E ⅛ E mag.), with a stone quarry on the eastern bank a little on the port bow, until ¼ mile from the bank, then steer northwestward, hauling gradually in to a distance of ⅛ mile from shore and following it at this distance to the wharves at Port Deposit.

Swan Creek, on the western side of Chesapeake Bay, 3½ miles below Havre de Grace, has a depth of about 5 feet in a narrow, unmarked channel to near the head, and is little used.

Spesutie Narrows, between Spesutie Island and the mainland westward, has a least depth of 2½ feet and is considerably used by small local craft. The best water leads eastward of an islet near the northern end, and southward of it the mid-channel is clear.

Romney Creek, on the western side of Chesapeake Bay, 6 miles northeastward of Pooles Island, has a depth of 6 feet in a narrow unmarked channel for 3 miles above the mouth and 2 feet for a farther distance of 1½ miles. It is used only by small boats. A

clump of trees on **Taylors Island** and a house and barn on the western side of Little **Romney Creek** are the only prominent marks. There is an unmarked rocky patch, with a least depth of ½ foot ¾ mile south-southeastward of the entrance, and the best water in approaching the entrance leads westward of it. A 7° true (N by E ¼ E mag.) course from Worton Point Shoal gas buoy will lead clear of all dangers to the entrance.

Bush River, on the western side of Chesapeake Bay, 3 miles north-northeastward of Pooles Island, has a depth of 6 feet to a railroad bridge 7 miles above the entrance, and is frequented only by small produce and pleasure boats. The principal shoals near the entrance are marked by buoys, and above these the mid-channel is clear and easy of navigation to the bridge. The bridge has a draw opening 35 feet wide, and a headroom of 12 feet at high water. The river is shoal and little used above. Bush River is a post office and railroad station at the bridge. The mean rise and fall of tides is 1.5 feet.

Pooles Island, on the western side of Chesapeake Bay, 10 miles above the mouth of Patapsco River, is low and covered with orchards. There is a wharf on the east side at which steamers from Baltimore make landings in summer. The white piles of the wharf and a white building near it are prominent from southward. **Pooles Island range** (white posts with slatted day marks), on the southeast end of Pooles Island, is a guide for crossing the middle ground eastward of the island, and is used by all vessels bound northward from Baltimore.

The channel westward of Pooles Island is marked by buoys and has a least depth of 7½ feet, although there is an unmarked 6-foot spot 600 yards northwestward of Pooles Island lighthouse. It is used only by small craft from the tributaries on the western side or boats seeking shelter from westerly winds.

Gunpowder River, Middle River, and Back River have a common entrance westward of Pooles Island, leading between Sprys Island on the north and Millers Island on the south. They are frequented mostly by small produce and pleasure boats and an occasional small tugboat, the deepest draft being 7 feet and usual draft 2 to 4 feet. The mean rise and fall of tides is 1.2 feet.

Gunpowder River has a depth of 11 feet for 2 miles above **Sprys Island** in the mouth, 6 feet to within 1 mile of a railroad bridge 6½ miles above Sprys Island, and 4 feet to the bridge. The bridge has a draw opening, but the river is shoal and there is no navigation above. Sprys Island is a bare marsh marked by two shanties. The main entrance leads southward and westward of the island, is unmarked, and is narrow as far as Carrolls Point, 1 mile above, with shoals of 3 to 6 feet depth close to the channel. Navigation to this point is difficult without local knowledge for anything except small craft. Above this point the mid-channel is clear to the bridge if the points be given a good berth. A 355° true (N ¼ E mag.) course from the black buoy east-northeastward of Millers Island, heading for the prominent clump of trees on the point 1 mile northwestward of Sprys Island, will lead to the entrance. A draft of 2 feet at low water can be carried into the river from northward, close around the end of **Ricketts Point**. **Harewood Park** is a railroad station at the western end of the bridge across Gunpowder River. **Magnolia** is a post village and railroad station 1 mile eastward of the bridge.

Seneca Creek, 2½ miles northward of Millers Island, has a depth of 8 feet in the entrance and 5 feet in mid-channel to near the head. It is frequented only by small craft.

Middle River, 2¼ miles 297° true (NW by W mag.) from the black buoy east-northeastward of Millers Island, has a depth of 8 feet for 3 miles above the entrance and 2½ feet for a further distance of ½ mile to the head of navigation. Unmarked shoals extend off both points at the entrance and from many of the points above the entrance, but the mid-channel is clear if the points be given a good berth. Middleriver is a post village and summer resort at the head of navigation; it is on the railroad and is the terminus of an electric road to Baltimore. The river has many tributaries, the most important being **Frog Mortar Creek**, which has a depth of 6 feet to near the head.

Hawk Cove, northwestward of Millers and Hart Islands, is the main approach to Back River, and affords secure anchorage in depths of 8 to 10 feet. A shoal, marked by a red buoy on the end, extends half way across the entrance from the northwest side. The principal shoals are marked by buoys.

Millers Island is a bare marsh without prominent marks.

Hart Island is marshy and marked by a thick clump of trees in the center and scattered trees near the northeast end.

The thoroughfare between the southwest end of Hart Island and the mainland has a depth of 1½ feet at low water and 2½ to 3 feet at high water, and is considerably used. **Craighill Channel range rear light** (skeleton tower) is on the east side.

Back River has a depth of 6 feet for a distance of 5½ miles above the entrance and 5 feet for a further distance of 1 mile to an electric railway bridge. The bridge has a draw opening 25 feet wide, and small boats can go about 1 mile above in either branch at high water, but boats seldom go above the bridge. The shoals at the entrance are marked by buoys, and above the entrance the mid-channel is clear for vessels of 4 feet draft to the bridge. The best water leads westward of an unmarked middle ground 3 miles above the entrance. A row of piles extends ⅜ mile eastward from the mouth of **Bread and Cheese Creek**, ¾ mile below the bridge, and is marked by a light on the end. The main approach to the river is through Hawk Cove, but small craft from southward usually enter through the thoroughfare westward of Hart Island.

INSIDE ROUTE, NEW YORK TO NORFOLK.

From New York Upper Bay the generally used passage is through Kill van Kull and Arthur Kill, and thence around Great Beds lighthouse to the entrance of Raritan River; but strangers frequently take the more open passage through New York Lower Bay and Raritan Bay to Raritan River. Thence the passage leads up Raritan River to New Brunswick, and thence through the Delaware and Raritan Canal to Bordentown. Thence down Delaware River to Delaware City, and thence through the Chesapeake and Delaware Canal to Chesapeake City. Thence down Back Creek and Elk River to the head of Chesapeake Bay at Turkey Point, and thence down Chesapeake Bay and through Hampton Roads and Elizabeth River to Norfolk.

A draft of 7 feet can be taken through the passage from New York Bay to Delaware Bay, and 9 feet from Delaware Bay to Chesapeake Bay, and these are the limiting drafts. The greatest speed permitted in the canals is 4½ statute miles per hour. A vessel with a speed of 10 miles, running in daytime only, can make the passage in three and one-half to four days under favorable conditions. It is advisable to inquire beforehand whether the Delaware and Raritan Canal is open for navigation.

Supplies.—Coal in limited quantities can be obtained at numerous places, but the best and most convenient coaling places are Perth Amboy, Philadelphia, Baltimore, and Norfolk. Gasoline, provisions, and water can be obtained at any of the towns or cities along the route.

Pilots can be obtained on inquiring at Perth Amboy, New Brunswick, Bordentown, Delaware City, Chesapeake City, and Baltimore for either the whole or parts of the passage. A fisherman or pilot may sometimes be obtained at the mouth of Back Creek competent to pilot a vessel to Chesapeake City. The fees are not prescribed by law.

Ice sufficient to interfere with the navigation of small craft may be expected at any time between December and April, and is most severe during January and February. The canals are kept open as long as navigation is possible, and are opened as soon as navigation is possible in the spring. During mild winters local vessels use them throughout most of the winter, but strangers should make inquiries about their condition before attempting the passage.

KILL VAN KULL AND ARTHUR KILL.

