APPENDIXES A TO G

APPENDIX A

Glossary of Terms Used

(This glossary is intended to serve as a ready reference to the legal and technical terms used in Volume Two, whether or not they are defined in the text. Many terms are common to both volumes. Where a term is actually discussed in Volume Two, the definition has been included; otherwise, the incorporation is by reference only. Figure references are to those in the text.)

A

Accretion.—The gradual and imperceptible accumulation of land by natural causes, as out of the sea or a river. This may result from a deposit of alluvion upon the shore, or by a recession of the water from the shore. Accretion is the act, while alluvion is the deposit itself. See *Riparian Rights, Alluvion, Gradual and Imperceptible.*

Accuracy of Horizontal Control.—See *Triangulation Classification.*

A Change in the Horizontal Datum.—Changes in the latitudes and longitudes of triangulation stations resulting in a shift in the projection lines on a survey sheet. See *United States Standard Datum, North American 1927 Datum.*

Acre.—A unit of area measurement in public land surveys. An acre equals 10 square chains, or 43,560 square feet; 640 acres equal 1 square mile. See *Chain.*

Act of Apr. 5, 1960.—This act had for its purpose the removal of geographical limitations on the activities of the Coast Survey. *See* Appendix C.

Act of Aug. 6, 1947.—The first of the recent legislation to define the function and duties of the Coast and Geodetic Survey (*see* Appendix C). It did not change previous authorizations to any great extent but eliminated a number of obsolete statutes and assembled into one place various items of substantive legislation which had been enacted at different times since 1807. See *Act of Apr. 5, 1960.*

Act of Feb. 19, 1895.—An act to adopt special rules for the navigation of harbors, rivers, and inland waters of the United States. Section 2 authorized the Secretary of the Treasury (now delegated to the Commandant of the Coast Guard) "to designate and define by suitable bearings or ranges with light houses, light vessels, buoys or coast objects, the lines dividing the high seas from rivers, harbors and inland waters." This determined the scope of application of the two sets of rules for navigation. See *Rules of the Road Boundary Lines.*

Act of Feb. 10, 1807.—The organic act of the Coast and Geodetic Survey. It authorized President Jefferson "to cause a survey to be taken of the coasts of the United States, in which shall be designated the islands and shoals, with the roads or places of anchorage,

within twenty leagues of any part of the shores of the United States." See *Marine League, Survey of the Coast, "Comprehending All Islands Within Twenty Leagues of Any Part of the Shores of the United States."*

Act of July 10, 1832.—Revived the Act of Feb. 10, 1807, for the Survey of the Coast. See *Act of Feb. 10, 1807.*

Act of June 20, 1878.—An appropriation act in which the name Coast and Geodetic Survey was first mentioned. This is considered as the date of change from the name Coast Survey. *See* Appendix C.

Act of Mar. 3, 1871.—Authorized an extension of the triangulation in the interior of the country so as to provide a geodetic connection between the Atlantic and Pacific coasts and to provide starting data for federal and state surveys.

Act of Oct. 31, 1945.—See *District of Columbia–Virginia Boundary Line.*

Ad Coelum.—To the sky. See *Ad Coelum Doctrine.*

Ad Coelum Doctrine.—A 16th century English legal maxim which stated that to whomsoever the soil belongs, he owns also to the sky and to the depths. This doctrine has been limited by 20th century courts to extend only to so far above the ground as the landowner can reasonably occupy or use in connection with the land. See *Ad Coelum, United States* v. *Causby.*

Ad Hoc.—For this; for this special purpose.

Adjoiner.—In land description, the call for the line of an adjoining tract. See *Call.*

Adjusted Position.—An adjusted geographic position of a point on the earth in which discrepancies arising from errors in the observational data are removed; a fixed position. See *Field Position.*

Adjustment (Leveling).—The determination and application of corrections to orthometric differences of elevation or to orthometric elevations, to make the elevations of all bench marks consistent. See *1929 General Adjustment, Orthometric Correction.*

Administrative Boundary Lines.—Boundaries established for administrative purposes rather than as a division of sovereignty. Such delineations are limited to the purposes intended. Examples of such lines are the Rules of the Road boundary lines, and the lines adopted by the Bureau of the Census for determining the outer limits of the United States. See *Rules of the Road Boundary Lines.*

Administrative Branch.—Applied to administrative agencies whose activities often represent a fusion of legislation, execution, administration, and adjudication. They are usually staffed with experts in the respective fields. See *Administrative Procedure Act.*

Administrative Procedure Act.—The Act of June 11, 1946, under which procedural protections surrounding the administrative process are established as well as the standards of judicial review. See *Administrative Branch, Judicial Review.*

Admiralty Law.—That branch of the body of the law which governs in maritime matters; administered in the United States by the Federal courts as a distinct legal system, the jurisdiction being exclusive and cannot be enlarged or restricted by state legislation. Admiralty jurisdiction requires the presence of two concurrent elements: (1) a navigable waterway which is part of an interstate or international highway, and (2) a vessel or craft used or capable of being used as a means of transportation on such waterway.

Admission of New States.—The creation of new states out of existing territory of the United States is derived from Art. IV, sec. 3, cl. 1, of the Constitution, which provides that "New States may be admitted by the Congress into this Union." See *Enabling Act.*

Admission of States to Union.—*See* Table 1.

Aerial Photography Index.—Indexes of the aerial photography of the Coast Survey prepared on 1: 250,000 scale base maps.

Affluent River.—A stream flowing into a larger stream or lake; a tributary stream.

Aid Proof.—A copy of the latest new print of a chart on which are indicated all changes in aids to navigation and important corrections that are applied to the printing plate before the next printing of the chart. Aid proofs are changed with every new print of a chart. See *New Print.*

Aid to Navigation.—A device external to a boat or vessel designed to assist in determination of position, a safe course, or to warn of dangers. Examples are: Lighthouses, lights, buoys, daybeacons, radio beacons, and electronic devices.

Air Commerce.—Defined in the Federal Aviation Act of 1958 as "any operation or navigation of aircraft which directly affects, or which may endanger safety in, interstate, overseas, or foreign air commerce."

Alaska Purchase.—The last of the major acquisitions to the territory of the United States. Purchased from Russia under a convention signed Mar. 30, 1867, and proclaimed June 20, 1867.

Alidade.—A part of the instrumental equipment of the planetable consisting of a straight-edge ruler upon which a telescope is mounted, the telescope having motion in a vertical plane only, so that its line of collimation is always parallel to the edges of the ruler (fig. 41). See *Planetable.*

Alkali Flat.—An alkaline, marshy area in an arid region. In the dry season, it is a barren area of hard mud covered with alkali (a soluble salt or mixture of soluble salts). Symbolized on early topographic surveys by an open dot pattern (*see* (*J*) in fig. 44).

Alluvion.—The soil that is deposited along a river or the sea by gradual and imperceptible action of the sea. See *Accretion.*

Aluminum-Mounted Sheets.—Bristol board mounted on aluminum to eliminate distortion of the paper and used subsequent to 1932 in planetable surveying. Replaced the cloth-mounted Whatman sheets formerly used.

Ambulatory Boundary.—A shifting water boundary. See *Shifting Riparian Boundary.*

American Meridian.—The meridian passing through the center of the dome of the old Naval Observatory in Washington, D.C., which under the Act of Sept. 28, 1850, was to be used as the initial or zero of longitudes for all astronomical purposes in the United States. The act was repealed Aug. 22, 1912. Many early state surveys are referred to this meridian. Its value west of Greenwich is 77°03′06″.276 on the North American 1927 Datum. See *Greenwich Meridian.*

American Polyconic Projection.—Same as *Polyconic Projection.*

Amicus Curiae Brief.—*See* Volume One, Appendix A.

Annexation by Joint Resolution.—Territory annexed by a simple majority in both Houses of Congress and approval by the President See *Annexation by Treaty.*

Annexation by Treaty.—Territory annexed by a two-thirds favorable vote in the Senate. See *Annexation by Joint Resolution.*

Annual Sea Level.—Sea level derived from tidal observations extending over a period of 1 year. See *Mean Sea Level.*

Antarctic Treaty.—A treaty which entered into force in 1961 between the United States, Russia, and 10 other nations to maintain the Antarctic as a peaceful international preserve.

Apparent Shoreline.—The outer edge of marine vegetation (marsh, mangrove, cypress) delineated on photogrammetric surveys where the actual shoreline is obscured.

Appellant.—See *Petitioner.*

Appellate Court.—A court having jurisdiction of appeal and review. See *Appellate Jurisdiction.*

Appellate Jurisdiction.—*See* Volume One, Appendix A.

Appellee.—See *Respondent.*

A Priori.—That kind of reasoning which deduces consequences from definitions formed, or principles assumed; deductive reasoning.

Artificial Monument.—An artificial object found on the land, such as a highway, wall, ditch, or post. See *Monument, Natural Monument.*

Astronomic Azimuth.—The azimuth which results directly from observations on a celestial body. See *Laplace Azimuth.*

Astronomic Determination.—The position of a point on the surface of the earth, with reference to the equator and to a principal meridian, determined by observations on the stars. See *Geodetic Determination.*

Atlantic Neptune.—An atlas of charts compiled between 1775 and 1781 by Des Barres, the Royal Surveyor General for the colonies, from surveys by British naval vessels, from private surveys, and from records by the Lords of Trade.

Atoll.—A coral island or islands, consisting of a belt of coral reef surrounding a central lagoon.

Attorney-General v. Chambers (4 De G. M. & G. 206).—An 1854 leading English case in which the word "ordinary," as applied to tides, was first construed as meaning the medium tides between the springs and neaps, and that the landward limit of the seashore is the line of the medium high tide between the springs and the neaps. *See* Appendix D.

Authentication.—The act or mode of giving authority or legal authenticity to a statute, record, or other written instrument so as to render it legally admissible in evidence. See *Certify, Seal.*

Authority Note.—The note included on a chart which gives the names of the federal agencies that have contributed to the information used in the compilation.

Automatic Tide Gage.—An instrument that automatically registers the rise and fall of the tide. Those used by the Coast and Geodetic Survey draw a continuous graph in which the height of the tide is represented by the ordinates of the curve and the correspond-

ing time by the abscissae. The first gage of this type was installed at Governor's Island, N.Y., in the winter of 1844–1845.

Avulsion.—The loss of lands bordering on the seashore by sudden or violent action of the elements, perceptible while in progress; a sudden and rapid change in the course and channel of a boundary river. Neither of these changes works a change in the riparian boundary. See *Accretion, Erosion, Reliction, Boundary River.*

Award of the Arbitrators of 1877.—The culmination of interstate controversy, discussion, and settlement of the Maryland–Virginia boundary dispute which began about 1661, an important milestone being the Compact of 1785. Defined the boundary on the Potomac as "following the meanderings of said river by the low-water mark, to Smith's Point," which was to be "from low-water mark at one headland to low-water mark at another, without following indentations, bays, creeks, inlets, or affluent rivers." See *Maryland–Virginia Compact of 1785.*

Awash ¼ Tide.—A notation (or similar notation) used on some surveys to indicate the status of a rock awash. Interpretation of such notation is that the rock was awash when the tide had risen to one-fourth its height above the sounding datum See *Rock Awash, Plane of Reference.*

Awash Rock.—Same as *Rock Awash.*

Azimuth.—The horizontal direction reckoned clockwise from the meridian plane. In the geodetic work of the Coast Survey, azimuths are measured clockwise from the south following continental European practice.

Azimuth Mark.—A mark established in conjunction with a triangulation station which gives directional control for future surveys and avoids the need of establishing a true meridian line by local surveyors and engineers. See *Azimuth.*

B

Bache, Alexander Dallas.—Noted American scientist and educator and great-grandson of Benjamin Franklin. Succeeded Hassler as Superintendent of the Coast Survey and directed its operations from 1843 to 1867 (*see* fig. 3).

Backshore (according to Coastal Engineering).—The zone of the shore that lies between the foreshore and the coast and is covered by water during exceptional storms only (*see* fig. 86).

Bank of a River (Legal).—The water-washed and relatively permanent elevation or acclivity at the outer line of the river bed which separates the bed from the adjacent upland, whether valley or hill, and serves to confine the waters within the bed and to preserve the course of the river. See *Bed of a River* (Legal), *Right Bank* (River), *Left Bank* (River).

Bare Rock.—In Coast Survey terminology, a rock extending above the plane of mean high water. See *Rock Awash.*

Base (also called Base Line).—In geodetic surveying, the side of one of a series of connected triangles of a triangulation network the length of which is measured on the ground with prescribed accuracy. From these bases and the measured angles the lengths of all other sides of the triangulation are computed by trigonometric methods. See *Triangulation.*

Base Line (Geodetic Surveying).—Same as *Base.*

Baseline (International Law).—A term used in the law of the sea to indicate the reference line from which the outer limits of the marginal sea and other offshore zones are measured; the dividing line between inland waters and the marginal sea. See *Normal Baseline, Straight Baselines, Headland-to-Headland Line.*

Base Line (Public Lands Surveys).—A true east-west line (a parallel of latitude) extending both east and west of the initial point in the rectangular system of surveys. Together with the principal meridian they constitute the axes of a system and the initial point constitutes the origin of that system (fig. 97). See *Initial Point, Principal Meridian, Rectangular System of Surveys.*

Basic Geodetic Networks of the Country.—The networks of triangulation and precise levels established by the Coast Survey throughout the country (*see* figs. 4 and 15), which provide rigid frameworks of horizontal control (latitudes and longitudes and plane coordinates) and vertical control (elevations above mean sea level) for all types of accurate maps and surveys and engineering projects. See *Triangulation, Leveling.*

Basic Survey.—A hydrographic survey so complete and thorough that it does not need to be supplemented by other surveys, and is adequate to supersede, for charting purposes, all prior hydrographic surveys of the area.

Batture.—An elevation of the bed of a river under the surface of the water; sometimes used to signify the same elevation when it has risen above the surface.