These passages have a combined length of 17 miles from Robbins Reef lighthouse to **Ward Point**, the southern end of Staten Island, and a width varying from 600 yards to less than 200 yards. There is considerable shipping, especially through Kill van Kull. Strangers should have no difficulty in making the passage with a draft of 10 feet, with the aid of the chart and the directions. The Baltimore & Ohio Railroad crosses Arthur Kill about ½ mile southward of Elizabethport. There is a clear width of 202 feet on each side of the center pier of the draw; the eastern channel has the deeper water and is generally used.

Anchorage is not permitted in the channel of Kill van Kull and Arthur Kill, anchorage limits being prescribed by regulation. The anchorage on the western side of Arthur Kill off Perth Amboy is good and convenient; its eastern limit is a line running northward from the horizontally striped buoy to the Lehigh Valley coal docks.

Tides.—The mean rise and fall of the tides at Shooters Island is 4.6 feet; high water occurs 17 minutes later than at Governors Island. At South Amboy the mean rise and fall is 5.3 feet, and high water occurs 8 minutes later than at Sandy Hook.

RARITAN RIVER

has a length of 10½ miles from South Amboy to New Brunswick, a width varying from ½ mile to 125 yards, and is crooked in places. Dredging has been done to obtain a channel 200 feet wide and 10

feet deep to a point ¼ mile above the mouth of South River, and thence 100 feet wide with the same depth to New Brunswick. At high water the marshy banks are generally covered, making it difficult for a stranger to follow the channel. Two drawbridges cross the river near its entrance at South Amboy.

New Brunswick is an important city at the entrance to the Delaware and Raritan Canal from Raritan River. The canal forms a basin abreast the city, which is the harbor of New Brunswick. At high water of spring tides a draft of 8 feet has been taken into the basin through the entrance lock of the canal, but 7 feet is the deepest draft for which the canal company will be responsible. The size of vessels entering the basin is limited to the size of the canal lock. Coal, water, and provisions can be had in the basin.

Sailing vessels, which are not going to tow down the Raritan River, are advised to remain in the basin at New Brunswick until the wind serves for them to sail down the river. There is no place for some distance below New Brunswick at which a vessel of 7 feet draft can make fast outside of the basin without lying aground at low water, and the river channel is too narrow for vessels to anchor.

Towboats.—A towboat can be obtained at Perth Amboy and South Amboy and sometimes at New Brunswick, and can always be had at New Brunswick by telephoning to Perth Amboy.

Tides.—At New Brunswick high water is 49 minutes later and low water 1 hour 33 minutes later than at Sandy Hook; the mean rise and fall of tides is 6 feet.

DELAWARE AND RARITAN CANAL.

This canal is 38 miles long from its eastern entrance at New Brunswick on the Raritan River to its western entrance at Bordentown on the Delaware River. The principal places on the canal and their distances, in miles, from New Brunswick are: **Bound Brook**, 7; **Millstone**, 12; **Kingston**, 21; **Trenton** (Coalport Basin), 32; **Bordentown**, 38. There are 13 locks in the canal, the dimensions of which are 210 feet long, 23 feet 4 inches wide, and 7 feet deep. The deepest draft permitted through the canal is 7 feet. Masted vessels are limited to masts less than 50 feet above canal level by the arched stone bridge at New Brunswick, which has a clear height of 50 feet in the middle. Coal in limited quantities may be obtained from local dealers at the principal places on the canal, but steamers will find it more convenient to coal at Perth Amboy and Philadelphia than along the canal. The water in the canal is fresh, but is not good for drinking purposes.

Toll rates, which are subject to change, are charged by the canal company and are collected at the entrance where the vessel is given clearance. Towage through the canal can be arranged at either entrance.

The following information is taken from the **Rules and Regulations Governing the Delaware & Raritan Canal**, published by the company, and which will be furnished by them at the canal entrance on application:

When under way at night, a small green signal light shall be carried on the stem; a steamer shall carry in addition a white light at the end of her flagstaff, or if towing other boats two white lights at

the end of her flagstaff; no other lights or reflectors shall be carried. No vessel shall carry sail in the canal. The speed shall not exceed 4½ miles (statute) per hour. When a vessel overtakes another, the slower shall give the inner track to the faster, unless within 300 yards of a lock or bridge. When in danger of meeting at a bridge or where both can not pass, the one going westward shall lie to. Everything towed by horses or mules, and rafts, on meeting steamboats shall keep on the side next the towpath; in all other cases, everything meeting shall keep to the right. When approaching a lock or bridge, notice shall be given on arriving within 300 yards of the same by a horn, bell, or whistle. Steamboats passing other boats or vessels, either in motion or at stopping places, shall "slow-up" till entirely past, especially in passing Coalport. Steamboats must not check headway by backing while in the locks, nor blow out their boilers while passing locks or bridges. The signal at night that a lock is ready will be two whistles from the lock engine for boats bound west and four for those bound east. No stones, rubbish, dead carcasses, or other offensive matter shall be thrown or dropped into the water.

DELAWARE RIVER, FROM BORDENTOWN TO DELAWARE CITY.

The distance is 60 miles from Bordentown to Delaware City, and the channel generally has ample width and is easily followed; but extra caution is required in the first ½ mile from Bordentown, where there is a depth of 7½ feet in a narrow channel. This is the shoalest place in the channel. Channels have been dredged 12 feet deep and 200 feet wide from Philadelphia to Trenton, and 30 feet deep and 800 to 1,200 feet wide from Delaware Bay entrance to Philadelphia. Many of the shoals in the river are bare at or before low water, and are generally covered with marsh grass, which makes them usually well defined. The water in the river above Chester is fresh and suitable for boilers; above Bristol the water is ordinarily suitable for drinking purposes, except in dry seasons.

Coal can be obtained at Philadelphia, either at the wharves or by lighters; it can also be obtained at Chester and New Castle and in limited quantities at Delaware City, but the facilties are not so good as at Philadelphia.

Anchorage.—Except for ½ mile below Bordentown, there is a sufficient width at most places in the channel for anchorage, for which the chart must be the guide. The anchorage limits at Philadelphia are prescribed by regulation. Below Marcus Hook suitable anchorage may be selected off the ranges.

Delaware City, at the entrance of the Chesapeake & Delaware Canal from Delaware River, has little commerce except that passing through the canal. Provisions and gasoline may be obtained. The wharves have a depth of 8 to 9 feet in Delaware River at their ends. There is a depth of 9 feet on the northern side at the entrance to the canal lock, and vessels usually lie here when waiting to lock in.

Tides.—The mean rise and fall of tides at Bordentown is 4.7 feet; Burlington, 5.4; Philadelphia, 5.3; Chester, 5.8; and Delaware City, 5.9. High water occurs at Bordentown 2 hours 25 minutes, and at Burlington 1 hour 32 minutes later than at Philadelphia, and at Chester 1 hour 24 minutes, and at Delaware City 2 hours 53 minutes earlier than at Philadelphia.

CHESAPEAKE & DELAWARE CANAL.

This canal is 12 miles long from its eastern entrance at Delaware City, on Delaware Bay, to its western entrance at Chesapeake City, on Back Creek. There are three locks in the canal, the dimensions of which are 220 feet long, 24 feet wide, and 9 feet deep. The deepest draft permitted through the canal is 9 feet. All bridges over the canal have draws. The water in the canal is fresh, but is not suitable for drinking purposes. **Toll rates,** which are subject to change, are charged by the company, and are collected at the entrance, where a pass bill is given the vessel. Towage through the canal can be arranged at either entrance. Strangers passing through this canal are advised to inquire at the entrance whether there are any shoal places which require attention. The canal is closed from 9 a. m. to 5 p. m. on Sundays.

The following information is taken from the **Regulations governing the Chesapeage & Delaware Canal,** published by the company, and which will be furnished by them at the canal entrance on application:

The pass bill must be shown to each lock keeper before passing through. No vessel shall carry sail in the canal, nor shall the speed exceed 4½ miles (statute) per hour. Vessels passing shall keep to the right, but shall give the inner track to vessels in tow of horses or mules. Masted vessels when meeting unmasted boats shall take the outer track. Rafts shall always keep the outer track. When a vessel overtakes another, the slower shall give the inner track to the faster, unless within 300 yards of a lock or bridge. When approaching a lock or bridge, notice shall be given on arriving within 300 yards of the same by a horn or bell. When passing through at night a light shall be carried on the bow. Vessels lying in the canal at night shall carry a light on the bow and at the stern. No earth, stone, timber, or other material shall be placed or put in the canal.

BACK CREEK AND ELK RIVER.

Back Creek has a length of 3¼ miles from Chesapeake City to Elk River. The channel is crooked and narrow, with shoals on both sides, but is marked by buoys. The deepest draft using the creek is 9 feet. For a distance of 1¾ miles below Chesapeake City the depth is 9 feet or over in a channel 120 to 150 feet wide, and below that point to the entrance the channel has a width of 200 to 400 feet. A pilot may be obtained on inquiry at Chesapeake City or the entrance to the creek. The channel in the creek is too narrow for anchorage. Gasoline and provisions are obtainble at Chesapeake City and there is a shipyard and marine railway.

Elk River has a length of nearly 8 miles from Back Creek to the entrance of the river at Turkey Point. The channel is wide and easily followed.

Tides.—In Back Creek high water occurs about 2 hours 20 minutes after high water at Baltimore, and the mean rise and fall of tides is 2.6 feet.

CHESAPEAKE BAY.

The channel in Chesapeake Bay is well marked and easily followed by the class of vessels using the inland waterway. Coal, gaso-

line, repairs, and supplies of all kinds can be best obtained at Baltimore and Norfolk. Some supplies and gasoline can be had at numerous places on the tributaries of the bay, the best places near the sailing route being Annapolis, Solomons on the Patuxent River, and Cockrells Creek (Reedville) on the Great Wicomico River. There are small marine railways at Annapolis, Solomons, Reedville, and Carter Creek on the Rappahannock River. Anchorage can be had at numerous places on the shores of the bay and its tributaries, depending on the direction of the wind. Those most frequently used and easiest of access are:

Severn River, at Annapolis in the mouth of Spa Creek, depth 13 feet; also in Annapolis Roads southeastward of Greenbury Point Shoal lighthouse.

Patuxent River.—Small vessels usually anchor on the north side, between Drum Point lighthouse and the horizontally striped buoy 5/8 mile westward of the lighthouse, and small craft frequently anchor in the cove on the north side of Solomons Island (1 5/8 miles westward of Drum Point lighthouse).

Cornfield Harbor, on the west side of Point Lookout, entrance of Potomac River, is occasionally used; it is sheltered only from northerly and northeasterly winds.

Great Wicomico River and the mouth of Cockrell Creek is a good and convenient harbor. The fish stakes off the entrance may give trouble at times to vessels entering. The depths at the anchorage are 15 to 20 feet.

Rappahannock River.—Anchorage, exposed to southeasterly winds, can be selected in the entrance.

Mobjack Bay is exposed to southerly and southeasterly winds, and except toward its head or in the arms it is exposed to northwest winds also.

Hampton Roads.—Small craft usually anchor in what is locally known as Mother Hawkins Hole, on the north side of the eastern part of Hampton Bar; the entrance is between the wharf at Old Point Comfort and the horizontally striped buoy close westward of it. Small craft usually seek shelter in Hampton Creek in bad weather.

Small vessels frequently anchor on the northerly part of Craney Island Flats westward of the dredged channel leading to Norfolk; also on the shoals eastward of that channel between the Virginian Railroad pier and Bush Bluff light vessel.

Tides.—The mean rise and fall of tides at Baltimore is 1.2 feet; Rappahannock River entrance, 1.2; Old Point Comfort, 2.5; and Norfolk, 2.8.

DIRECTIONS, INSIDE ROUTE, NEW YORK TO NORFOLK.

These directions are good in the daytime for a draft of 7 feet to Philadelphia, and for a draft of 9 feet from Philadelphia to Chesapeake Bay. Strangers are advised not to run at night.

The directions in Chesapeake Bay are intended for vessels of 9 feet or less draft that use the inland route, but are good for vessels of greater draft in most places. With westerly winds small vessels can follow with advantage the western shore more closely, being guided by the chart, but care should be taken at night to avoid the fish traps which extend long distances from shore in

places, especially on the shoals between Great Wicomico River and Old Point Comfort. For information concerning fish traps in Chesapeake Bay, see page 122.

Through Kill van Kull and Arthur Kill to South Amboy, 19 miles.—Enter Kill van Kull between Robbins Reef lighthouse and the north end of Staten Island, giving the lighthouse a berth of 600 yards and the shore of Staten Island a berth of 300 yards, and follow a mid-channel course for about 2½ miles from Constable Point. Then pass about 100 yards southward of the red buoy eastward of Bergen Point lighthouse, and pass 220 yards south of the lighthouse.

Then steer 267° true (W ⅝ N mag.) and pass about 75 yards southward of the wharves on the southern side of **Shooters Island** (which will be recognized by the ruins of the shipyard on it). When the western end of Shooters Island is abeam, steer about 308° true (NW ¼ N mag.) for ¼ mile to a position a little southward of a horizontally striped buoy, then a more westerly course for ¼ mile, leaving a black buoy on the port hand and a horizontally striped buoy on the starboard hand.

Then steer about 269° true (W ¾ N mag.), leaving a red buoy on the starboard hand, and then follow a mid-channel course past Elizabethport. Vessels of 7 feet draft can pass through either of the wide openings of the railroad drawbridge southward of Elizabethport, although the eastern opening has the deeper water. When ½ mile southward of the bridge, steer 185° true (S by W ¼ W mag.), and pass in mid-channel eastward of Buckwheat Island (small and grassy) and westward of Pralls Island, following a general mid-channel course.

From the southern end of Pralls Island follow the western bank at a distance of about 150 yards, except for a distance of ⅜ mile northward of Tufts Point, where that bank should be given a berth of 200 yards. Pass about 150 yards southward of Tufts Point, steer about 270° true (W ⅞ N mag.), and pass about 150 yards northward of Smoking Point. Then follow the northwestern bank at a distance of about 300 yards, passing northward and westward of the white anchorage buoys and the red buoy at Storys Flats. When past the latter buoy follow the western bank at a distance of 200 yards to Perth Amboy. Anchorage can be had on the western side of the channel at Perth Amboy.

Pass 100 yards eastward of the horizontally striped buoy off Perth Amboy, steer about 153° true (S by E ⅝ E mag.), and pass 100 yards westward of Ward Point, and eastward of the horizontally striped buoy southward of the point. Pass 200 yards eastward and southward of Great Beds lighthouse, and steer 268° true (W ⅝ N mag.) for black buoy No. 9. Pass about 100 feet northward of this buoy and steer 303° true (NW ⅛ W mag.), heading for the left draw in the railroad bridge. Anchorage can be had on the north side of the channel, northward of a line joining the anchorage buoys and the center pier of the drawbridge.

New York Lower Bay and Raritan Bay to South Amboy.—Pass eastward and southward of the black bell buoy lying ¾ mile northward of West Bank lighthouse, and steer 239° true (WSW ⅛ W mag.) for 7½ miles, passing ½ mile northward of West Bank and Old Orchard Shoal lighthouses, passing southward of Old Orchard Shoal

red buoy and to a position ¼ mile northward of Conaskonk Point Shoal buoy No. 3. Then steer 269° true (W ¾ N mag.) for 3¼ miles, passing between buoys Nos. 7 and 8 to a position 200 yards southward of Great Beds lighthouse as in the preceding paragraph.

Raritan River to New Brunswick, 10½ miles.—Except at high water, when the marshy banks are covered in places, vessels of 7 feet or less draft, with the aid of the chart, should have no difficulty in going up the Raritan River to New Brunswick.

From the railroad drawbridge at South Amboy pass about 200 feet off Sandy Point, and then go through the draw in the second bridge. Then follow the northern bank, giving the ends of the wharves a berth of 200 to 300 feet, to light No. 1, which is on the lower end of a dike on the northwestern side. Follow this dike and the northwest bank above it at a distance of 200 feet until above the opening in the dike on the southeast side of the channel ½ mile above light No. 2. Then keep in mid-channel as defined by the dikes until ¼ mile above light No. 3, and then pass the point on the north bank, lying opposite the western end of the dike on the southern side, at a distance of 200 feet.