Bay (according to Geneva Convention).—A well-marked indentation whose penetration is in such proportion to the width of its mouth as to contain landlocked waters and constitutes more than a mere curvature of the coast. The area of such an indentation must be as large as, or larger than, the semicircle whose diameter is a line drawn across the mouth of the indentation. See *Semicircular Rule, Conventions on the Law of the Sea, Bay* (General).

Bay (General).—An indentation of the coast; an embayment; a subordinate adjunct to a larger body of water; a body of water between and inside of two headlands. See *Open Bay, Closed Bay, Bay* (according to Geneva Convention).

Beach.—Same as *Tidelands.*

Bed of a River (Legal).—That portion of its soil which is alternately covered and left bare, as there may be an increase or diminution in the supply of water, and which is adequate to contain it at its average and mean stage during the entire year, without reference to the extraordinary freshets of the winter or spring, or the extreme droughts of the summer or autumn.

Bench Mark.—A marked point whose elevation above or below an adopted datum is known and which provides a starting point for a survey or engineering operation where elevation is a significant factor. See *Standard Disk.*

Bench Mark (Geodetic).—A bench mark set to reference a station in the level net of the country and the elevation of which is determined with relation to the Sea Level Datum of 1929. See *Bench Mark* (Tidal).

Bench Mark (Tidal).—A bench mark set to reference a tide staff at a tide station and the elevation of which is determined with relation to the local tidal datum. Established wherever tides are observed, no matter how short the series, and the zero of the tide staff is

connected by spirit levels to these marks. Elevations of tidal bench marks are determined with reference to the local planes of high water, mean sea level, low water, and other tidal planes.

Bering Sea Fur Seal Arbitration.—*See* Volume One, Appendix A.

Bessel Spheroid of 1841.—The spheroid used in the Bureau's work between 1844 and February 1880. The semimajor axis=6,377,397.2 meters, the semiminor axis=6,356,079.0 meters, and the ellipticity=1/299.15. See *Clarke Spheroid of 1866.*

Best Evidence.—Primary evidence, as distinguished from secondary; original, as distinguished from substitutionary; the highest evidence of which the nature of the case is susceptible. See *Best Evidence Rule.*

Best Evidence Rule.—The rule that the highest available degree of proof must be produced; that is, that no evidence which is merely substitutionary in its nature can be received as long as original evidence can be had. See *Best Evidence.*

Bilby Steel Tower.—A triangulation tower consisting of two steel tripods, one within the other, designed by J. S. Bilby of the Coast and Geodetic Survey. First put into use in 1927.

Bill of Rights.—The first ten amendments to the Constitution.

"Bis" Sheet.—A redrawing of an original topographic survey that has become dilapidated through continued use.

Black–Jenkins Award of 1877.—Same as *Award of the Arbitrators of 1877.*

Board of Surveys and Maps.—Created by President Wilson on Dec. 30, 1919, to coordinate the activities of the various map-making agencies of the Government and to standardize results. On Jan. 4, 1936, the name was changed to Federal Board of Surveys and Maps, and on Mar. 10, 1942, it was abolished by President Roosevelt.

Boat Sheet.—The work sheet used by the hydrographer in the field for plotting the details of a hydrographic survey as it progresses. It is similar to the smooth sheet, with projection lines, control stations, shoreline, and proposed sounding lines. Corresponds to what was termed in early instructions for hydrographic work as "diagram," "sounding-sheet," and "working-sheet." See *Smooth Sheet.*

Bonne Projection.—A modification of the simple conic projection, by Rigobert Bonne, in which all parallels are subdivided according to their values on the earth. Its characteristics are curved meridians except the central one, concentric arcs of circles for all parallels, and nonorthogonality of intersections except at the central meridian. The scale along all the parallels is correct by construction, which makes the projection more suitable for maps having considerable north-south extent than the simple conic. See *Simple Conic Projection.*

Borax Consolidated, Ltd. v. Los Angeles (296 U.S. 10).—A 1935 landmark case in the law of tidal boundaries, in which the Supreme Court established the doctrine that in construing a federal grant, the common-law term "ordinary high-water mark," as the boundary between upland and tideland, is to be interpreted as "the mean high-tide line"; that is, as neither the mean of the spring tides nor the mean of the neap tides, but a mean of all the high tides. The case also established the first precise standard for the demarcation of the line of mean high water on the ground; that is, by using for the plane of mean high water a determination from "an average of 18.6 years" as near as possible (citing Tidal

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Datum Planes, Special Publication No. 135, U.S. Coast and Geodetic Survey (1927)). *See* Appendix D.

Bottom Characteristics.—Designations used on surveys and charts to indicate the consistency, color, and classification of the sea bottom. Thus, "soft gray sand, shells, pebbles" is designated "sft gy S Sh P."

Bottom Samples.—Samples of the bottom obtained by means of a coring device or by dredging.

Boundary River.—A river that forms the dividing line between two political jurisdictions. River boundaries are delimited as (1) the geographic middle or *medium filum acquae,* (2) the middle of the channel or *thalweg,* and (3) the shore or bank. See *International River, National River.*

Bounds.—The limiting lines or boundary lines, either real or imaginary, which enclose or mark off a tract of land, or the natural or artificial marks which indicate the beginning and ending. See *Metes and Bounds.*

Bowie Method of Triangulation Adjustment.—A special method (similar to that used in the adjustment of a first-order level net) devised in the Coast Survey for adjusting the triangulation nets in the western and eastern portions of the country. See *North American 1927 Datum.*

Bridgeport Harbor, Conn.—The first published chart of the Coast Survey of which there is a present record. Engraved commercially in 1835.

Bromide.—A photographic process, used in the Coast Survey for making copies of original surveys, in which the subject is first photographed at a reduced scale on a film or glass negative and then enlarged on bromide paper to the desired scale. The paper does not come in contact with the negative. See *Photostat.*

Bulkhead Line.—The line to which solid or solid filled structures may be built (fig. 105). See *Pierhead Line, Harbor Line.*

Buoyage System in the United States.—The system by which buoys are marked (as to shape and color) and numbered for the safe navigation of the waters of the United States. It dates back to the act passed by Congress on Sept. 28, 1850. See *Lateral System.*

Buoy-Control Method.—A system of accurately located buoys on which three-point fixes could be observed, or to which distances could be measured by radio acoustic methods, for extending hydrographic surveys beyond the visibility of shore control. See *Radio Acoustic Ranging.*

C

Call.—A reference to, or statement of, an object, course, distance, or other matter of description in a survey or grant requiring, or calling for a corresponding object, or other matter of description, on the land. See *Locative Call, Descriptive Call.*

Canadian Proclamation of June 4, 1963.—Established a 12-mile exclusive fisheries zone along the whole of Canada's coastline as of mid-May 1964, and implemented the straight baseline system as the basis from which Canada's territorial sea and fisheries zone shall be measured. See *Straight Baselines.*

Cardinal Points.—North, south, east, west.

Case or Controversy.—Stems from the provision in Art. III, sec. 2, of the Constitution, which limits the scope of federal judicial power to "cases" and "controversies." Interpreted to mean that there must be a bona fide dispute between opposing parties before a Federal court will accept the dispute for adjudication. "Cases" have been held to be broader in scope and to apply to civil and criminal suits, whereas "controversies" are confined to civil suits only.

Catalog of Nautical Charts.—Lists nautical charts, auxiliary maps, and related publications of the Coast Survey and includes references to publications of other federal agencies. This is supplemented monthly by a revised list of charts titled "Dates of Latest Editions," which brings the user's attention to new charts, new editions, and discontinued charts.

Central Meridian.—The meridian in a polyconic projection that is central to the survey sheet and about which the projection is constructed. It is represented by a straight line and distances on it are true to scale. See *Polyconic Projection.*

Certified Copy.—A copy of a document or record, signed and certified as a true copy by the officer in whose custody the original is entrusted.

Certify.—To testify in writing; to make known or establish as a fact. See *Certified Copy.*

Certiorari.—A writ or order by an appellate court which directs a lower court to send up the record of a pending cause for review. See *Writ of Error.*

Chain.—The legal unit of linear measure for the survey of the public lands of the United States, and all measurements are made in miles, chains, and links. A chain equals 100 links, or 66 feet, and 80 chains equals 1 statute mile, or 5,280 feet. All areas are expressed in acres, an acre being equal to 10 square chains.

Chamizal Arbitration.—An arbitration between the United States and Mexico in 1910 over the movement southward of the Rio Grande into Mexican territory. The question was whether the river boundary under the treaties of 1848 and 1853 was a fixed or a shifting one. The International Boundary Commission held it to be a shifting one because the subsequent conduct of the parties and their formal conventions were "wholly incompatible with the existence of a fixed line boundary." See *Fixed Riparian Boundary.*

Chart Classification.—Categories of charts based on scale and special purpose.

Chart Datum (also called Sounding Datum).—The tidal datum used on nautical charts for referencing the soundings (depth units). See *Tidal Datums.*

Checks and Balances.—A term applied to the American tripartite system by which each branch of government exercises a certain restraint on the other two. The veto power of the President and the power of Congress to override a veto, and the power of the Supreme Court to hold unconstitutional acts of Congress and acts of the President are examples of how this system works in practice. See *Tripartite System.*

Chronometer.—A portable timekeeper with compensated balance, capable of showing time with extreme precision and accuracy.

Chronometric Method.—A method of determining longitude by transporting chronometers between stations whose difference in longitude was to be determined.

Circuit Closure (Leveling).—The amount by which the algebraic sum of the measured differences of elevation around a circuit fails to equal the theoretical closure, zero.

Civil Law.—The system of law that is based upon statutes and upon written codes, and has for its antecedents the Roman law, particularly the Justinian Code. It is distinguished from the common, or unwritten, law which is based upon judicial decisions and precedent. See *Common Law*.

Clarke Spheroid of 1866.—The spheroid used in the Bureau's work since February 1880. The semimajor axis = 6,378,206.4 meters, the semiminor axis = 6,356,583.8 meters, and the ellipticity = 1/294.98. See *Bessel Spheroid of 1841*.

Closed Bay.—*See* Volume One, Appendix A.

Closing Errors (Leveling).—See *Circuit Closure* (Leveling).

Closing Line.—*See* Volume One, Appendix A.

Coast.—The zone of land of indefinite width (perhaps 1 to 3 miles) that extends inland from the shore to the first major change in terrain features (*see* fig. 86).

Coastal Engineering.—That part of engineering dealing with harbor improvement, channel development and maintenance, or shore protection.

Coast and Geodetic Survey.—A Bureau of the U.S. Department of Commerce created under the Act of Feb. 10, 1807, as "Survey of the Coast" which in 1845 became known as "Coast Survey" and which name was changed to "Coast and Geodetic Survey" by the Act of June 20, 1878. In this publication, the words "Bureau," "Survey," and "Coast Survey" are used interchangeably with "Coast and Geodetic Survey."

Coast Chart No. 33 (issue of 1877).—The Coast Survey chart on which the arbitrators of 1877 laid down the boundary between Maryland and Virginia in accordance with their findings (*see* fig. 102).

Coast Charts.—Charts of scales 1:50,000 to 1:100,000 for inshore navigation where the course may lie inside outlying reefs and shoals, for entering or leaving bays and harbors of considerable width, and for navigating large inland waterways.

Coastline.—The line of contact between land and sea. In the Coast Survey, the term is considered to be synonymous with shoreline. See *Coast Line* (according to Public Law 31).

Coast Line (according to Public Law 31).—*See* Volume One, Appendix A.

Coast Pilots.—Adjuncts to the nautical charts containing information of importance to the navigator most of which cannot be shown conveniently on the charts and is not readily available elsewhere. The Coast Pilots of the Coast and Geodetic Survey comprise 8 volumes and cover the coasts of continental United States, Hawaii, the Virgin Islands, and Puerto Rico.

Coasts.—Usage in Act of Feb. 10, 1807, in a very broad sense to cover both land and water areas. Modern usage confines the term "coast" to a zone of land of indefinite width (perhaps 1 to 3 miles) bordering the sea; the land that extends inland from the shore. See *Act of Feb. 10, 1807*.

Coast Survey.—See *Coast and Geodetic Survey*.

Coast Survey Polyconic Projection.—Same as *Polyconic Projection*.

Code Napoleon.—A civil code of France, founded on the Roman law, prepared for Napoleon in 1804. Much of the civil-law system adopted by Louisiana is based on this code. See *Justinian Code*.

Commerce Clause.—Art. I, sec. 8, cl. 3 of the Constitution, which empowers Congress "To regulate Commerce with foreign Nations, and among the several States, and with the Indian Tribes."

Committee of Twenty.—A committee appointed in 1857 by the American Association for the Advancement of Science to examine into the character and progress of the Coast Survey. In 1858, the committee, consisting of leading scientists and educators, published its report entitled, "Report on the History and Progress of the American Coast Survey," in which it was highly laudatory of the management, progress, and outstanding achievements of the Survey.

Common Law.—The body of judicial decisions developed in England and based upon immemorial usage. It is unwritten law as opposed to statute, or written, law. The English common law forms the foundation for the system of law in the United States. See *Civil Law.*

Compact of 1834.—A compact between New York and New Jersey which invested the State of New York with an extraterritorial jurisdiction over all the waters of the "bay of New York."

Comparison of Simultaneous Observations.—A reduction process in which a short series of tide observations at a place is compared with simultaneous observations at a control tide station where tidal constants have been determined previously from a long series of observations. See *Control Tide Station, Short-Series Tide Station.*

"Comprehending All Islands Within Twenty Leagues of Any Part of the Shores of the United States".—A phrase used in the Treaty of 1783 with Great Britain which has been interpreted by the Supreme Court as not intended to establish United States territorial jurisdiction over all waters lying within 20 leagues of the shore.

Concurrent Powers.—Those powers of the National Government that are exercisable by the states in the absence of federal action, or with congressional consent. Such powers are not concurrent in the sense of equal power with the Nation; they are subordinate to the superior authority and are superseded whenever the power of Congress is exercised. State regulation of pilotage is an example of a concurrent power.