In making the bend around Crab Island follow the dike on the northwest side of the channel at a distance of 300 feet. Then cross over and follow the eastern and southern bank, at a distance of 200 feet, past Sayreville and the canal leading to Washington. From the canal entrance keep in mid-channel northward through Long Reach for a distance of ¼ mile, and then gradually favor the eastern bank and follow it at a distance of 125 feet in the northern part of this reach. When the river begins to bend northwestward, edge out gradually to mid-channel, and so continue around the bend until approaching the entrance of South River.

Then favor the southern bank past the entrance of South River and the dock ¼ mile westward. When past this dock, edge over gradually and favor the eastern bank northward through Rocky Reach. When the river begins to bend northwestward, edge out gradually to mid-channel, and so continue around the bend to Lawrence Creek (on southern bank) and also in the next reach northwestward to Martins Landing.

There is a stone dock on the north bank 400 yards westward of Martins Landing; favor the north bank between them until 300 yards westward of the stone dock, and then keep in mid-river around the next bend until up with the rocky bluff on the southern bank. Then favor well the southern bank to the lock at New Brunswick.

Delaware River from Bordentown to Delaware City, 60 miles.—A stranger, proceeding with caution in the narrow parts of the river and using the lead, should have little difficulty in making the passage from Bordentown to Delaware City with the aid of the chart and the directions. Extra caution is required in the first ½ mile below Bordentown.

Bordentown to Florence.—On leaving the lock at Bordentown, head so as to pass about 125 feet westward of the steamboat wharf on the east bank just south of the entrance to the creek, and then head about 214° true (SW ⅛ S mag.), with Bordentown range front light (white post), on the south bank ⅜ mile distant, a little on the starboard bow. Leave a black buoy 50 feet on the starboard hand, and

then haul westward so as to follow the curve of the channel, and pass about midway between the light and a horizontally striped buoy.

When below Bordentown range front light steer 229° true (SW by W ⅛ W mag.), following at first the southeastern bank at a distance of 100 yards, to a mid-channel position 600 yards above Newbold Island. Then haul westward gradually, giving the northern bank a berth of over 150 yards, and pass in mid-channel northward of Newbold Island until past Penn Manor light; this light is on the north bank westward of a small wharf.

Bring this light astern on a 228° true (SW by W ⅛ W mag.) course, heading for Kinkora light and passing between the buoys which mark the channel at Kinkora Bar; Kinkora light may be seen well to the left of a sand wharf. When abreast the clubhouse wharf haul a little westward, following the buoys to abreast the sand wharf, pass about 150 yards northward of it, and then follow the southern bank at a distance of 150 yards to Florence (large pipe works).

Florence to Torresdale.—Keep in mid-channel in making the bend northward of Florence and then follow the western bank at a distance of 150 yards, drawing in to 100 yards from that bank from the northern end of the pipe foundry above Bristol to abreast the yacht club wharf ⅜ mile below. Then follow a mid-channel course between Burlington Island and Bristol, and when up with the ferry landing (Bristol) bring it astern on a 206° true (SW ⅞ S mag.) course and pass 75 to 100 yards westward of a red buoy off the lower end of Burlington Island.

Favor, if anything, the southern bank in passing Burlington until abreast the large foundry at its western end, and then steer 258° true (W ¼ S mag.) for College Point light (northern bank) until ¼ mile from it, and pass it at a distance of 200 yards. Then steer 250° true (W by S mag.) for the standpipe in the town of Beverly (southern bank); the black buoy near Beverly should be nearly ahead. Pass about 200 feet southward of this buoy and 300 feet off the northerly wharves of Beverly on a 282° true (WNW ¼ W mag.) course, with an old wharf on the northern bank a little on the starboard bow.

Pass 150 yards southeastward of this wharf, and steer 239° true (WSW mag.) with the wharf at Torresdale a little on the starboard bow and a concrete tower and high chimney a little on the port bow, to the entrance of the dredged channel leading past Mud Island. Pass through the dredged channel on a 236° true (SW by W ¾ W mag.) course, with a lighted range astern, being guided by the buoys and heading for the high chimney, and continue this course to a position 275 yards southeastward of the wharf at Torresdale (marked by Torresdale light).

Torresdale to Philadelphia.—Follow the west bank at a distance of 200 yards to the southern end of Torresdale, then steer 222° true (SW ½ W mag.) with the prominent clubhouse and flagstaff on the end of the pier at Riverton a little on the port bow; Riverton light is also on the end of the pier. On this course pass about 100 yards southeastward of the two black spar buoys which lie near the northwestern bank ¾ and 1 mile below Torresdale, and about 200 yards northwestward of the red spar buoy which lies near mid-river, 1½ miles below Torresdale.

Pass 200 yards north of Riverton light (end of pier), and bring the light astern on a 262° true (W ⅛ N mag.) course; on this course pass 150 yards north of the red spar buoy 1 mile westward of Riverton. Then follow the western bank at a distance of about 300 yards and pass 150 yards westward of buoy No. 2 off Bridesburg. Then steer 202° true (SSW ¾ W mag.) for the draw (draw is 50 feet above high water), and when through the bridge follow a mid-river course in passing Philadelphia. Anchorage can be made on the eastern side of the river, either at Petty Island, 2 miles below the bridge, or from Kaighns Point to Gloucester, 5 to 7 miles below the bridge.

Philadelphia to Chester.—Keep in mid-river in passing Philadelphia, and when up with the ferry landing at Gloucester steer 206° true (SW by S mag.) about 1 mile on the Horseshoe east group upper range (ahead). Pass about 200 yards eastward of gas buoy No. 37, and steer 240° true (WSW ⅛ W mag.) on the Eagle Point range (ahead).

Pass about 200 yards northward of buoy No. 46 and steer 274° true (WNW ⅞ W mag.) about 1⅞ miles, and when up with buoy No. 44 haul southward and pass about 200 yards westward of it. Then steer 234° true (SW by W ½ W mag.) on the Fort Mifflin Bar range (may be seen over the ferry landing ahead); this course follows the northern bank at a distance of about 300 yards, passes about 300 yards westward of a ruined pier (with white daymark) near mid-river, and leads north of a red buoy and south of a black buoy.

Then steer 250° true (W by S mag.) for 1¼ miles, giving the southern bank a berth of about 300 yards, to a position 100 yards northward of a red nun buoy. Then steer 272° true (W ⅞ N mag.), keeping the Tinicum Island range astern, and pass about midway between the buoys off the western end of Tinicum Island. When gas buoy No. 2T is on the port beam distant 300 yards, steer 230° true (SW by W ⅛ W mag.) with the Chester range astern to the red gas buoy off the south end of Chester.

Chester to Delaware City.—From the red gas buoy steer 237° true (SW by W ¾ W mag.) on the Marcus Hook range for 4¼ miles, passing between the buoys which mark the edges of the channel. When Grubbs Landing light (crib in water) is nearly abeam, steer 215° true (SW ⅛ S mag.) nearly 3 miles on the Bellevue range which is ahead.

When abreast of Edgemoor Rolling Mill and buoy No. 2B is on the port beam, steer 197° true (SSW ¼ W mag.) for 4⅜ miles with the Cherry Island range astern until at the intersection with the Deepwater Point range and abreast gas and bell buoys No. 2C. Then steer 234° true (SW by W ½ W mag.) for 3½ miles, passing about 300 yards eastward of black buoy No. 27 and the same distance westward of the horizontally striped buoy at the northeastern end of Bulkhead Shoal; red spar buoy No. 6 should be on the port bow, and as it is approached should be left 200 yards on the port hand. When abreast of red spar buoy No. 6, steer about 195° true (SSW mag.) for 1½ miles, and leave two black spar buoys 350 yards on the starboard hand.

Then haul southward, pass 200 yards westward of gas buoy No. 4, and steer 148° true (SSE ⅛ E mag.) about 1½ miles to a position about 300 yards off the wharves at Delaware City. Anchorage may

be made on the eastern side of the channel, about ¼ mile off the wharves, in 15 to 17 feet. If going into the canal, whistle when ¼ to ½ mile away and slow down. The entrance lock is on the south side of the southernmost wharf, and vessels make fast to the wharf, on the starboard side at the entrance to the lock, until the lock is open and ready to enter. The current in the river setting past the ends of the wharves must be considered and allowed for when turning in for the canal wharf.

Through Back Creek and Elk River to Turkey Point, 11 miles.—A stranger should proceed slowly in Back Creek, and keep the leads going on both sides, as the slope on either side is sufficient to make the difference in depth, obtained with the two leads, a warning of the approach to the flats. Vessels must slow down when passing other vessels. The buoys are in a depth of 6 feet on the edges of the channel.

From the lock at Chesapeake City favor the northern bank for a distance of ⅜ mile, leaving buoy No. 8 on the port hand, and buoy No. 7 on the starboard hand, at a distance of 25 yards. When past the latter buoy keep near the middle of the creek until approaching the next point on the southern bank, and pass 50 yards northward of it. Then steer 285° true (WNW mag.) and leave the end of a wharf at the entrance of Long Creek 50 feet on the starboard hand and buoy No. 5, just below, about 25 yards on the starboard hand. Then follow mid-creek, leave buoy No. 6 about 25 yards on the port hand, and then pass 50 yards northward of the next point on the south bank (marked by the ruins of a wharf).

Emilys Point, the next point on the north bank, should be passed at a distance of 60 yards, and the next point ⅛ mile below on the south bank should be passed at the same distance. Then steer for a position in mid-creek a little westward of the marshy opening on the north bank, and then steer 271° true (W ¾ N mag.) for ¼ mile to a position 100 yards from the north bank just westward of a marshy opening. Then steer 260° true (W ¼ S mag.) for a little over ¼ mile to a position between buoys Nos. 3 and 4. The shoalest water in the creek (about 10 feet) is between the buoys, and the best water can be carried by keeping the extreme end of the piling outside of Randall Wharf light in range with the tallest tree beyond until a little past the buoys, then shaping the course to pass 70 yards northward of the light.

Round the light at a distance of 70 yards, and steer 218° true (SW mag.), with the south point at the entrance to the creek ahead. Leave buoy No. 1 about 30 yards on the starboard hand, and when past it edge a little westward and bring Randall Wharf light astern on a 230° true (SW by W ⅛ W mag.) course, leaving buoy No. 2 100 yards on the port hand and the horizontally striped buoy off Welch Point 200 yards or more on the starboard hand. This course slightly favors the southern bank at the entrance of Back Creek, and leads 275 yards northward of Courthouse Point, which is the prominently projecting point on the south bank ¾ mile from the entrance to Back Creek.

Continue the 230° true (SW by W ⅛ W mag.) course nearly ½ mile past Courthouse Point, and when Old Field Point light (pile structure in water off prominent point of north bank) bears 286°

true (NW by W 7/8 W mag.), distant nearly 1/4 mile, steer 256° true (W 5/8 S mag.) so as to pass about 225 yards southward of it. Continue the course for 7/8 mile past the light to a position 350 yards northward of Old Town Point Wharf light, and then haul southward to a mid-channel position westward of it. Then steer 225° true (SW 5/8 W mag.) for 5 miles, keeping in the middle of the river to the entrance at Turkey Point.

Turkey Point to Baltimore, 35 miles.—From the middle of the entrance of Elk River abreast Turkey Point, steer 235° true (SW by W 1/2 W mag.) for 11 miles, passing 3/8 mile off Howell Point, a little over 1/4 mile southeastward of the black buoy lying near the middle of the bay off Still Pond, and to a position 1/4 mile northwestward of Worton Point Shoal gas buoy.

Then steer 209° true (SW 3/4 S mag.) for 3 1/4 miles to a position 1/4 mile east-southeastward of bell buoy No. 3. Then steer 261° true (W 1/8 S mag.) on the Pooles Island range (posts with white slatted daymarks) ahead, passing 1/8 mile southward of the bell buoy and to a position 100 yards northwestward of buoy No. 4. Then steer 229° true (SW by W mag.) for 1 1/2 miles to a position 150 yards southeastward of Pooles Island Flats gas buoy. Then steer 238° true (SW by W 3/4 W mag.) for 9 miles to gas and bell buoy No. 3B, Brewerton Channel. This course leads 3/8 mile northwestward of a red buoy and 3/4 mile northwestward of Craighill Channel range front light.

Then follow the dredged channels to Baltimore, courses—291° true (NW by W 1/2 W mag.) on the Brewerton Channel range, following the buoys to gas and bell buoy No. 12B; then steer a little more northward to gas and bell buoy No. 4M; and then steer 320° true (NW by N mag.), following the buoys which mark the Fort McHenry Channel to Lazaretto Point. Then steer more northward into Baltimore Harbor between Lazaretto Point lighthouse and Fort McHenry, passing eastward of the two black buoys on the northeast side of Fort McHenry. The anchorages in Baltimore Harbor are marked by white buoys; they are on the northeasterly side of the harbor between Canton and Fells Point, and in the cove on the southerly side eastward of Federal Hill.

Baltimore to Sandy Point, 20 miles.—Follow the dredged channels as described in the preceding paragraph to gas and bell buoy No. 3B, Brewerton Channel, and then steer southeastward to gas and bell buoy No. 13K. Then steer 149° true (SSE 1/8 E mag.) on the Cutoff Channel range astern, and follow the buoys to gas and bell buoy No. 5K nearly 1 mile southward of Seven Foot Knoll lighthouse. Then steer 161° true (S by E 1/8 E mag.) for 1 1/2 miles to gas and bell buoy No. 9C. Then steer 180° true (S 5/8 W mag.) on the Craighill Channel range astern, and follow the buoys to a position 350 yards eastward of Baltimore lighthouse. Then steer 154° true (S by E 3/4 E) mag.) for 2 3/4 miles to a position 3/4 mile eastward of Sandy Point lighthouse.

Turkey Point to Sandy Point direct, 32 miles.—From the middle of the entrance of Elk River abreast Turkey Point steer 235° true (SW by W 1/2 W mag.) for 11 miles, passing 3/8 mile off Howell Point, a little over 1/4 mile southeastward of the black buoy lying near the

middle of the bay off Still Pond, and to a position ¼ mile northwestward of Worton Point Shoal gas buoy.

Then steer 202° true (SSW ⅝ W mag.) for 7½ miles, passing nearly ⅜ mile westward of a red buoy, nearly ¼ mile eastward of buoy No. 3, and to a position 300 yards eastward of the black buoy lying westward of the summer resort of Tolchester Beach. Then steer 218° true (SW mag.) for 3½ miles until Craighill Channel range front lighthouse bears 286° true (WNW mag.). Then steer 198° true (SSW ¼ W mag.) for 9½ miles, passing over ¼ mile westward of the red buoy off Swan Point, and to a position ¾ mile eastward of Sandy Point lighthouse.

Sandy Point to Norfolk, 138 miles.—From a position ¾ mile eastward of Sandy Point lighthouse steer 197° true (SSW ⅛ W mag.) for 7¼ miles to a position 1 mile eastward of Thomas Point Shoal lighthouse. Then steer 186° true (S by W ⅛ W mag.) for 9 miles, passing 1½ miles westward of Bloody Point Bar lighthouse, and to Poplar Island Shoal gas and bell buoy. Then steer 177° true (S ⅜ W mag.) for 12 miles, passing 2½ miles westward of Sharps Island lighthouse, and to Sharps Island gas and bell buoy.

From Sharps Island gas and bell buoy make good a 163° true (S by E mag.) course for 42 miles, passing 1 mile eastward of Cove Point lighthouse, 1⅞ miles eastward of Cedar Point lighthouse, 2½ miles westward of Hooper Island lighthouse, 1½ miles eastward of Point No Point lighthouse, and to a position 1 mile eastward of Smith Point lighthouse.

Then make good a 180° true (S ½ W mag.) course for 29½ miles, passing close to Tangier Island Shoal Lump gas and bell buoy, 3¼ miles eastward of Windmill Point lighthouse, and 1¼ miles eastward of the black bell buoy at the end of Rappahannock Spit, and to a position 1 mile eastward of Wolf Trap lighthouse.

Then make good a 186° true (S by W mag.) course for 23 miles, passing 1 mile eastward of New Point Comfort Middle Ground buoy, 3 miles eastward of York Spit and Back River lighthouses, and in a depth of about 15 feet across the Horseshoe about 1 mile eastward of Thimble Shoal lighthouse.