Conformal Projection.—A class of map projections in which the property of correct shape is preserved for geographical features, rather than correct size. The exact condition for conformality is that the scale at any point is the same in all directions; the scale may change from point to point, but at each point it is independent of the azimuth. Projections of this type are the Mercator, the transverse Mercator, and the Lambert conformal conic, the latter two being used in the State Coordinate Systems. See *Equal-Area Projection.*

Conical Projections.—Projections that use the cone as the developable surface for determining their elements. See *Developable Surface.*

Constitutional Courts.—Courts which share in the exercise of the judicial power defined in Art. III of the Constitution, and their judges are appointed for life or good behavior and can only be removed by the impeachment process. See *Legislative Courts.*

Conterminous United States.—The 48 States and the District of Columbia; all of the States exclusive of Alaska and Hawaii. They have common boundaries and are not separated by foreign territory or the high seas. See *Continental United States, United States.*

Contiguous Zone.—In international law, an area of the high seas outside and adjacent to the territorial sea of a country but not beyond 12 miles from the baseline from which the breadth of the territorial sea is measured. See *High Seas.*

Continental Shelf.—*See* Volume One, Appendix A.

Continental Slope.—*See* Volume One, Appendix A.

Continental Terrace.—*See* Volume One, Appendix A.

Continental United States.—Includes conterminous United States plus Alaska. See *Conterminous United States.*

Contour.—An imaginary line on the ground all points of which are at the same elevation above a specified datum surface. See *Depth Contours.*

Control Tide Station (formerly called Primary Tide Station).—A place at which continuous tide observations have been taken or are to be taken over a number of years to obtain basic tidal data for the locality (*see* fig. 19).

Conventional Signs (1911).—Promulgated by the U.S. Geographic Board; the first complete set of topographic and hydrographic symbols to be published by a government agency. See *Standard Symbols* (1928).

Conventional Symbols.—A system of conventions in which the character of every line and every symbol on a survey, map, or chart conveys a definite meaning. See *Earliest Published Conventional Symbols.*

Conventional Symbols (1860).—A pamphlet titled "Rules for Representing Certain Topographical and Hydrographical Features on the Maps and Charts of the United States Coast Survey" (*see* figs. 47 and 48).

Convention on the Territorial Sea and the Contiguous Zone.—*See* Volume One, Appendix A.

Conventions on the Law of the Sea.—The four conventions adopted at Geneva in 1958, at the United Nations Conference on the Law of the Sea. As of Mar. 9, 1964, the number of nations that had ratified or acceded to the various conventions was as follows: Convention on the Territorial Sea and the Contiguous Zone—21 nations; Convention on the Continental Shelf—21 nations; Convention on the High Seas—27 nations; and Convention on Fishing and Conservation of the Living Resources of the High Seas—14 nations. See *Optional Protocol of Signature.*

Corrected Establishment of the Port (also called High-Water Lunitidal Interval).—The time interval between the moon's meridian passage (upper or lower) and the following high water.

Correction Date (also called Hand-Correction Date).—The date printed in the lower left-hand margin on Intracoastal Waterway and Small-Craft charts, or as hand-stamped in the lower right-hand margin of standard charts. It gives the number and date of the Notice to Mariners through which the chart has been corrected by hand for changes in aids to navigation, newly discovered dangers, and important changes in channel depths. See *Notice to Mariners.*

Correction Factor.—A factor to be applied to measured distances on a survey sheet to take into account distortion. It is the difference between the true value on the earth and the value on the survey sheet divided by the survey value. See *Distortion of Medium.*

Cosa Chart of 1500.—The earliest map now extant which shows the American coast. Drawn on oxhide and in bright colors and purports to cover the entire world (*see* fig. 66).

Cosa, Juan de la.—Master of the flagship on the first voyage of Columbus and cartographer on the second voyage. See *Cosa Chart of 1500.*

County of Virginia.—That portion of the original limits of the District of Columbia on the west side of the Potomac River which Virginia ceded to the Federal Government on Dec 3, 1789 and was receded to Virginia on Sept. 7, 1846. See *Original Limits of District of Columbia.*

County of Washington.—That portion of the original limits of the District of Columbia lying on the east side of the Potomac River which Maryland ceded to the Federal Government on Dec. 23, 1788. See *Original Limits of District of Columbia.*

Course.—See *Courses and Distances.*

Courses and Distances.—A method of describing land; mathematical descriptions of boundary lines indicating their direction and length. A course is the direction or bearing of a line with reference to the true or magnetic meridian. See *Magnetic Meridian, True Meridian.*

Court of Claims.—Originally established in 1855 as a special tribunal to investigate claims against the Government and report its findings to Congress. Subsequent acts of Congress have given it the status of a court of special jurisdiction with power to hear all claims against the United States except those in the nature of tort actions. In 1953, Congress established it as a constitutional court. See *Constitutional Courts.*

Cross Lines.—Sounding lines that cross the main system of lines at either right angles or at an oblique angle to serve as a check on the accuracy of the work. When all soundings are reduced to the same plane of reference, the soundings on one system of lines must agree, within certain limits, with the soundings which they cross on the other system of lines.

Curvature of the Coast.—*See* Volume One, Appendix A.

Cylindrical Projections.—Projections that use the cylinder as the developable surface for determining their elements. See *Developable Surface.*

D

Daily Sea Level.—Sea level derived from tidal observations extending over a period of 1 day. See *Mean Sea Level.*

Datum.—A reference point, line, or plane used as a basis for measurements. For a group of statistical references, the plural form is *data,* as geographic data for a list of latitudes and longitudes, but where the concept is geometrical, rather than statistical, the plural form is *datums,* as two geographic datums. See *Datum Plane, Geographic Datum.*

Datum Correction.—The correction (in latitude and longitude) that must be applied to the projection lines on a survey sheet or chart to bring it to a different datum. See *Distortion Factor.*

Datum Plane.—*See* Volume One, Appendix A.

Day Letters.—Letters or combination of letters, in alphabetical order, assigned each day's work, starting with the letter *A* or *a* on each hydrographic survey, and using capital

letters for identifying the major survey vessel of the party and lower-case letters for the supplementary launches, a different color being assigned to each separate unit. The letters in their distinctive colors are carried in the sounding records and on the smooth sheet. See *Position Numbers, Identification Letters and Numbers.*

Dead Reckoning.—A method of navigation that has been used in hydrographic surveying to control the position of the survey ship beyond the range of control stations, and to supplement astronomic observations. The position is determined by applying the ship's run to the last well-determined position, using the course steered and the distance traveled by log. See *Precise Dead Reckoning.*

Decisions of the United States Geographic Board.—Printed quarterly. At long intervals, all decisions of the board since its establishment are published complete in one consecutive alphabetical list. See *Sixth Report of the United States Geographic Board (1933).*

Deed.—An instrument in writing and under seal used for transferring land from one owner to another, an essential requirement of which is that the land be fully described in order that it may be properly identified. See *Seal.*

Deflection of the Vertical (also called Plumb-Line Deflection and Station Error).—The difference between the observed and computed positions corresponding to the astronomic and geodetic values of a point.

Delegated, Limited, Enumerated Powers.—Those powers which the States chose to surrender when the Federal Government was formed and the Constitution adopted. Does not apply to powers of external sovereignty which do not depend upon the affirmative grants of the Constitution. See *National External Sovereignty.*

Delimitation of Boundary Line.—The definition of a boundary line as given in treaties and statutes and generally involves problems of interpretation before the line can be laid down on a map or chart. See *Demarcation of Boundary Line.*

Demarcation of Boundary Line.—The actual marking of the boundary line on the ground or the marking of reference points tied in to points on the boundary line by measured directions and distances. See *Delimitation of Boundary Line.*

Demarcation of District of Columbia–Virginia Boundary Line.—Surveyed and mapped by the Coast and Geodetic Survey, pursuant to Act of Oct. 31, 1945, using a combination of geodetic and photogrammetric methods. Boundary witness monuments were established at 15 points, on the fast land near the water's edge, by second-order triangulation and traverse, the elevation of each monument above mean high water being determined from existing Survey bench marks, and a distance and direction taken to the mean high-water mark as determined by spirit leveling.

De Novo.—*See* Volume One, Appendix A.

Department of Commerce.—Designation as of Mar. 4, 1913, when the Department of Labor was created. Coast Survey remained in Commerce. See *Department of Commerce and Labor.*

Department of Commerce and Labor.—Created under Act of Feb. 14, 1903, and Coast Survey transferred to it from Treasury Department on July 1, 1903. See *Department of Commerce.*

Depth Contour Navigation.—A method of position determination by utilizing the depth contours on the nautical chart. Consists in fitting a series of observed echo soundings to the depth contours by recording a number of soundings and simultaneous log distances and plotting them on a strip of transparent paper at the scale of the chart. The line of soundings is fitted to the depth contours by moving it so that it remains parallel to the true course steered. See *Depth Contours.*

Depth Contours.—Depth curves whose delineation on hydrographic surveys is based on intensive development, as exemplified by modern echo-sounding surveys. See *Depth Curves.*

Depth Curves.—Curves of equal depth, every point of which is at the same depth below the sounding datum (*see* fig. 56). They are shown on hydrographic surveys and nautical charts for the purpose of bringing clearly to the eye the general configuration of the bottom, and for emphasizing important navigational features, such as shoals and channels. Depth curves are comparable to land contours and the same principles are followed in their delineation. See *Depth Contours.*

Depth Curve Symbolization.—The symbols and colors used to identify curves of various depths on the hydrographic surveys and nautical charts.

Depth Units.—The units (fathoms, feet) in which the soundings are plotted on the smooth sheet or on the nautical chart. On the early surveys, two depth units were generally used on one survey, but with no uniform dividing line (*see* Registers Nos. H–1 (1837) and H–336 (1852)). Modern practice is to use one depth unit only, feet or fathoms, or the combined form of fathoms and feet to 11 fathoms on nautical charts, the foot part of the sounding being shown as a subscript.

Dereliction.—Same as *Reliction.*

Descriptive Call.—A general or directory call directing attention to the neighborhood where the specific or locative calls may be found. See *Call, Locative Call.*

Descriptive Report.—A written report that accompanies every topographic and hydrographic survey for the purpose of supplementing it with information that cannot be shown graphically thereon, and to direct attention to important results. Descriptive Reports were not a standard requirement in the Coast Survey until Apr. 11, 1887.

Developable Surface.—A curved surface that can be spread out in a plane without distortion—the cone and the cylinder, for example. See *Nondevelopable Surface.*

Dictum.—Same as *Obiter Dictum.*

Director of the Coast Survey.—See *Superintendent of the Coast Survey.*

Discretionary Function Exception.—One of the exceptions in the Federal Tort Claims Act for which the Government is relieved from liability if the claim is based upon the exercise or performance or the failure to exercise or perform a discretionary function or duty on the part of a federal agency or employee, whether or not the discretion involved is abused. See *Federal Tort Claims Act.*

Disposition of the Public Domain.—The power which Congress has under authority of Art. IV, sec. 3, cl. 2, of the Constitution "to dispose of and make all needful Rules and Regulations respecting the Territory or other Property belonging to the United States." This power has been held to be without limitation.

Distortion Factor.—A factor that must be applied to every distance that is to be plotted on a survey sheet in order to account for deviation from true scale. It is found by comparing the scaled distances between projection lines on the survey sheet with the corresponding values given in the tables (Special Publication No. 5), and is determined from the relationship: Tabular value minus survey value divided by tabular value. See *Datum Correction, Tables for a Polyconic Projection of Maps, Correction Factor.*

Distortion of Medium.—Changes in the dimensions of surveys or charts due to expansion or contraction of the paper on which the survey or chart is drawn or printed which must be accounted for in making quantitative measurements. See *Correction Factor.*

District of Columbia–Virginia Boundary Commission.—A commission named for the purpose of surveying and ascertaining the boundary line between the District of Columbia and the State of Virginia, under the Act of the Virginia General Assembly of Mar. 24, 1932, and the Act of Congress of Mar. 21, 1934. The Commission made its report in 1936.

District of Columbia–Virginia Boundary Line.—Established by the Act of Oct. 31, 1945, as the mean high-water line along the Virginia shore, except at Alexandria where it follows the established pierhead line; surveyed and marked by the Coast Survey in 1946–1948 (fig. 104). See *Demarcation of District of Columbia–Virginia Boundary Line.*

Diurnal Inequality.—*See* Volume One, Appendix A.

Diurnal Range of Tide.—See *Range of Tide.*

Diurnal Tides.—*See* Volume One, Appendix A.

Dms.—The equivalents in meters of the seconds of latitude of triangulation stations; meridional differences (fig. 37). See *Dps.*

Dock.—An artificial basin or inclosure, in connection with a harbor, for the reception of vessels; the slip or waterway extending between two piers or projecting wharves, or cut into the land for the reception of ships. See *Wharf, Pier.*

Doctrine of Precedent.—Same as *Stare Decisis.*

Documentary Evidence.—Evidence supplied by written instruments. Documents are either public or private.

Dps.—The equivalents in meters of the seconds of longitude of triangulation stations; parallel differences (fig. 37). See *Dms.*

Drying Rock.—*See* Volume One, Appendix A.

Drying Shoal.—*See* Volume One, Appendix A.

Due North.—May be magnetic north or true north; interpretation depends upon how the surveys in a particular state are referenced. See *True North.*

E

Earliest Hydrographic Survey in Bureau Archives.—A survey of Boston Harbor by the Navy Department in 1817 (Register No. H–1961). See *First Hydrographic Survey.*

Earliest Instructions for Hydrographic Work.—The instructions (in manuscript form) issued around 1844. Characterized by their brevity and generality. See *First Published Instructions for Hydrographic Work.*

Earliest Instructions for Topographic Work.—Instructions (in manuscript form) issued around 1840 by Ferdinand Hassler, the first Superintendent of the Coast Survey. See *First Planetable Manual.*

Earliest Published Conventional Symbols.—Coast Survey symbols published around 1840, and dealt for the most part with bridges, roads, fences, and navigational aids (*see* fig. 46).

Earliest Rock Symbols.—The symbols published by the Coast Survey around 1840 (*see* fig. 46).

Earthquake Bay.—The bight between Point Loma and Point Fermin on the coast of California, which Kohl described in his hydrographic description of the western coast in 1857. The name was first introduced by the land expedition of Portala. See *Hydrographic Description of Western Coast.*

Easement.—A right, in one person, created by grant, or its equivalent, to do certain acts on or over another person's land. See *Servitude.*

Eastern Adjustment.—The unified adjustment of the triangulation east of the 98th meridian. See *North American 1927 Datum.*

Echo Sounding.—A method of measuring the depth of water by determining the time required for sound waves to travel, at a known velocity, from the survey vessel to the bottom and return.

Ecliptic.—The intersection of the plane of the earth's orbit with the celestial sphere.

Edition Date.—The date of first publication of a chart, or the date when a new edition is printed. See *New Edition.*

Egress.—In the law of riparian rights, the right of access to navigable water which a riparian owner enjoys. See *Ingress, Right of Access.*

Electronic Position Indicator (E.P.I.).—A pulse-type arcuate system utilizing the propagation of electromagnetic waves through the atmosphere for controlling offshore hydrographic surveys that were formerly controlled by Radio Acoustic Ranging, astronomic sights, and dead reckoning, and to control surveys beyond the limits of Shoran. Distances to 500 nautical miles can be measured with this system under low static conditions.

Elevations.—Heights of natural and artificial objects above an adopted reference plane. On nautical charts of the Coast Survey the elevations of bare rocks, bridges, landmarks, and lights are referenced to the plane of mean high water; contour and summit elevations are referenced to mean sea level, if the source for such information is referenced to this plane. All elevations are in feet.

Ellipsoid of Revolution.—See *Oblate Spheroid.*

Ellipticity of the Spheroid (also called Flattening of the Earth).—The ratio of the difference between the equatorial (a) and polar (b) radii of the earth (major and minor semiaxes of the spheroid) and its equatorial radius, or $(a-b)/a$.

Emerging Shoreline.—An upwarping of the earth's crust or a lowering of sea level.

Eminent Domain.—See *Right of Eminent Domain.*

Enabling Act.—As applied to admission of new states into the Union, it is an act passed by Congress empowering the people of a territory to frame a constitution and lay down certain requirements that must be met preliminary to statehood.

Envelope Line.—The locus of the center of a circle of fixed radius the circumference of which is always in contact with the baseline. For delimiting the territorial sea, it is a line every point of which is at a distance from the nearest point of the baseline equal to the breadth of the territorial sea (fig. 93). *See also* Volume One, Appendix A.

Equal-Area Projection.—A class of map projections in which the property of correct size is preserved for geographical features, rather than correct shape. On an equal-area map, a definite area, such as a square inch, represents a constant area on the sphere, no matter on what part of the map the square inch is located. See *Conformal Projection.*

Equal Footing.—See *Equal-Footing Clause.*

Equal-Footing Clause.—A clause usually included in the statutes of admission of states entering the Union subsequent to the adoption of the Constitution and provides that the new states are admitted to the Union on an equal footing with the Original States. The clause has been held to refer to political rights and to sovereignty and not designed to wipe out diversities in economic standing. It has nevertheless been held to have a direct effect on certain property rights, as, for example, ownership of the tidelands and the submerged lands under inland navigable waters. See *Inland Water Rule.*

Equatorial Tides.—Tides occurring when the moon is on the equator.

Equidistant Polyconic Projection.—Referred to in the Annual Report of the Coast Survey for 1853, and probably used for the field sheets of the Survey and perhaps some charts of the early years. By construction, equal meridian distances are intercepted everywhere between the same parallels. Not strictly a polyconic projection, the only similarity to it being the fact that the auxiliary parallels used to develop the meridians are conic developments. See *Polyconic Projection.*

Eratosthenes.—Greek astronomer and philosopher and librarian of Alexandria who in 240 B.C. made measurements from which he calculated the size of the earth to be about 28,000 miles in circumference based on the distance from Alexandria to Syene.

Erosion.—In riparian law, the gradual and imperceptible washing away of the land along the sea by natural causes. Also applied to the submergence of the land due to encroachment of the waters. See *Riparian Law.*

Error of Closure.—The amount by which a value of a quantity obtained by surveying operations fails to agree with another value of the same quantity held fixed from earlier determinations.

Executive Orders.—Orders issued by the President to implement the Constitution and the enacted statutes.

Ex Parte.—On one side only; by or for one party.

Expert Witness.—Witnesses in a cause who testify in regard to some technical or professional matter and who are permitted to give their opinion as to such matter because of their special training, skill, or familiarity with it.

Exterior Boundaries.—The seaward boundaries of the zones of the open sea recognized in international law—the territorial sea, the contiguous zone, the continental shelf—and the seaward boundaries of the states recognized under the Submerged Lands Act. See *Open Sea, Seaward Boundaries* (Submerged Lands Act).

Extreme Low Water.—As part of the tide note included on the nautical charts, it is the value of the lowest water level observed or estimated for the limits of the chart. It

may be based on the lowest water level observed at a tide station over a short period or a long period, or it may be an estimated value based on the best available reports and information. It is not a recognized tidal plane and should not be confused with the lowest tide resulting primarily from astronomic causes. See *Tide Notes.*

F

Fair Journal.—A smooth copy of the original sounding records and the records used to record the angles taken at shore stations—a practice followed on some of the early surveys. Very few of the fair journals are now available.

Fast Land.—Land inshore of the inner edge of a marsh; usually at or above the plane of mean high water.

Fathom.—A unit of length equal to 6 feet, and used principally as a measure of depth of water.

Federal Board of Surveys and Maps.—See *Board of Surveys and Maps.*

Federalism.—The division of political power between a central government, with authority over the entire territory of a nation, and the states, or local governments, which individually include only limited portions of the country, but which collectively cover the entire area. See *Federal-State Relationship.*

Federal Judiciary.—The federal system of courts provided for in the Constitution and comprising one Supreme Court and a number of inferior courts. The arrangement is hierarchical with the trial courts (district courts) at the base, the intermediate appellate courts (courts of appeals) at the middle, and the final appellate court (Supreme Court) at the top. It is the primary function of the Federal courts to enforce federal law. See *State Judiciaries.*

Federal Power Commission.—Created under the Federal Water Power Act of 1920 and authorized to license the construction of dams in navigable waterways under certain specified conditions. See *United States* v. *Appalachian Electric Power Co.*

Federal-State Relationship.—The American constitutional system under which the Federal Government is held to be one of limited, delegated, and enumerated powers, with the powers not expressly granted or necessarily implied in the Constitution held to be reserved to the States, or to the people. See *Implied Powers.*

Federal Tort Claims Act.—An act passed in 1946 as Title IV of the omnibus Legislative Reorganization Act by which the United States waived its sovereign immunity from suits for injury caused by the negligent act of a federal employee and permitted claims to be brought against it under certain specified conditions. See *Discretionary Function Exception.*

Ferrel Tide Predicting Machine.—The first tide predicting machine used by the Coast and Geodetic Survey. It was designed by William Ferrel, a mathematician in the Survey, in 1882, and was used from 1885 to 1911 for the prediction of tides. See *Tide Predicting Machine No. 2.*

Field Engineers Bulletins, U.S. Coast and Geodetic Survey.—A series of unofficial bulletins published at irregular intervals between 1930 and 1939 (Vols. 1 to 13), under the auspices of the field engineers of the Survey, for the dissemination of special articles, memoranda, etc., pertaining to the field and office operations of the Survey. See *Journal Coast and Geodetic Survey.*

Field Examination.—A report furnished by a field party of the Bureau of an examination of small details (hydrographic or topographic) for which control is available and which can be correlated with the charts. Each examination is assigned a consecutive number, each calendar year beginning a new series.

Field Position.—An unadjusted, geographic position of a point on the earth, computed while field work is in progress to determine the acceptability of the observations or to provide a preliminary position for other purposes. See *Adjusted Position.*

Figure of the Earth (also called the Geoid).—The surface which coincides with the mean surface of the oceans—the sea level surface—and which is everywhere perpendicular to the direction of the force of gravity. The true figure is quite irregular and no geometric solid exactly fits its shape. See *Spheroid.*

Filum Acquae.—Same as *Medium Filum Acquae.*

Findings of the Special Master.—*See* Volume One, Appendix A.

First Control Tide Station (United States).—Established in 1844 at Governor's Island, N.Y.

First Geneva Conference.—The United Nations Conference on the Law of the Sea held at Geneva, Feb. 24 to Apr. 27, 1958. See *Conventions on the Law of the Sea.*

First Hydrographic Survey.—A survey of Great South Bay, Long Island, made in 1834 by the Coast Survey (Register No. H–44). See *Earliest Hydrographic Survey in Bureau Archives.*

First Marine Charts.—Constructed by Marinus of Tyre during the 2d century.

First Mercator Chart.—Chart 52, Montauk Point to New York and Long Island Sound (scale 1: 200,000), issued in Oct. 1889, by the Coast Survey.

First-Order Leveling.—The most exact method of determining elevations. Lines are run in both directions and the two runnings are such that in a 100-mile circuit the error of closure is on an average about 2 inches. It satisfies the requirements of the International Union of Geodesy and Geophysics for "leveling of high precision."

First Planetable Manual.—Published as Appendix 22 to the Annual Report of the Coast Survey for 1865. See *Earliest Instructions for Topographic Work.*

First Published Chart of the Coast Survey.—See *Bridgeport Harbor, Conn.*

First Published Instructions for Hydrographic Work.—Published around 1860 under the superintendency of A. D. Bache and consisted of 28 printed pages. See *Earliest Instructions for Hydrographic Work.*

First Topographic Survey.—A survey of the north shore of Great South Bay, Long Island, from Patchogue to Babylon, made in 1834 (Register No. T–1).

First Triangulation Work.—Executed by Ferdinand Hassler in 1816–1817 in the vicinity of New York City (*see* fig. 2).

Fischer Level.—An instrument designed in the Coast Survey about 1900 for use in first-order leveling. With but comparatively slight changes this has continued to be the standard instrument since that time (*see* fig. 16).

Fixed Riparian Boundary.—A water boundary that remains fixed regardless of changes brought about by erosion or accretion. Two riparian owners with a common water boundary may agree that the boundary as established at a given time shall remain so

forever. If the language is unclear, the intent of the parties is deduced from the circumstances surrounding the establishment of the boundary. See *Shifting Riparian Boundary, United States–Canadian Boundary, Chamizal Arbitration.*

Flats.—A place covered with water too shallow for navigation with vessels ordinarily used for commercial purposes; the space between high- and low-water marks along the edge of an arm of the sea, a bay, tidal river, etc.

Flattening of the Earth.—Same as *Ellipticity of the Spheroid.*

Florida Purchase.—The second addition to the territory of the United States. Ceded by Spain in 1819 under a treaty which settled conflicts with Spain in West Florida and defined the boundary between the United States and the Spanish possessions in the Southwest (*see* fig. 96).

Following the Footsteps of the Surveyor.—An expression used to indicate true boundaries where lines and corners of a survey have been run and marked, and can be found, and reference is made in the conveyance to such lines.

"Following the Meanderings of Said River by the Low-Water Mark."—A basic provision in the Award of the Arbitrators of 1877 in the Maryland–Virginia boundary dispute.

Foreign Commerce.—Under the commerce clause of the Constitution, this has been held to apply to transportation necessitating passage through waters not under the jurisdiction of a state, even though both termini of the voyage lie within the borders of that state. See *Commerce Clause.*

Foreshore (according to Coastal Engineering).—That part of the shore lying between the crest of the seaward berm (or the upper limit of wave wash at high tide) and the ordinary low-water mark (fig. 86). See *Foreshore* (according to Riparian Law).

Foreshore (according to Riparian Law).—The strip of land between the high- and low-water marks that is alternately covered and uncovered by the flow of the tide. See *Foreshore* (according to Coastal Engineering).

Fractional Scale.—The scale expressed as a fraction (termed the representative fraction or "R.F." of the map) in which the numerator is unity and the denominator is the number that the unit distance must be multiplied by in order to obtain its distance on the ground in the same units, thus 1/12,000. Also used in the form 1: 12,000 and 1–12,000. Sometimes referred to as natural scale. See *Scale.*

Fractional Section.—In the public land surveys, a section containing appreciably less than 640 acres, usually due to the presence of a navigable body of water, or by other land which cannot properly be surveyed or disposed of as part of that section. See *Meander Lines.*

Freedom of the Seas.—*See* Volume One, Appendix A.

Free Seas Doctrine.—See *Freedom of the Seas.*

G

Gadsden Purchase.—A purchase from Mexico in 1853 to settle a question as to the limits of the Mexican cession of 1848. It lies in the States of Arizona and New Mexico (*see* fig. 96).

General Charts.—Charts of scales 1: 100,000 to 1: 600,000 for coastwise navigation outside of outlying reefs and shoals.

General Coastline of United States.—Determined by using a unit measure of 30 minutes of latitude (approximately 34.5 statute miles) on charts as near the scale of 1: 1,200,000 as possible. Includes the coastline of bays and sounds to a point where the waters narrow to the width of the unit measure, the distance across at such points being included. (*See* Table 4.)

General Instructions for Field Work.—The form of publication used between 1908 and 1928 in which instructions for all field work of the Coast Survey were included and which superseded the separate instructions previously issued, for example, Instructions for Hydrographic Work.

Geodesy.—The science which treats mathematically of the figure and size of the earth.

Geodetic Azimuth.—An azimuth derived by computation through the triangulation.

Geodetic Bench Mark.—See *Bench Mark* (Geodetic).

Geodetic Datum.—Same as *Geographic Datum.*

Geodetic Determination.—The position of a point on the surface of the earth, with reference to the equator and a principal meridian, that has been computed through the network of triangles from the measured angles and distances by starting from some predetermined position of one of the triangulation stations. See *Astronomic Determination.*

Geodetic Process.—The process of referring all the triangulation in an extensive area (to wit, the United States) to the latitude and longitude of a single point whose position on the adopted spheroid of reference has been determined from a consideration of the astronomic and geodetic values of common points in the system. See *Deflection of the Vertical, Standard Geographic Datum.*

Geodetic Survey.—A survey that takes into account the shape and size of the earth, as distinguished from a plane survey in which the surface of the earth is considered as a plane. It includes the determination of latitudes and longitudes, and elevations above sea level, of numerous points throughout the country, and involves astronomic observations, measurement of base lines, and measurement of the force and direction of gravity.