On approaching Thimble Shoal lighthouse haul westward and pass 300 yards southward of it. Then steer 251° true (WSW ¾ W mag.), pass about ¼ mile northward of Willoughby Spit gas and bell buoy, and pass about midway between Old Point Comfort and Fort Wool. Then steer 234° true (SW by W ¼ W mag.) for Newport News Middle Ground lighthouse and pass northward of Sewall Point Shoal gas and bell buoy. Pass about 200 yards westward of this buoy and stand southward in the dredged channel to Norfolk, being guided by the buoys, some lighted, and Bush Bluff light vessel, which mark the edges of the channel. The courses are 184° true (S ⅞ W mag.) to abreast Bush Bluff light vessel, then 172° true (S ¼ E mag.) until abreast the southerly piers at Lambert Point, and then 131° true (SE ⅛ S mag.) to the city wharves.

The anchorages for small vessels near Norfolk are on the northeast side of the channel opposite Hospital Point, on the west side of the channel between Hospital Point and Portsmouth, and on the south side of the Eastern Branch between Norfolk and Berkley.

APPENDIX.

COAST PILOTS OF THE COAST AND GEODETIC SURVEY.

	Price.
U. S. Coast Pilot, Atlantic Coast, Parts I–II, from St. Croix River to Cape Ann	$0.50
U. S. Coast Pilot, Atlantic Coast, Part III, from Cape Ann to Point Judith	.50
U. S. Coast Pilot, Atlantic Coast, Part IV, from Point Judith to New York, including Long Island Sound	.50
U. S. Coast Pilot, Atlantic Coast, Section C, Sandy Hook to Cape Henry, including Delaware and Chesapeake Bays	.50
U. S. Coast Pilot, Atlantic Coast, Section D, Cape Henry to Key West	.50
U. S. Coast Pilot, Atlantic Coast, Section E, Gulf of Mexico, from Key West to the Rio Grande (in press)	.50
Inside Route Pilot, Coast of New Jersey	.20
Inside Route Pilot, New York to Key West	.20
Inside Route Pilot, Key West to New Orleans	.20
U. S. Coast Pilot, Pacific Coast, California, Oregon, and Washington	.50
U. S. Coast Pilot, Pacific Coast, Alaska, Part I, from Dixon Entrance to Yakutat Bay	.50
U. S. Coast Pilot, Pacific Coast, Alaska, Part II, Yakutat Bay to Arctic Ocean; replaces Coast Pilot Notes from Yakutat Bay to Cook Inlet and Shelikof Strait, and Coast Pilot Notes on Bering Sea and Arctic Ocean	.50
U. S. Coast Pilot, West Indies, Porto Rico	.50
Coast Pilot Notes on Hawaiian Islands	Free.

SAILING DIRECTIONS, PHILIPPINE ISLANDS.

Section I. North and west coasts of Luzon and adjacent islands	Free.
Section II. Southwest and south coasts of Luzon and adjacent islands	Free.
Section III. Coasts of Panay, Negros, Cebu, and adjacent islands	Free.
Section IV. Coasts of Samar and Leyte and the east coast of Luzon	Free.
Section V. Coasts of Mindanao and adjacent islands	Free.
Sections VI and VII. Mindoro Strait, Palawan Island, and Sulu Sea and Archipelago	Free.

METEOROLOGICAL TABLES.

Meteorological tables compiled by the United States Weather Bureau for New York, N. Y.; Atlantic City, N. J.; Baltimore, Md.; Richmond, Va.; and Norfolk, Va., are shown on pages following.

Meteorological tables compiled by the United States Weather Bureau.

NEW YORK, N. Y.

Month.	Barometer at 32° F. and mean sea level.				Air temperature, in °F.							Average relative humidity.	Average amount of clouds 0-10.	Precipitation.			Wind.											
	Mean.	Extremes.			Mean.				Extremes.								Statute miles.		Average number of times (observations at 8 a. m. and 8 p. m.) from—									Number of days with winds of 40 miles or over.	Number of days dense fog.
	For month.	Highest.	Lowest.	Range.	For month.	Mean max.	Mean min.	Range.	Highest.	Lowest.	Range.			Average fall.	Number of days 0.01 inch or more.	Maximum fall in 24 hours.	Average hourly velocity.	Highest velocity.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.		
	Ins.	Ins.	Ins.	Ins.								%		Ins.		Ins.													
January	30.10	30.78	28.75	2.03	30.2	37.3	23.8	13.5	67	−6	73	74	6	3.79	12	2.48	13.1	76	4	7	4	3	5	8	14	16	1	6	3
February	30.09	30.86	28.70	2.16	30.7	37.9	24.1	13.8	69	−6	75	72	5	3.74	11	3.25	14.5	96	5	5	4	2	4	6	13	17	0	8	1
March	30.03	30.93	29.22	1.71	37.5	45.1	29.7	15.4	78	3	75	71	6	4.10	13	3.60	13.8	80	4	8	7	4	6	6	10	17	0	6	2
April	30.02	30.63	29.16	1.47	48.1	56.9	40.5	16.4	90	20	70	68	5	3.30	11	3.72	11.8	84	4	7	7	5	7	5	9	16	0	6	2
May	29.98	30.45	29.13	1.32	59.3	68.2	51.6	16.6	95	34	61	71	5	3.18	11	4.17	10.7	64	3	6	10	7	9	9	7	11	0	4	2
June	29.99	30.46	29.34	1.12	68.5	77.3	61.1	16.2	97	45	52	73	5	3.26	11	3.63	9.5	72	4	7	5	6	10	8	8	9	3	2	0
July	29.98	30.51	29.46	1.05	73.5	82.1	66.6	15.5	99	50	49	73	5	4.54	12	3.80	9.1	72	4	5	3	5	12	11	10	12	0	2	0
August	30.01	30.33	29.28	1.06	72.2	80.0	65.9	14.1	96	51	45	75	5	4.53	10	5.05	8.8	76	4	8	7	6	12	8	7	10	0	1	0
September	30.08	30.55	29.55	1.00	66.5	74.0	59.8	14.2	100	36	64	76	5	3.59	9	6.17	9.8	72	5	7	8	6	10	8	6	10	0	2	1
October	30.08	30.55	29.29	1.26	55.6	63.0	48.4	14.6	88	31	57	73	5	3.71	9	9.40	11.6	76	6	8	4	6	6	7	12	13	0	4	1
November	30.11	30.80	28.70	2.10	44.0	50.9	37.5	13.4	74	7	67	73	5	3.44	10	3.62	12.5	76	4	5	3	1	5	6	17	19	0	6	1
December	30.12	30.89	28.97	1.92	34.4	40.6	28.0	12.6	68	−6	74	73	6	3.45	11	2.93	13.3	78	4	6	3	2	5	9	15	18	0	6	2
Mean	30.05	.....	.....	.....	51.7	59.5	44.8	14.7	.....	.....	.....	73	5	.....	.....	.....	11.5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	44.63	130	.....	.....	.....	51	79	65	53	91	91	128	168	4	53	15

Meteorological tables compiled by the United States Weather Bureau—Continued.

ATLANTIC CITY, N. J.

Month.	Barometer at 32° F. and mean sea level.				Air temperature, in °F.							Average relative humidity.	Average amount of clouds 0-10.	Precipitation.			Wind.										Number of days with winds of 40 miles or over.	Number of days dense fog.
	Mean.	Extremes.			Mean.				Extremes.								Statute miles.		Average number of times (observations at 8 a. m. and 8 p. m.) from—										
	For month.	Highest.	Lowest.	Range.	For month.	Mean max.	Mean min.	Range.	Highest.	Lowest.	Range.			Average fall.	Number of days 0.01 inch or more.	Maximum fall in 24 hours.	Average hourly velocity.	Highest velocity.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.		
	Ins.	Ins.	Ins.	Ins.								%		Ins.		Ins.													
January	30.11	30.94	28.80	2.14	32.5	39.9	25.9	14.0	64	−4	68	80	6	3.40	12	2.98	10.4	64	9	6	3	3	4	13	9	15	0	1	4
February	30.11	30.97	28.79	2.18	33.0	39.5	25.6	13.9	71	−7	78	76	5	3.27	12	2.66	11.1	55	3	5	2	2	4	8	10	17	0	2	3
March	30.02	30.93	28.76	2.17	38.8	45.3	32.1	13.2	79	8	71	79	6	3.73	13	2.63	11.2	60	7	8	4	4	8	12	5	14	0	1	4
April	30.00	30.67	29.14	1.53	47.6	54.2	40.8	13.4	84	19	65	78	6	2.99	11	3.15	11.0	53	6	7	3	5	8	14	5	12	0	1	4
May	29.98	30.56	29.34	1.22	57.5	64.4	51.3	13.1	91	33	58	81	5	3.00	11	2.05	9.7	50	5	9	5	5	8	15	6	9	0	0	5
June	29.98	30.51	29.43	1.08	66.8	73.3	60.5	12.8	96	45	51	82	5	3.03	10	2.82	8.8	56	5	8	4	6	9	17	6	5	0	0	4
July	29.98	30.50	29.55	.95	72.5	78.5	66.2	12.3	99	52	47	82	5	3.78	10	5.41	8.0	50	5	7	4	4	10	22	5	5	0	0	2
August	30.00	30.45	29.48	.97	72.6	77.9	66.4	11.5	98	48	50	82	5	4.30	10	3.97	8.4	60	6	8	6	5	10	16	5	6	0	0	1
September	30.07	30.60	29.37	1.23	67.6	73.1	61.0	12.1	94	37	57	80	5	3.05	9	3.88	9.3	72	9	7	7	5	8	11	6	7	0	0	2
October	30.07	30.81	29.06	1.75	57.4	63.4	49.7	13.7	86	29	57	78	5	3.30	9	9.21	9.9	60	11	7	5	4	6	9	8	12	0	1	2
November	30.10	30.84	28.74	2.10	45.5	52.3	38.7	13.6	77	10	67	78	5	3.23	9	3.70	9.9	63	7	3	3	3	3	9	14	18	0	1	2
December	30.10	30.90	28.57	2.33	36.4	43.2	29.3	13.9	68	−7	75	78	6	3.74	10	3.52	10.1	64	8	5	2	2	4	8	14	19	0	1	2
Mean	30.04	.....	.....	.....	52.4	58.8	45.6	13.2	.....	.....	.....	80	5	.....	.....	.....	9.8	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	40.82	126	.....	.....	.....	86	80	48	48	82	154	93	139	0	8	35

Meteorological tables compiled by the United States Weather Bureau—Continued.

PHILADELPHIA, PA.

Month.	Barometer at 32° F. and mean sea level.				Air temperature, in °F.							Average relative humidity.	Average amount of clouds 0–10.	Precipitation.			Wind.											Number of days with winds of 40 miles or over.	Number of days dense fog.
	Mean.	Extremes.			Mean.				Extremes.								Statute miles.		Average number of times (observations at 8 a. m. and 8 p. m.) from—										
	For month.	Highest.	Lowest.	Range.	For month.	Mean max.	Mean min.	Range.	Highest.	Lowest.	Range.			Average fall.	Number of days 0.01 inch or more.	Maximum fall in 24 hours.	Average hourly velocity.	Highest velocity.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.		
	Ins.	*Ins.*	*Ins.*	*Ins.*								%		*Ins.*		*Ins.*													
January	30.11	30.96	28.67	2.29	31.8	39.3	25.7	13.6	72	−5	77	73	6	3.41	12	3.33	10.8	60	8	7	3	6	7	11	6	16	0	1	2
February	30.10	30.94	29.10	1.84	32.8	40.8	25.9	14.4	75	−6	81	70	6	3.38	11	3.86	11.5	48	7	6	2	4	4	9	7	18	0	1	1
March	30.02	30.92	28.80	2.12	40.0	48.3	32.9	15.4	83	5	78	69	6	3.45	12	2.79	11.9	60	9	8	4	7	7	8	5	14	0	0	1
April	30.01	30.69	29.22	1.47	50.3	60.2	42.8	17.4	93	18	75	64	6	2.91	11	2.77	11.1	50	9	4	4	8	8	8	6	13	0	0	0
May	29.99	30.56	29.36	1.20	62.2	71.5	53.5	18.0	96	36	60	67	6	3.20	11	3.10	9.9	60	7	7	5	6	8	10	6	11	0	0	0
June	29.98	30.54	29.45	1.09	71.2	80.2	62.8	17.4	98	46	52	68	6	3.30	10	3.43	9.2	54	6	6	5	7	8	11	6	9	0	0	0
July	29.98	30.51	29.54	.97	75.8	84.7	62.1	16.6	103	54	49	68	6	4.33	11	3.00	8.7	53	6	5	4	9	9	13	5	11	0	0	0
August	30.00	30.42	29.42	1.00	73.8	82.2	66.5	15.7	101	51	50	72	6	4.61	11	5.89	8.2	55	8	9	5	9	10	10	4	7	0	0	1
September	30.08	30.61	29.46	1.15	67.4	76.3	60.4	15.9	102	40	62	74	5	3.38	9	5.62	8.8	58	10	8	4	9	7	10	5	9	0	0	1
October	30.07	30.66	29.10	1.56	56.3	64.7	49.0	15.7	88	31	57	71	5	3.10	9	2.56	9.9	75	8	9	4	7	6	9	5	15	0	0	2
November	30.10	30.84	28.88	1.96	44.9	52.6	38.7	13.9	77	8	69	70	6	3.06	9	2.41	10.3	60	6	5	2	3	6	12	9	16	0	0	2
December	30.11	30.98	29.03	1.90	35.7	42.3	29.2	13.1	70	−5	75	72	6	3.04	10	3.78	10.7	63	6	7	2	3	6	11	8	18	0	0	2
Mean	30.05	.....	.....	.....	53.6	61.9	46.3	15.6	.....	.....	.....	70	6	.....	.....	.....	10.1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	41.17	126	.....	.....	.....	90	81	44	78	86	122	72	157	0	2	12

Meteorological tables compiled by the United States Weather Bureau—Continued.

BALTIMORE, MD.

Month.	Barometer at 32° F. and mean sea level.				Air temperature, in °F.							Average relative humidity.	Average amount of clouds 0–10.	Precipitation.			Wind.										Number of days with winds of 40 miles or over.	Number of days dense fog.
	Mean.	Extremes.			Mean.				Extremes.								Statute miles.		Average number of times (observations at 8 a. m. and 8 p. m.) from—										
	For month.	Highest.	Lowest.	Range.	For month.	Mean max.	Mean min.	Range.	Highest.	Lowest.	Range.			Average fall.	Number of days 0.01 inch or more.	Maximum fall in 24 hours.	Average hourly velocity.	Highest velocity.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.		
	Ins.	*Ins.*	*Ins.*	*Ins.*								%		*Ins.*		*Ins.*													
January	30.12	30.98	28.91	2.07	33.4	40.9	27.4	13.5	74	− 6	80	72	6	3.22	12	2.36	7.0	48	10	6	4	6	8	10	6	11	1	[1] 0	2
February	30.11	30.94	28.96	1.98	34.6	42.0	27.7	14.3	78	− 7	85	68	5	3.51	11	3.48	7.8	45	10	5	3	4	5	10	5	14	0	0	1
March	30.03	30.92	29.09	1.83	41.9	50.1	34.5	15.6	86	5	81	68	6	3.88	13	3.51	7.7	50	8	8	5	5	10	9	5	11	1	0	1
April	30.01	30.71	29.10	1.61	53.0	62.0	44.5	17.5	94	23	71	62	5	3.27	11	3.69	7.7	60	9	6	5	6	10	7	5	12	0	0	0
May	29.99	30.56	29.38	1.18	64.2	73.3	55.4	17.9	96	34	62	66	5	3.56	11	2.99	7.0	43	8	7	6	6	10	10	5	10	0	0	0
June	29.99	30.50	29.49	1.01	73.0	83.9	64.1	19.8	99	47	52	69	5	3.84	11	4.47	6.4	42	8	7	5	5	11	12	4	8	0	0	0
July	29.98	30.51	29.58	.93	77.3	85.9	69.1	16.8	104	55	49	69	5	4.82	11	4.02	6.1	70	8	7	4	3	14	13	4	8	1	0	0
August	30.01	30.43	29.44	.99	74.7	83.1	67.0	16.1	100	51	49	72	5	4.21	11	4.36	5.7	45	10	9	6	5	13	11	4	4	0	0	0
September	30.08	30.62	29.27	1.35	68.6	77.0	60.9	16.1	101	39	62	74	5	3.85	9	6.07	5.9	40	11	9	7	3	11	7	3	8	1	0	1
October	30.08	30.84	28.83	2.01	57.5	65.8	49.3	16.5	90	30	60	71	5	3.02	9	3.42	6.6	45	11	8	5	3	7	10	6	11	1	0	1
November	30.11	30.84	28.99	1.85	45.8	53.4	38.7	14.7	79	15	64	70	5	2.92	9	2.85	6.7	48	8	5	4	2	6	14	7	14	0	0	1
December	30.13	30.92	28.74	2.18	36.9	43.7	30.4	13.3	73	− 3	76	70	6	3.08	11	3.16	6.7	46	8	7	3	3	5	13	9	13	1	0	2
Mean	30.05	.....	.....	.....	55.1	63.4	47.4	16.0	.....	.....	.....	69	5	.....	.....	.....	6.8	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	43.18	129	.....	.....	.....	109	84	57	51	110	126	63	124	6	1	9