Geodimeter.—An instrument for measuring distances by the speed of light.

Geographical Poles.—The north and south extremities of the earth's axis of rotation.

Geographic Center.—For an area on the earth it is the point on which the area would balance if it were a plate of uniform thickness; the center of gravity of the plate. For conterminous United States, it is near Lebanon, Kans., in latitude 39°50′ N., longitude 98°35′ W.; for continental United States (includes Alaska), it is in Butte County, S. Dak., in latitude 44°59′ N., longitude 103°38′ W.; and for the United States (includes Alaska and Hawaii), it is in Butte County, S. Dak., in latitude 44°58′ N., longitude 103°46′ W.

Geographic Coordinates.—Data defining the locations of horizontal control stations (triangulation and traverse) in terms of geographic coordinates include their latitudes and longitudes and the lengths and azimuths of the lines between contiguous stations. This system of computations takes into account the earth's curvature.

Geographic Datum (also called Horizontal or Geodetic Datum).—The adopted position in latitude and longitude of a single point to which the charted features of a vast region are referred. It consists of five quantities: the latitude and longitude of the point,

the azimuth of a line from this point to another point to which it is tied by the triangulation, and two constants necessary to define the terrestrial spheroid See *Clarke Spheroid of 1866.*

Geographic Dictionary of Alaska.—One of the earlier Coast Survey studies of geographic names, by Wm. Dall and Marcus Baker, begun in 1873, and completed by Baker in 1901 while in the Geological Survey. Adopted by Board on Geographic Names and reissued as a second edition in 1906.

Geographic Middle of a River.—See *Medium Filum Acquae.*

Geographic Mile.—Same as *Nautical Mile.*

Geographic Position.—The position of a point on the surface of the earth expressed in terms of latitude and longitude.

Geoid.—Earth-shaped. See *Figure of the Earth.*

Gibbons v. Ogden (9 Wheat. 1).—An 1824 case and the first of a long line of decisions that established the power of the United States to regulate interstate commerce free from state infringement. An important question in this case was whether commerce includes navigation. The Supreme Court answered this in the affirmative, saying: "The mind can scarcely conceive a system for regulating commerce between nations, which shall exclude all laws concerning navigation." See *Commerce Clause.*

Gnomonic Chart.—A chart constructed on the gnomonic projection and often used as an adjunct for transferring a great circle to a Mercator chart. See *Gnomonic Projection.*

Gnomonic Projection.—A perspective map projection on a plane tangent to the surface of a sphere, the point of projection being at the center of the sphere. Great circles are represented on this projection by straight lines. See *Gnomonic Chart.*

Gradual and Imperceptible.—A term used to describe changes in riparian lands that bring them within the scope of the doctrine of accretion and erosion. The test of what is gradual and imperceptible has been held to be that "Though the witnesses may see, from time to time, that progress has been made, they could not perceive it while the progress was going on." See *Riparian Lands, Accretion, Erosion.*

Grand Tides.—Same as *Tropic Tides.*

Grantee.—The one to whom a grant is made.

Graphic Method.—A method of applying a datum correction to a survey sheet under certain conditions by means of the *dms* and *dps.* of several triangulation stations (fig. 37). See *Numerical Method, Dms., Dps.*

Graphic Scale (also called Linear Scale).—A line or bar on a map or chart subdivided to represent distances on the earth in various units, to wit: Nautical miles, statute miles, yards, feet, kilometers, etc.

Great Circle (also called Orthodromic Curve).—The shortest distance between two points on the surface of the earth. A curved line on the Mercator projection (*see* fig. 87).

Great Diurnal Range (Tidal).—Same as *Diurnal Range of Tide.*

Greatest Ocean Depth.—See *Mariana Trench.*

Greenwich Meridian.—The meridian of the Royal Observatory, Greenwich, England. Adopted in 1884 by a conference of nations, called by the President of the United States, as the initial or zero of longitudes for all nations.

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Grid Azimuth.—The azimuth of a line in a plane rectangular coordinate system. In the State Coordinate Systems, grid azimuth is reckoned from south (0°) clockwise through 360°. See *Azimuth, State Coordinate Systems.*

Guano Act.—The Act of Aug. 18, 1856, under which blanket authority was granted to the President to proclaim the "appurtenancy" to the United States of certain guano islands. See *Guano Islands.*

Guano Islands.—Islands scattered over the Pacific Ocean and Caribbean Sea, having deposits of guano suitable for use as fertilizer, which under the Guano Act could be taken possession of and occupied at the discretion of the President and be considered as appertaining to the United States, if not occupied by citizens of, or under the lawful jurisdiction of, any other government. See *Guano Act.*

Guide Meridians.—See *Twenty-Four-Mile Tracts.*

Gulf.—A tract of water within an indentation or curve of the coastline, in size between a bay and a sea—the Gulf of California, for example. See *Ocean Nomenclature.*

Gulf Stream.—An ocean current forming a part of the general circulatory system of the North Atlantic Ocean.

H

Hague Conference of 1930 for the Codification of International Law.—*See* Volume One, Appendix A.

Half-Tide Level (also called Mean Tide Level).—A tidal datum midway between mean high water and mean low water.

Hand-Correction Date.—Same as *Correction Date.*

Handlead and Line.—Same as *Leadline.*

Harbor Charts.—Charts of scales larger than 1:50,000 for navigation in harbors, anchorage areas, and the smaller waterways.

Harbor Line.—The line beyond which wharves and other structures cannot be extended. See *Bulkhead Line, Pierhead Line.*

Harmonic Analysis.—The mathematical process by which the observed tide at a place is analyzed by breaking it down into a number of constituent tides of simple periodic forces, each having a fixed period. In this process, the sun and moon are replaced by a number of hypothetical tide-producing bodies which move in circular orbits around the earth in the plane of the equator. See *Harmonic Constituent, Harmonic Constant.*

Harmonic Constant.—The amplitude and epoch (the time, in angular measure, between the meridian passage of a hypothetical tide-producing body and the high water of its tide) of a harmonic constituent of the tide. See *Harmonic Constituent, Harmonic Analysis.*

Harmonic Constituent.—One of the harmonic elements in a mathematical expression for the tide-producing force and in corresponding formulas for the tide, each constituent representing a periodic change or variation in the relative positions of the earth, sun, and moon. See *Harmonic Analysis.*

Harmonic Method (Tidal).—See *Harmonic Analysis.*

Harmonic Tide Plane.—Same as *Indian Tide Plane.*

Hassler, Ferdinand Rudolph.—A Swiss geodesist and scientist of outstanding reputation who immigrated to the United States in 1805 and whose plan for a survey of the coast was accepted by President Jefferson. He later became the first Superintendent of the Survey (*see* Frontispiece).

Hawaiian Archipelago.—Includes all the islands of the Hawaiian group between Hawaii and Kure Island (*see* fig. 95). It does not include Palmyra Island, Johnston Island, Sand Island, and Kingman Reef. See *Territory of Hawaii.*

Headland.—*See* Volume One, Appendix A.

Headland-to-Headland Line.—The line which joins the termini at the outer headlands of an indentation of the coast that has been determined to be inland waters by the semicircular rule or on historic grounds. It marks the seaward limit of inland waters. See *Termini at Headlands, Semicircular Rule, Historic Bay.*

High- and Low-Water Records.—Tabulation of the times and heights of high and low waters as scaled from the tide roll at a control tide station. They provide basic data on time and height relationships including ranges, diurnal inequalities, high- and low-water datum planes, half-tide level, and mean and extreme heights. See *Control Tide Station, Tide Roll.*

Higher Low Water.—The higher of the two low waters of a tidal day where the tide is of the semidiurnal or mixed type. See *Lower Low Water.*

High Seas.—The open sea beyond and adjacent to the territorial sea, which is subject to the exclusive jurisdiction of no one nation. Littoral nations frequently exercise limited jurisdiction over portions of the high seas adjacent to their coasts for purposes of enforcing customs and other regulations. The Geneva Convention on the High Seas defines it as "all parts of the sea that are not included in the territorial sea or in the internal waters of a State." See *Territorial Sea.*

High Water.—The maximum height reached by a rising tide. This may be due solely to the periodic tidal forces or it may have superimposed upon it the effects of prevailing meteorological conditions.

High-Water Line.—A generalized term associated with the tidal plane of high water but not with a specific phase of high water, such as higher high water, lower high water. See *Mean High-Water Line, Mean High Water.*

High-Water Lunitidal Interval.—Same as *Corrected Establishment of the Port.*

Hipparchus.—Astronomer and mathematician who lived in the 2d century B.C. and who is credited with having invented the trigonometry and with having devised the method of dividing the earth by a system of parallels and meridians. See *Parallels, Meridians.*

Historic Bay.—*See* Volume One, Appendix A.

History of Cartographic Work.—Same as *History Sheet.*

History Sheet (also called History of Cartographic Work).—A record of the original compilation and subsequent corrections of every chart published by the Coast Survey. Preserves, in compact form, every detail and authority used on the chart together with the date when a correction was applied.

Horizontal Curves.—Same as *Depth Curves.*

Horizontal Datum.—See *Geographic Datum.*

Horrebow-Talcott Method.—A precise method of determining astronomic latitude by measuring the difference of the meridional zenith distances of two stars of known declination, one north and the other south of the zenith. Devised by Peter Horrebow in 1732 and independently by Captain Andrew Talcott of the U.S. Engineers in 1834.

Hourly Height Records.—Tabulations of the hourly heights of the tide as scaled from the tide roll at a control tide station. They provide data for computing mean sea level, for computing harmonic constants used in the prediction of tides, and for a compact and condensed file record for future reference and reproduction. See *Control Tide Station, Tide Roll.*

"H" Sheets.—See *Registry Numbers.*

heights of predicted tides. See *Tidal Datums.*

Hydrographic Datum.—A datum used for referencing depths of water or the

Hydrographic Description of Western Coast.—Prepared by Kohl in 1857 and describes the coast as the early explorers saw it, with special reference to the names they applied to the different features. There are 695 geographic names in this work among which is the name "Bahia de los Temblores" (Earthquake Bay). See *Kohl (Dr. John George), Earthquake Bay.*

Hydrographic Manuals.—The form of publication used since 1928 for instructions for hydrographic work. Three such manuals have been issued to date—in 1928, in 1942, and in 1960. See *General Instructions for Field Work.*

Hydrographic Survey (Coast and Geodetic Survey).—A record of a survey, *of a given date,* of a water area, with particular reference to the submarine relief which is shown by means of soundings (depth units) and depth contours. It is the authority for all data below the plane of high water, including the names of hydrographic features (fig. 56). See *Smooth Sheet.*

Hydrographic Surveying.—As used in the Coast Survey, it is the process of developing upon a survey sheet all that portion of the earth's surface which lies beneath the water, including a delineation of the submerged contour lines of channels, banks, and shoals, and a collection of bottom specimens and water samples. It also includes that part of physical hydrography which takes into account tide and current phenomena, and in modern surveys embraces temperature and salinity characteristics of the water insofar as they relate to the accurate measurement of depth by echo sounding.

Hypsograph.—A circular instrument of the slide-rule type used to compute elevations from vertical angles and horizontal distances. Commonly used in planetable surveys.

I

Ibid.—Abbreviation for *ibidem,* a Latin term meaning "in the same place," "in the same book," "on the same page," etc. As used in this publication, it indicates an immediately preceding citation with an identical page reference. See *Id.*

Id.—Abbreviation for *idem,* a Latin term meaning "the same." As used in this publication, it indicates an immediately preceding work but a different page reference, for example, *Id.* at 25. See *Ibid.*

Identification Letters and Numbers.—Letters and numbers (in color) used to identify sounding lines on a hydrographic survey sheet and correspond to those used in the sounding records. See *Position Numbers, Day Letters.*

Implied Powers.—Those powers which are derived from the powers expressly granted by the Constitution. They are incidental to these powers or to other implied powers and are not set forth in the Constitution. The Act of Feb. 10, 1807, which authorized a Survey of the Coast, was an exercise of an implied power growing out of the enumerated power of Congress to regulate commerce. See *Commerce Clause.*

Improved Channels.—Dredged channels under the jurisdiction of the Corps of Engineers, and maintained to provide an assigned controlling depth. Symbolized on the nautical charts by black, dashed lines to represent the side limits, with the controlling depth and date of ascertainment given together with a tabulation for more detailed information (*see* fig. 80).

In Banco (also called In Bank).—A term applied to court proceedings before the full bench.

Inchoate Title.—The beginning of a title; one not yet perfected into a legal title. Under the Swamp Lands Act, the legal title was perfected when the lands were identified as swamp lands by the Secretary of the Interior and a patent issued. The legal title, when acquired, then related back to the passage of the act. See *Swamp Lands Act.*

Incorporated Territory.—A territory where there is general applicability of the Constitution with respect to the civil and private rights of the inhabitants. See *Unincorporated Territory.*

Independent Datum.—A detached system of triangulation based on one or more astronomic determinations of latitude, longitude, and azimuth, but which has not been connected to the standard datum of the continental area. See *United States Standard Datum.*

In Derogation of the Common Law.—A statute inconsistent with the common law. See *Statutory Law.*

Index Maps (Control Survey Data).—A series of maps each covering 1° of latitude and 2° of longitude, at a scale of 1: 250,000, on which both horizontal and vertical control of the Coast and Geodetic Survey and the Geological Survey are shown. The maps contain all the information necessary for identifying the control stations in an area. When completed they will supersede the separate index maps formerly published by states at a scale of 1: 667,000.

Index Maps (Tidal Data).—A series of maps covering each coastal state which shows by symbol and numbered position the localities for which tidal bench-mark data may be obtained (fig. 23). See *Tidal Bench-Mark Data.*

Indian Claims Commission Act.—The Act of Aug. 13, 1946, under which Indian claims to land based upon fair and honorable dealings that are not recognized by any existing rule of law or equity may be submitted to the Commission with right of judicial review by the United States Court of Claims.