[1] Mean less than 0.5.

Meteorological tables compiled by the United States Weather Bureau—Continued.

RICHMOND, VA.

Month.	Barometer at 32° F. and mean sea level.				Air temperature, in °F.							Average relative humidity.	Average amount of clouds 0–10.	Precipitation.			Wind.											Number of days with winds of 40 miles or over.	Number of days dense fog.
	Mean.	Extremes.			Mean.				Extremes.								Statute miles.		Average number of times (observations at 8 a. m. and 8 p. m.) from—											
	For month.	Highest.	Lowest.	Range.	For month.	Mean max.	Mean min.	Range.	Highest.	Lowest.	Range.			Average fall.	Number of days 0.01 inch or more.	Maximum fall in 24 hours.	Average hourly velocity.	Highest velocity.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.		
	Ins.	Ins.	Ins.	Ins.								%		Ins.		Ins.													
January	30.13	31.00	28.92	2.08	38.0	47.8	29.8	16.0	78	−1	79	71	5	3.02	10	2.14	7.7	51	9	8	2	6	16	10	4	7	0	1	2
February	30.11	30.88	29.00	1.88	39.9	46.7	28.7	18.0	75	−3	78	67	4	3.10	10	2.37	7.9	61	9	9	3	5	9	8	5	8	0	1	1
March	30.04	30.90	29.04	1.86	46.9	57.9	38.2	19.7	94	15	79	71	5	3.72	11	3.59	8.3	54	8	10	5	7	13	8	3	8	0	1	1
April	30.02	30.70	29.29	1.41	57.2	67.1	46.0	21.1	92	25	67	64	4	3.45	10	5.33	8.3	52	8	7	4	8	15	8	4	6	0	1	0
May	29.99	30.56	29.44	1.12	67.3	77.6	56.2	21.4	95	38	57	68	9	3.85	12	2.39	7.0	53	7	9	4	11	13	9	3	6	0	0	0
June	30.01	30.47	29.57	.90	75.1	83.4	63.9	19.5	100	48	52	72	5	3.52	11	3.20	6.1	48	6	10	5	10	13	8	2	6	0	0	0
July	30.01	30.39	29.64	.75	79.2	88.3	68.7	19.6	100	57	43	72	5	4.42	11	3.59	6.4	45	7	8	4	10	17	10	2	4	0	0	0
August	30.01	30.39	29.56	.83	77.5	87.9	67.5	20.4	102	55	47	76	5	4.41	12	3.29	5.9	55	7	10	5	11	16	6	2	4	1	0	1
September	30.07	30.58	29.60	.98	70.8	80.5	61.6	18.9	100	41	59	78	5	3.43	8	3.21	5.8	45	10	14	4	8	10	6	2	5	1	0	1
October	30.08	30.59	29.33	1.26	59.8	69.6	49.8	19.8	90	29	61	78	4	3.32	8	2.95	6.5	49	12	11	4	6	10	8	3	7	1	0	2
November	30.12	30.73	29.12	1.61	48.8	58.2	38.6	11.6	82	19	63	70	4	2.39	7	2.77	6.9	46	8	6	2	5	14	11	4	9	1	0	2
December	30.14	30.85	29.31	1.54	41.0	48.1	31.1	17.0	74	4	70	73	5	3.00	10	2.52	7.0	53	7	9	2	8	11	9	5	10	1	1	1
Mean	30.06	.....	.....	.....	58.5	67.8	48.4	18.6	.....	.....	.....	71	5	.....	.....	.....	7.9	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	41.63	120	.....	.....	.....	98	111	44	95	157	101	39	80	5	5	11

Meteorological tables compiled by the United States Weather Bureau—Continued.

NORFOLK, VA.

Month.	Barometer at 32° F. and mean sea level.				Air temperature, in °F.							Average relative humidity.	Average amount of clouds 0-10.	Precipitation.			Wind.											Number of days with winds of 40 miles or over.	Number of days dense fog.
	Mean.	Extremes.			Mean.				Extremes.								Statute miles.		Average number of times (observations at 8 a. m. and 8 p. m.) from—											
	For month.	Highest.	Lowest.	Range.	For month.	Mean max.	Mean min.	Range.	Highest.	Lowest.	Range.			Average fall.	Number of days 0.01 inch or more.	Maximum fall in 24 hours.	Average hourly velocity.	Highest velocity.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.		
	Ins.	*Ins.*	*Ins.*	*Ins.*								%		*Ins.*		*Ins.*													
January	30.13	30.82	29.00	1.82	40.4	48.6	33.3	15.3	80	6	74	76	5	3.37	10	1.28	9.6	64	10	10	4	5	11	10	6	6	0	1	2
February	30.11	30.83	29.04	1.79	41.8	50.0	33.7	16.3	81	2	79	76	5	3.75	11	1.79	10.7	59	10	11	3	5	9	6	6	6	0	1	1
March	30.03	30.91	29.24	1.67	47.7	57.0	39.8	17.2	92	14	78	76	5	4.28	12	2.14	10.4	60	7	12	4	8	13	8	5	5	0	1	2
April	30.01	30.59	29.36	1.23	56.0	65.4	47.6	17.8	95	24	71	74	5	3.79	10	2.63	10.3	45	8	7	3	8	16	9	5	4	0	0	0
May	30.00	30.56	29.52	1.03	66.2	75.1	57.3	17.8	98	38	60	76	5	4.07	12	3.34	9.1	62	7	8	5	7	17	10	4	4	0	1	1
June	30.00	30.42	29.67	.85	74.4	83.1	66.1	17.0	102	49	53	78	5	4.33	11	5.97	8.4	49	4	10	4	11	14	11	3	3	0	1	0
July	30.00	30.38	29.61	.77	78.4	87.2	70.7	16.5	102	57	45	79	5	5.80	13	3.60	8.1	60	4	6	5	8	17	15	4	3	0	0	0
August	30.00	30.32	29.68	.64	76.7	84.4	69.9	14.5	100	56	44	82	5	5.97	11	5.00	7.4	54	5	9	6	11	17	9	3	2	0	0	0
September	30.06	30.44	29.77	.67	71.7	79.0	65.0	14.0	100	40	60	81	4	4.06	7	3.23	7.8	50	8	16	5	8	10	8	3	2	0	0	0
October	30.07	30.49	29.37	1.12	61.3	68.8	54.0	14.8	89	31	58	78	4	3.91	8	3.00	8.8	60	11	15	5	4	12	6	4	5	0	0	2
November	30.11	30.72	29.15	1.57	51.2	59.3	43.3	16.0	80	20	60	76	5	2.72	8	5.48	9.2	42	11	7	3	4	12	8	8	7	0	0	2
December	30.13	30.61	29.32	1.29	43.0	50.6	35.5	15.1	75	6	69	75	5	3.49	10	2.49	9.2	58	12	8	3	6	9	9	7	8	0	0	2
Mean	30.05	.....	.....	.....	59.1	67.4	51.6	15.8	.....	.....	.....	77	5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
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