Indian Tide Plane (also called Harmonic Tide Plane).—A plane of reference used for a number of ports in India and used for a time in Puget Sound, Wash., and for all

Alaskan waters except at the mouth of the Yukon River. It corresponded closely to a plane 2 feet below mean lower low water. See *Present Planes of Reference.*

Indian Towing Co. v. United States (350 U.S. 61).—A 1955 case and one of the first maritime tort cases to come before the Supreme Court under the Federal Tort Claims Act involving the discretionary function exception of the act. The Court held that the Coast Guard did not have to undertake the lighthouse service, but once it exercised its discretion to operate a light, it was obliged to use due care to make certain the light was kept in good working order. See *Discretionary Function Exception.*

Indicia of Navigability.—Indications of navigability, prima facie or otherwise. All tidewater is prima facie navigable. Other indicia are whether a waterway leads from one public terminus to another; and whether a waterway by its depth, width, and location is rendered available for commerce. See *Prima Facie Evidence.*

Indictment.—An accusation in writing found and presented by a grand jury, charging that the person named therein has done some act, or been guilty of some omission, which, by law, is a public offense. See *Information.*

Inferior Call.—A call lower in the order of precedence for resolving conflicts in land descriptions. A call for course and distance is inferior to a call for a natural monument. See *Call.*

Inferior Courts.—Federal courts below the Supreme Court that are established by Congress under Art. III of the Constitution.

Information.—An accusation, in the nature of an indictment, presented by a competent public officer on his oath of office. See *Indictment.*

Infra.—Below, under. When used in text it refers to matter in a later part of the publication. See *Supra.*

Infrared Photography.—*See* Volume One, Appendix A.

Ingress.—In the law of riparian rights, the right of return to his land from navigable water which a riparian owner enjoys. See *Egress.*

Initial Point.—The origin of a system in the rectangular system of surveys of which a principal meridian and a base line constitute the axes for a given area (*see* fig. 97). There are 32 such points in conterminous United States and 5 in Alaska (in 1960). See *Principal Meridian, Base Line* (Public Lands Surveys), *Rectangular System of Surveys.*

Inland Rules of the Road.—The rules of navigation that are applicable to the water areas landward of the lines established by the U.S. Coast Guard. See *Rules of the Road Boundary Lines, International Rules of the Road, United States* v. *Newark Meadows Improvement Co., Act of Feb. 19, 1895.*

Inland Water Rule.—The doctrine laid down by the Supreme Court that the submerged lands under inland navigable waters and the tidelands belong to the states as an incident of sovereignty. The first was established in the case of *Martin* v. *Waddell,* 16 Pet. 367 (1842) and involved one of the Thirteen Original States, and the second was established in the case of *Pollard's Lessee* v. *Hagan,* 3 How. 212 (1845), and involved one of the subsequently admitted states. See *Tidelands, Equal-Footing Clause.*

Inland Waters (according to Sixteenth Census).—A category of waters measured in 1940 by the Bureau of the Census in accordance with adopted rules (*see* Table 2).

Inland Waters (also called National Waters, Interior Waters, and Internal Waters).—*See* Volume One, Appendix A.

Inlet Migration.—The lateral movement of an inlet in the direction of the dominant current.

Inner Edge of Marsh.—See *Fast Land.*

In Personam.—The ordinary proceeding against a particular person, as distinguished from a proceeding against a thing, such as a vessel. See *In Rem.*

In Praesenti.—At the present time. The Swamp Lands Act of 1850 is an example of a grant taking effect *in praesenti,* that is, on the date of passage of the act. See *Swamp Lands Act.*

In Rem.—A proceeding in admiralty law against the offending vessel, rather than against the owner of the vessel. See *In Personam.*

Inshore Hydrographic Survey.—A hydrographic survey of relatively shallow water, immediately adjacent to the shore, executed by launches and small boats using a leadline or sounding pole. On modern surveys a shoal-water echo-sounding instrument is generally used. See *Hydrographic Survey.*

Insular Possessions.—Areas subject to the dominion of the United States which do not have state or territorial status. The Virgin Islands and Samoa are existing examples.

Intercardinal Points.—Between the cardinal points; northeast, northwest, southeast, southwest. See *Cardinal Points.*

International Boundary.—*See* Volume One, Appendix A.

International Committee on the Nomenclature of Ocean Bottom Features.—*See* Volume One, Appendix A.

International Ellipsoid of Reference.—The spheroid adopted by the International Geodetic and Geophysical Union in 1924 (now the International Union of Geodesy and Geophysics) as the best available figure for the earth as a whole. This was based (with some slight modification) upon an investigation made in 1909 by Hayford—a geodesist in the Coast Survey—using the large triangulation net then existing in the United States, and taking into account the unequal density of the earth's crust. The semimajor axis= 6,378,388 meters, the semiminor axis=6,356,912 meters, and the ellipticity=1/297.0 as compared with an ellipticity of 1/296.96 determined by Hayford.

International Hydrographic Bureau (IHB).—A body founded in 1921 with the objective of maritime security to be achieved through the standardization of the nautical chart and related publications, the improvement of hydrographic survey practices, and in general the establishment of a close and permanent association among all hydrographic services. The Bureau is located in Monte Carlo, Principality of Monaco.

International Law Commission.—*See* Volume One, Appendix A.

International Nautical Mile.—See *Nautical Mile.*

International River.—A river that separates or passes through several nations between its source and its mouth at the open sea.

International Rules of the Road.—The rules of navigation that are applicable to the water areas seaward of the lines established by the U.S. Coast Guard. See *Rules of the*

Road Boundary Lines, Inland Rules of the Road, United States v. *Newark Meadows Improvement Co., Act of Feb. 19, 1895.*

Interstate Compacts.—Agreements between states authorized by Art. I, sec. 10, cl. 3, of the Constitution, which provides that "No State shall, without the Consent of Congress . . . enter into any Agreement or Compact with another State"; a legal device for adjusting interstate relations and interstate boundaries, the requirement of congressional consent insuring that national interests will not suffer in the process. Compacts betewen the states were a practice that existed even prior to the adoption of the Constitution. See *Maryland–Virginia Compact of 1785.*

Intracoastal Waterway.—An inside protected route extending through New Jersey; from Norfolk, Va., to Key West, Fla.; across Florida from St. Lucie Inlet to Fort Myers, Charlotte Harbor, Tampa Bay, and Tarpon Springs; and from Carabelle, Fla., to Brownsville, Tex. See *Intracoastal Waterway Charts.*

Intracoastal Waterway Charts.—Charts of scale 1: 40,000 for navigating the Intracoastal Waterway and designed especially for small-boat operators and yachtsmen. See *Intracoastal Waterway.*

Island Shelf.—*See* Volume One, Appendix A.

Isostasy.—A condition of approximate equilibrium in the outer part of the earth, such that the gravitational effect of masses extending above the surface of the geoid in continental areas is approximately counterbalanced by a deficiency of density in the material beneath those masses, while the effect of deficiency of density in ocean waters is counterbalanced by an excess of density in the material under the oceans.

Isostatic Compensation.—See *Isostasy.*

J

Journal, Coast and Geodetic Survey.—A technical publication issued at irregular intervals and containing signed articles, memoranda, notes, etc., to reflect the progress of the Survey and to serve as a medium for the presentation of new methods and new developments in both field and office. The Journal was begun in January 1948 and was continued through October 1957 (Vols. 1 to 7) when it was superseded by the Technical Bulletins series. See *Technical Bulletins U.S. Coast and Geodetic Survey.*

Judicial Notice.—The act by which a court, in conducting a trial, or framing its decision, will, of its own motion, take cognizance of certain facts without proof which are regarded as established by common knowledge—the laws of the state, international law, historical events, main geographical features. In *United States* v. *Romaine,* 255 Fed. 253 (1919), it was said a court might properly take judicial notice of the official plats of the Coast and Geodetic Survey, and in the *Borax* case the Supreme Court took judicial notice of the Bureau's definition of mean high water as given in Tidal Datum Planes, Special Publication No. 135. See *Borax Consolidated, Ltd.* v. *Los Angeles.*

Judicial Process.—The set of legal principles that courts have developed to govern their decisions. In its broadest concept, it involves the whole field of judicial backgrounds, experiences, and philosophies by which judges interpret the law and determine its meaning when new problems and new situations arise.

Judicial Review.—As used in this publication, it is the power of the courts to review decisions of administrative agencies to determine whether an erroneous rule of law was applied, and whether the proceeding in which facts were adjudicated was conducted in a regular manner. See *Administrative Branch.*

Jus Privatum.—*See* Volume One, Appendix A.

Jus Publicum.—*See* Volume One, Appendix A.

Justinian Code.—The body of Roman law as codified by Emperor Justinian in 533 and 534 A.D., and consists of the Institutes, the Digest, and the Code; the basis for much of the present civil-law system. See *Code Napoleon.*

K

King Plats.—A series of 16 maps of the central portion of the City of Washington, surveyed in 1803 at a scale of 1: 2,400 and published at the same scale.

King's Chambers.—*See* Volume One, Appendix A.

Kohl Collection of Early Maps.—A collection of maps which Kohl brought with him to this country in 1854, relating to the progress of discovery in America, and consisted of a series of portfolios of hand-copies which Kohl made from old geographical and other printed treatises and from manuscripts in European archives and libraries. In 1903, this collection was transferred from the State Department to the Library of Congress. See *Kohl (Dr. John George).*

Kohl Collection of Maps and Names.—Part of the study which Kohl undertook for Superintendent Bache, between 1855 and 1857, comprising historic descriptions of the Pacific, Atlantic, and Gulf coasts; and a hydrographic description of the western coast.

Kohl, Dr. John George.—A noted ethnographer engaged by Superintendent Bache to trace the succession of discoveries and explorations of the western coast, and to furnish a catalog of the names of headlands, capes, sounds, bays, and harbors, with the authorities.

L

Lambert Conformal Conic Projection.—A conformal map projection of the conical type, on which the meridians are straight lines meeting in a common point outside the limits of the map, and the parallels are concentric arcs of circles having the common point as center. The projection with two standard parallels is the base for the State Coordinate Systems for states whose greatest extent is in an east-west direction. See *State Coordinate Systems.*

Land Area (according to Sixteenth Census).—As defined by the Bureau of the Census for measuring the area of the United States, it is land permanently dry, and land temporarily or partially covered by water, such as marshland; streams, sloughs, estuaries, and canals less than one-eighth of a statute mile in width; and lakes, reservoirs, and ponds of less than 40 acres in area (*see* Table 2).

Land Ordinance of 1785.—The ordinance under which the first public land surveys were made. This required the surveys to begin "on the river Ohio, at a point that shall be found to be due north from the western termination of a line which has been run as the

southern boundary of the state of Pennsylvania." See *Point of Beginning, Rectangular System of Surveys.*

Land Ownership.—The right of possession or use and control of the land owned. See *Land Possession.*

Land Ownership in the United States.—Refers to the three categories of holdings: federal, state, and private.

Land Possession.—A use of the land with or without ownership. See *Land Ownership.*

Laplace Azimuth.—A geodetic azimuth derived from an astronomic azimuth to distinguish it from a geodetic azimuth derived by computation through the triangulation.

Laplace Station.—A triangulation station at which a Laplace azimuth is determined. At such station both astronomic longitude and astronomic azimuth are determined. See *Laplace Azimuth.*

Large-Scale (Survey or Chart).—A relative term, but generally one covering a small area on the ground. In Coast Survey usage, a scale of 1: 80,000 (1 inch on survey or chart= 80,000 inches on the ground) would be the upper limit of such classification. See *Small-Scale.*

Las Siete Partidas.—*See* Volume One, Appendix A.

Latent Ambiguity.—A hidden ambiguity. Where language used in land conveyances is clear and suggests only a single meaning, but some extrinsic fact creates a need for interpretation or choice between two or more possible meanings. See *Patent Ambiguity.*

Lateral Boundaries.—Side boundaries; boundaries between adjacent states extending from shore to their seaward boundaries under Public Law 31; boundaries between adjacent nations through the marginal sea and the contiguous zones. See *Public Law 31.*

Lateral Ownership.—The right that the owner of a parcel of land has to occupy and use it to the full extent of his boundaries.

Lateral System.—The system of buoyage used for marking the waters of the United States. The position of marks in this system are determined by the general direction taken by the mariner when approaching a harbor, river, estuary, or other waterway from seaward. The right or starboard side of the channel is marked by red, conical-shaped buoys with even numbers, while the left or portside is marked by black, cylindrical-shaped buoys with odd numbers, the numbers for each side increasing from seaward.

Latitude.—The distance (angular or linear) north or south on the earth's surface from the equator.

Latitude Scale.—The subdivided east and west borders of a Mercator chart into degrees and minutes; a variant of the graphic scale, since a minute of latitude is very nearly equal to a nautical mile. See *Graphic Scale.*

Leadline.—A line of sash cord or tiller rope to which a sounding lead is attached, and is used for measuring depths of water. The line is graduated in fathoms and feet, and the bottom of the lead is scooped out to receive tallow or soap for picking up specimens of the bottom while sounding.

League.—A measure of distance, varying for different times and for different countries from 2.4 to 4.6 miles. See *Marine League.*

Ledge.—A rocky formation connected with and fringing the shore, and generally uncovered at the sounding datum (*see* fig. 62).

Left Bank (River).—The bank on the left-hand side as one proceeds downstream. See *Right Bank.*

Legal Concept of Navigability.—The doctrine laid down by the Supreme Court in *The Daniel Ball* v. *United States,* 10 Wall. 557 (1871), to wit: "Those rivers must be regarded as public navigable rivers in law which are navigable in fact. And they are navigable in fact when they are used, or are susceptible of being used, in their ordinary condition, as highways for commerce, over which trade and travel are or may be conducted in the customary modes of trade or travel on water." See *United States* v. *Appalachian Electric Power Co.*

Legislative Courts.—Courts established under authority implied from provisions other than Art. III of the Constitution. Their functions are always directed toward the execution of one or more of such powers as are prescribed by Congress, independently of Art. III, and their judges hold for such term as Congress may prescribe, whether it be a fixed term of years or during good behavior. See *Constitutional Courts.*

Legislative History of an Act.—The history of an act through the legislative body from its inception to its final passage; includes hearings, committee reports, and floor debate. See *Legislative Intent.*

Legislative Intent.—When the wording of an act of Congress is subject to more than one interpretation, courts will look to the discussions and debates on the measure for a guide as to which interpretation was intended. See *Legislative History of an Act.*

Leveling.—The operation of determining differences of elevation between points on the surface of the earth; the determination of the elevations of points relative to some arbitrary or natural level surface called a datum.

Leveling Classification.—Classified as first order and second order according to allowable error of closure. See *First-Order Leveling.*

Level Net (also called Survey Net).—Lines of spirit leveling connected together to form a system of loops and circuits extending over an area. See *Spirit Leveling.*

Limits of Oceans and Seas.—A publication of the International Hydrographic Bureau (Special Publication No. 23 (1953)) consisting of text material in which the proposed limits of oceans and seas and certain gulfs, bays, and straits are described and shown on three accompanying diagrams for the convenience of national hydrographic offices for use in compiling sailing directions, notices to mariners, etc. (*see* fig. 94).

Linear Scale.—Same as *Graphic Scale.*

Line of Mean High Water.—Technically, the same as mean high-water line. In the context of the planetable surveys of the Coast and Geodetic Survey, it is the mean high-water line as near as it is possible for the topographer to determine without recourse to leveling. See *Surveyed Line.*

Line of Ordinary Low Water.—Same as *Mean Low-Water Line.* See *Ordinary Tides.*

Lines of Allocation.—Lines which are sometimes delimited through the high seas for the purpose of allocating lands without conveying sovereignty over the waters. See *United States-Russian Convention Line.*

Link.—0.66 foot or 1/100 chain. See *Chain.*

List of Lights.—Lists and describes all marine aids to navigation maintained by or under authority of the U.S. Coast Guard. Covers the Atlantic, Gulf, and Pacific coasts, and the Pacific islands in three volumes.

Littoral.—*See* Volume One, Appendix A.

Littus (or **Litus**) **Maris.**—The seashore.

Local Mean Sea Level.—Derived entirely from observations at a local station; the basis for the elevations of tidal bench marks. See *Mean Sea Level.*

Local Notice to Mariners.—A circular issued at frequent intervals by Coast Guard districts giving changes and deficiencies in aids to navigation and other information of navigational importance within the particular district. Information of a continuing nature is inserted in the weekly Notice to Mariners. See *Notice to Mariners.*

Locative Call.—A specific or particular call exactly locating a point or line. See *Call, Descriptive Call.*

Longitude.—The distance (angular or linear) east or west on the earth's surface from the meridian of Greenwich.

Loran.—A pulse-type, electronic, navigation system for fixing a vessel's position by measuring the time differences between the arrival times of a pair of radio pulses transmitted from two fixed stations of known geographic position, each time difference establishing a Loran line of position of the hyperbolic type. The intersection of two such lines of position locates the position of the receiving vessel. See *Loran Lines of Position.*

Loran Lines of Position.—Two or more charted families of hyperbolic curves for use with the Loran system of navigation, each family being shown in a distinctive color. See *Loran.*

Louisiana Purchase.—The territory purchased from France in 1803 (*see* fig. 96). The earliest acquisition of foreign territory by the United States.

Lower Low Water.—The lower of the two low waters of any tidal day where the tide is of the semidiurnal or mixed type. The single low water occurring daily during the periods when the tide is diurnal is considered to be a lower low water.

Lowest Observed Water Level.—Results from tide and surge, and, strictly speaking, is not a lowest observed *tide.* See *Extreme Low Water.*

Low-Tide Elevation (according to Geneva Convention).—A *naturally formed* area of land surrounded by and above water at low tide but submerged at high tide. See *Rock Awash.*

Low Water.—The minimum height reached by a falling tide. This may be due solely to the periodic tidal forces or it may have superimposed upon it the effects of prevailing meteorological conditions.

Low-Water Area.—The area between the high-water line and the low-water line (the sounding datum for a given area). See *Tidal Datums.*

Low-Water Datum.—A datum associated with the tidal plane of low water but not with a specific phase of low water, such as lower low water, higher low water. See *Tidal Datums.*

Low-Water Line (Hydrographic Surveys).—The curve of zero depth as established by the sounding datum of the area—mean low water for surveys along the Atlantic and Gulf coasts, and mean lower low water for surveys along the Pacific coast. In the context of tidal boundaries, *see* Volume One, Appendix A.

Low-Water Line Survey of Louisiana Coast.—A cooperative undertaking between the Bureau of Land Management, the State of Louisiana, and the Coast and Geodetic Survey, by which the Survey mapped the mean low-water line from aerial photographs coordinated with an accurate tidal datum. See *Map Location.*

Low-Water Line (Topographic Surveys).—In the context of the planetable surveys of the Coast Survey, it is the topographer's estimate of the line represented by the plane of reference for the soundings. See *Low-Water Line* (Hydrographic Surveys).

Low-Water Lunitidal Interval.—The time interval between the moon's meridian passage (upper or lower) and the following low water.

Loxodromic Curve.—Same as *Rhumb Line.*

Lunar Method.—A method of determining the longitude of a place from observations on the moon and its position with respect to other astronomic bodies, and from the local time of observation. One of the first methods used by the Coast Survey. The points at which the boundary between the United States and Canada along the 141st meridian crosses the Yukon and Porcupine Rivers were originally determined by lunar methods. See *Yukon Datum.*

Luttes v. The State of Texas (324 S.W. 2d 167).—A 1958 decision by the Supreme Court of Texas, interpreting the civil law (Spanish law) concept of seashore—in the light of modern conditions and the need for exact application—as extending to the line of mean higher high tide determined from a 19-year period. *See* Appendix D.

Luzon Datum.—The standard datum for the Philippine Islands established in 1911 from observations on Luzon Island, supplemented by theoretical inference and approximate results from other regions.

M

Magnetic Bearings.—Those determined with a magnetic compass and related to the magnetic meridian.

Magnetic Declination (also called Variation).—The angle between the true meridian and the magnetic meridian, and is considered east or west according as magnetic north is east or west of true north. See *True Meridian, Magnetic Meridian.*

Magnetic Meridian.—The line having the direction of the magnetic needle at a given place; a vertical plane fixed by the direction taken by a perfect compass needle. See *True Meridian.*

Magnetic Needle.—The needle of a surveyor's compass.

Magnetic Pole.—The place on the earth's surface where the dip is 90°, the horizontal intensity is zero, and a compass does not show direction. The positions of the magnetic poles adopted for the 1960 isogonic charts of the world are: North magnetic pole—74°.9 N., 101°.0 W.; south magnetic pole—67°.1 S., 142°.7 E.

Mandatory Authority.—Authority that is binding on courts; imperative authority. Decisions of the United States Supreme Court are mandatory on all inferior Federal courts, and on all state courts in cases involving federal questions. But they are only persuasive authority in state courts on all other matters. See *Persuasive Authority.*

Manuscript Map.—The original drawing of a map as compiled or constructed from various data, such as ground surveys, photographs, etc.

Map.—A printed reproduction of a compilation resulting from one or more topographic surveys drawn to the scale of the original survey or smaller and on a definite projection. It may include some water area but basically it furnishes information relative to the land area.

Map Location.—The location of a point or line on a map rather than its demarcation on the ground. See *Low-Water Line Survey of Louisiana Coast.*

Map Projection.—The process by which a portion or all of the curved surface of the earth can be represented on a plane with the least amount of distortion; a systematic drawing of lines representing meridians and parallels on a plane surface, either for the whole earth or some portion of it.

Marbury v. Madison (1 Cr. 137).—An 1803 landmark case that established, by judicial interpretation, the great constitutional doctrine of the power of the Supreme Court to declare an act of Congress invalid, if it is repugnant to the Constitution.

Marginal Sea.—Same as *Territorial Sea.*

Mariana Trench.—A submarine feature in the Western Pacific where the greatest known ocean depth (36,198 feet) is located. See *Mount Everest.*

Marine Accident File.—A special file of nautical charts set up in the Coast Survey for use in connection with marine accident cases or wreck investigations. When information of an accident is received, three copies of the appropriate charts in force at the time are placed in this file and retained for a period of 5 years.

Marine League.—A measure of distance over the water; equals 3 nautical or geographic miles.

Marine Mile.—*See* Volume One, Appendix A.

Maritime Boundary.—A water boundary. See *National Boundary, International Boundary.*

Maritime Tort.—Civil wrongs committed on navigable waters.

Marsh.—A product of the shallow water of lagoons and other sheltered localities, usually resulting from the deposit of sediment on the bottom, which is built up to a point where certain kinds of vegetation can take root.

Marsh Areas Mostly Flooded at High Water (also called Grassy Shoals).—Marsh in the early stages of development often found contiguous to a well-defined marsh or outside the high-water line.

Maryland–Virginia Boundary Dispute.—A dispute between Maryland and Virginia arising out of the interpretation of the Award of the Arbitrators of 1877, insofar as it pertained to the south bank of the Potomac River between Jones and Smith Points. See *Award of the Arbitrators of 1877.*

Maryland–Virginia Boundary Line.—The boundary along the Potomac River as adopted by the Mathews–Nelson survey of 1927 and demarcated on the ground by the Coast Survey in 1929. See *Mathews–Nelson Survey of 1927.*

Maryland–Virginia Compact of 1785.—A treaty whereby Maryland, who owned the Potomac River, gave Virginia certain fishing rights in the river in return for free passage of Maryland ships through the lower Chesapeake Bay.

Mathews–Nelson Survey of 1927.—The map location of the Maryland–Virginia boundary along the Potomac River as laid down on six charts of the Coast Survey by geologists of both States (demarcated on the ground by the Coast Survey in 1929) in accordance with their interpretation of the Award of 1877. See *Potomac River Compact of 1958.*

Meades Ranch.—A triangulation station established in 1891 in central Kansas which was adopted as the basis for the United States Standard Datum. The selection was based on the fact that it was near the center of area of the United States and was common to two great arcs of triangulation extending across the country—one along the 39th parallel and the other along the 98th meridian. See *United States Standard Datum.*

Meadow.—The final stage in the upward growth of marsh. It is then dry all the time or substantially all the time.

Meander Lines.—Lines run a short distance back from navigable water within a section in order to determine the quantity of land in the fractional section. The meander line is generally not a boundary line.

Mean Higher High Water.—*See* Volume One, Appendix A.

Mean Higher-High-Water Mark.—The intersection of the tidal plane of mean higher high water with the shore. See *Mean Higher High Water, Luttes* v. *The State of Texas.*

Mean High Tide.—Same as *Mean High Water.*

Mean High Water.—The average height of the high waters over a 19-year period. All high waters are included in the average where the type of tide is either semidiurnal or mixed. Where the type of tide is predominantly diurnal, only the higher-high-water heights are included in the average on those days when the tide is semidiurnal. *See also* Volume One, Appendix A.

Mean High-Water Line.—The intersection of the tidal plane of mean high water with the shore. See *Mean High Water, Shore* (according to Riparian Law).

Mean High-Water Mark.—Same as *Mean High-Water Line.*

Mean Lower Low Water.—The average height of the lower low waters over a 19-year period. The tidal plane used on the Pacific coast as the datum for soundings on the hydrographic surveys and nautical charts of the Coast and Geodetic Survey. See *Lower Low Water.*

Mean Lower-Low-Water Line.—The intersection of the tidal plane of mean lower low water with the shore. See *Mean Lower Low Water, Shore* (according to Riparian Law).

Mean Low Water.—The average height of the low waters over a 19-year period. All low-water heights are included in the average where the type of tide is either semidiurnal or mixed. Where the type of tide is predominantly diurnal, only the lower-

low-water heights are included in the average on those days when the tide becomes semidiurnal. See *Diurnal Tides, Mixed Tides, Semidiurnal Tides, Nineteen-Year Tidal Cycle.*

Mean Low-Water Line.—The intersection of the tidal plane of mean low water with the shore. See *Mean Low Water, Shore* (according to Riparian Law).

Mean Low Water Springs.—The average height of low waters occurring at the time of the spring tides; the plane of reference used by the Coast Survey on hydrographic surveys at the Pacific entrance to the Panama Canal. See *Spring Tides.*

Mean of Selected Lowest Low Waters.—A plane of reference used for soundings in Puget Sound, Wash., for a period from the late 1870's to 1897 and corresponded to a plane 3.2 feet below the plane of mean lower low water. See *Present Planes of Reference.*

Mean of the Lowest Low Waters of Each 24 Hours.—A plane of reference for soundings used on some of the early surveys along the Pacific coast and interpreted to be the same as mean lower low water. See *Mean Lower Low Water.*

Mean Range of Tide.—See *Range of Tide.*

Mean Sea Level.—The average height of the surface of the sea for all stages of the tide over a 19-year period, usually determined from hourly height readings. A determination of mean sea level that has been adopted as a standard for heights is called a *sea level datum.* The sea level datum now used for the Coast and Geodetic Survey level net is officially known as the *Sea Level Datum of 1929,* the year referring to the last general adjustment of the net, and is based upon observations taken over a number of years at various tide stations along the coasts of the United States and Canada. *See Nineteen-Year Tidal Cycle.*

Mean Tide Level.—Same as *Half-Tide Level.*

Mean Values.—In tidal technology, the values obtained from averaging tidal observations at a station over a long period of time, a period of 19 years giving the best value. See *Nineteen-Year Tidal Cycle.*

Median Line.—*See* Volume One, Appendix A.

Medium Filum Acquae (also called Filum Acquae).—The geographic middle of a river supposed to divide it into two equal parts, without considering the channel or channels of the river. Identical with a median line, every point of which is equidistant from the nearest points of the baseline on the opposite shores. See *Thalweg.*

Memorandum of Understanding, Mar. 25, 1947.—A memorandum between the Coast and Geodetic Survey and the Geological Survey whereby the activities of the two agencies would be more closely integrated so as to avoid overlapping and duplication in survey operations, but without any change in the responsibilities of either agency.

Mercator, Gerhard (also called Gerhard Krämer).—Flemish mathematician and cartographer who lived in the 16th century and who devised the well-known projection which bears his name. See *Mercator Projection.*

Mercatorial Bearing.—The straight-line bearing on a Mercator chart that is obtained by applying a correction to a radio bearing (arc of a great circle) for convergency of the meridians.

Mercator Projection.—A conformal map projection upon a plane, in which the latitude and longitude lines are straight parallel lines intersecting each other at right

angles, and in which the meridians of longitude are spaced equally throughout the map, based on their distance apart at the equator, and the distances between parallels are derived by a mathematical analysis, their spacing bearing an exact relationship to the spreading of the meridians along a corresponding parallel (fig. 77). See *Rhumb Line, Conformal Projection.*

Meridian-Arc Method.—A method of determining the dimensions of the ellipsoid by measuring (by triangulation) the linear distances between three points on a meridian and the angular distances between them from observed differences in their astronomic latitudes.

Meridian Line.—A north-south line from which longitudes or azimuths are reckoned. See *Azimuth.*

Meridians.—Imaginary planes passing through the poles and measure longitudes east or west of the principal meridian of Greenwich. See *Longitude.*

Meridional Parts.—The number of nautical miles by which any given latitude is distant from the equator on a Mercator projection if every degree and minute between them is lengthened proportionately to the spreading of the longitude. *See Mercator Projection.*

Meter.—A unit of length in the metric system of measures (a decimal system) and is equal to 39.37 inches in the United States. See *Yard.*

Metes.—The exact length of each line of a tract of land. See *Metes and Bounds.*

Metes and Bounds.—The boundary lines or limits of a tract of land. One of the oldest methods of describing land and was used to transfer lands in the Thirteen Original Colonies. Defined variously in law dictionaries as: the boundary lines of land with their terminal points and angles; the boundary lines and corners of a piece of land; and the boundary lines of lands with their terminating points or angles.

Method of Squares.—A method of transferring one survey to another of different scales (fig. 27). See *Radial-Line Method.*

Mexican Cession.—Territory included approximately within the present limits of California, Nevada, Utah, and parts of Colorado, Arizona, and New Mexico, ceded to the United States in 1848 under the Treaty of Guadalupe Hidalgo (fig. 96). See *Treaty of Guadalupe Hidalgo.*

"Minus" Soundings.—Soundings that reduced to heights above the sounding datum when corrected for height of tide. On the early surveys they were variously shown as underscored soundings, as minus soundings, and as red soundings. See *Tide Reducer.*

Mixed Tides.—*See* Volume One, Appendix A.

Modes of Acquiring Territory.—The United States has acquired territory principally by the following three methods: (1) by treaty, (2) by joint resolution of the two Houses of Congress, and (3) by statute.

Monthly Lowest Low Water Datum.—The plane determined from the average height of the lowest low waters of each month over a considerable period of time. A datum used when it is desired to have the datum so low that most low waters will be above it.

Monthly Sea Level.—Sea level derived from tidal observations extending over a period of 1 month. See *Mean Sea Level.*

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Monthly, Yearly, and Cumulative Averages.—Compilations available for each control tide station obtained from the hourly height and high- and low-water records. See *Control Tide Station.*

Monument.—For the purpose of deed description, any object or mark on the land which may serve to identify the location of a line constituting a part of the boundary. Objects, to be ranked as monuments, must have certain physical properties such as visibility, permanence and stability, and definite location, independent of measurements.

Monumented Points.—Permanently marked points on the ground whose latitudes and longitudes have been determined and which can be used as starting points for all mapping and engineering projects where geographic location is a consideration (*see* fig. 11).

Moon Culminations.—A method of determining longitude by observations on the moon at the time it transits the local meridian.

Moon's Meridian Transit.—The time the moon crosses the local meridian.

Moon's Nodes.—The points where the plane of the moon's orbit intersects the ecliptic. The point where the moon crosses in going from south to north is called the *ascending node,* and the point where the crossing is from north to south is called the *descending node.* References are usually made to the ascending node, which for brevity is called "the node." It takes approximately 18.6 years for the regression of the moon's nodes to complete a circuit of 360° of longitude, or a westward motion of about 19° a year. See *Ecliptic.*

"More or Less".—When used in connection with quantity or distance in a conveyance of land are considered words of safety or precaution, intended to cover some slight or unimportant inaccuracy. The same applies to the use of the word "about."

Mount Everest.—The highest known elevation (29,028 feet) located in the Himalayas on border between Tibet and Nepal. See *Mariana Trench.*

Multiple Projection Lines.—Several systems of latitude and longitude lines appearing on many of the early surveys of the Bureau, resulting from a change in the spheroid of reference, a change in longitude values, or a change in the horizontal datum, which caused a change in the geographic values of control points.

N

National Boundary.—*See* Volume One, Appendix A.

National External Sovereignty.—*See* Volume One, Appendix A.

National Reporter System.—A series of unofficial reports of decisions of state and Federal courts begun in 1879 and now covers the entire country including a special series for the courts of record of New York (The New York Supplement). The state court decisions (appellate courts and some trial courts) are contained in the regional areas designated as Atlantic, North Eastern, South Eastern, Southern, South Western, North Western, and Pacific, followed in each instance by the word "Reporter." The federal decisions are reported in volumes designated as *Supreme Court Reporter* (for Supreme Court cases), *Federal Reporter* (for courts of appeals cases), and *Federal Supplement* (for district court cases). See *Federal Judiciary.*

National River.—A river that is under the sway of one nation.

Natural Monument.—A permanent natural object found on the land, such as a river, stream, lake, pond, ledge of rocks, or tree. See *Monument, Artificial Monument.*

Natural Scale.—See *Fractional Scale.*

Nautical Almanac.—A periodical publication of astronomical statistics useful to and designed primarily for marine navigation, particularly the *American Nautical Almanac,* published by the U.S. Naval Observatory.

Nautical Chart.—A printed reproduction of a compilation of data derived from topographic and hydrographic surveys and miscellaneous information for use in marine navigation. The distinction between a survey and a chart is that the first is an original record *of a given date,* whereas the second is a compilation of many surveys *of different dates.* See *Hydrographic Survey, Topographic Survey.*

Nautical Chart Adjuncts.—Publications issued by the Government to provide the navigator with information that is not feasible to show on the nautical chart (*see* fig. 89).

Nautical Chart Manual.—A manual for the cartographic engineer engaged in the construction and revision of nautical charts. Useful for establishing a charting practice as of a specific time. Several such manuals have been issued by the Coast and Geodetic Survey, the latest being the sixth (1963) edition.

Nautical Mile (also called Sea Mile and Geographic Mile).—A unit of distance used in marine navigation, and may be taken as equal to the length of a minute of arc along the equator or a minute of latitude on the map which is being measured. Prior to July 1, 1954, the United States nautical mile was defined as equal to 1/60 of a degree or 1/21,600 of a great circle on a sphere whose surface equals the surface of the earth. Its value calculated for the Clarke spheroid of 1866 was 1,853.248 meters, or 6,080.20 feet. On July 1, 1954, the United States adopted the international nautical mile which is 1,852.0 meters, or 6,076.10333 feet. This value was revised on July 1, 1959, to reflect the new relationship of the yard to the meter, making the new value for the international nautical mile equal to 1,852.0 meters, or 6,076.11549 international feet. See *Yard.*

Navigability (American Doctrine).—See *Tidal Test, Navigability Test.*

Navigability (English Doctrine).—First pronounced in the case of *The Royal Fishery of the Banne* (circa 1604), in which the court classified rivers as of two kinds—navigable and not navigable—and said: "Every navigable river, so high as the sea flows and ebbs in it, is a royal river . . . but in every other river not navigable . . . the terre [land] tenants on each side have an interest of common right." From this, the inference has been drawn, erroneously, that in England the only rivers that are navigable are those in which the tide ebbs and flows. See *Tidal Test.*

Navigability Test.—A test of navigability based upon the actual navigable capacity of a waterway rather than the extent of tidal influence. Enunciated by the Supreme Court in 1851 in *The Genesee Chief* v. *Fitzhugh,* 12 How. 443, in which it expressly overruled its former restrictive decisions based upon the tidal test of navigability. See *Tidal Test, Navigability* (English Doctrine).

Navigable Airspace.—Defined in the Federal Aviation Act of 1958 as "airspace above the minimum altitudes of flight prescribed by regulations issued under this Act," and includes "airspace needed to insure safety in take-off and landing of aircraft."

Navigable Waters.—Waters which afford a channel for useful commerce. See *Navigable Waters of the United States, Navigable Waters of a State.*

Navigable Waters of a State.—Navigable waterways that lie wholly within the limits of a state and have no navigable connection with any navigable waters outside the boundaries of the state. Such intrastate waters are subject to regulation and control by state laws and do not fall within the jurisdiction of Congress nor of the laws enacted by it for the preservation and protection of the navigable waters of the United States. See *Navigable Waters of the United States.*

Navigable Waters of the United States.—Waters which form in their ordinary condition by themselves, or by uniting with other waters, a continued highway over which commerce is or may be carried on with other states or foreign countries in the customary modes in which such commerce is conducted by water. This applies also to an artificial canal, as long as it forms a means of communication between ports and places in different states, even though the canal is wholly within the body of a state and subject to its ownership and control. See *Navigable Waters of a State.*

Neap Tides.—*See* Volume One, Appendix A.

Negative Engraving (also called Scribing).—A chart reproduction process in which the compilation manuscript is photographed on glass negatives and then coated with an emulsion pervious to light so the negative engraver has a facsimile of the manuscript. Both glass and plastic are used in this process.

New Edition.—A new printing of an existing chart embodying corrections that have become so extensive or of such importance to navigation as to render all previous printings obsolete, or when there is an accumulation of hand corrections of the order of 80 or more.

New Print.—A new issue of a chart embodying only minor corrections. Such corrections are applied to the negatives and a new printing plate made. New prints do not render previous printings of the current edition obsolete. See *New Print Date, New Edition, Hand-Correction Date.*

New Print Date.—The date when a new print of a chart is issued which embodies changes or corrections of a relatively minor character. The new print date is added to the right of the edition date in the lower left-hand corner of the chart. See *New Print.*

Nine-Lens Camera.—A specially designed aerial mapping camera for coastal photography. It takes a vertical central picture and eight oblique wing pictures, the latter requiring transformation and rectification before being used for mapping (*see* fig. 69). The transformed photographs are assembled to form one composite photograph equivalent to a photograph taken with a single wide angle lens. See *Transformation, Rectification.*

1929 General Adjustment (Leveling).—An adjustment of the level net of the United States to obtain the best available elevations for all bench marks so as to avoid excessive rates of correction when fitting new work to work already adjusted. In the adjustment, sea level was held fixed at 21 tide stations in the United States and 5 in Canada, and the miles of levels used were 40,000 in the United States and 20,000 in Canada.

1927 Special Adjustment (Leveling).—An adjustment for theoretical purposes in which only the closed circuits of spirit leveling, including water leveling in the Great

Lakes region, were adjusted without any sea-level connections being held fixed. See *1929 General Adjustment.*

Nineteen-Year Tidal Cycle.—The period of time generally reckoned as constituting a full tidal cycle because the more important of the periodic tidal variations due to astronomic causes will have passed through complete cycles. The longest cycle to which the tide is subject is due to a slow change in the declination of the moon which covers 18.6 years. See *Mean Low Water, Mean High Water.*

"No Bottom" Soundings.—Where the bottom was not reached because the general depths were too great for the method of measurement. A "no bottom" sounding at 20 fathoms meant that the 20-fathom leadline did not reach bottom and was shown on the smooth sheet variously by a line under the 20, by a line under the 20 and a dot under the line, or by a line over the 20 and a small circle over the line.

Nondevelopable Surface.—A curved surface that cannot be spread out in a plane without distortion—the sphere, for example. See *Developable Surface.*

Nonharmonic Method (Tidal).—An approximate method of tide prediction and is based on the principle that "the tide follows the moon." It makes use of the close relationship that exists between the time of tide at most places and the moon's meridian passage. See *Harmonic Analysis.*

Normal Baseline.—*See* Volume One, Appendix A.

North American Datum.—The same as United States Standard Datum. The name was changed to North American Datum early in 1913 when Canada and Mexico adopted the United States Standard Datum for their triangulation. This change in name reflected the continental character the datum had now assumed. See *United States Standard Datum.*

North American 1927 Datum.—The name to which the North American Datum was changed in 1927 as a result of the unified adjustment of the triangulation in the western half of the country. In the adjustment, the position (latitude and longitude) of station *Meades Ranch* was held fixed but the azimuth to station *Waldo* was reduced by 4".88, making the present value of 75°28'09".64. The positions of all other stations in the net were changed by varying amounts. As of 1963, all of conterminous United States and the whole of Alaska—including the offshore islands in the Bering Sea—were connected by one continuous triangulation and placed on the North American 1927 Datum. See *United States Standard Datum, North American Datum.*

North Atlantic Coast Fisheries Arbitration of 1910.—See Volume One, Appendix A.

North Magnetic Pole.—See *Magnetic Pole.*

Northwest Ordinance of 1787.—The ordinance which governed the Territory Northwest of the Ohio River prior to adoption of the Constitution in 1789. The provisions were reenacted on Aug. 7, 1789. See *Territory Northwest of the Ohio River.*

Northwest Territory.—See *Territory Northwest of the Ohio River.*

Notice to Mariners.—A pamphlet issued weekly by the U.S. Naval Oceanographic Office (formerly Navy Hydrographic Office) and published jointly with the U.S. Coast Guard. It contains material affecting the safety of navigation, such as changes in aids to navigation and channel depths, with which the mariner can bring his charts up to date. See *Local Notice to Mariners.*

Numbering System for Bureau Publications.—A system inaugurated Jan. 1, 1957, based on identification of class of subject matter covered. The entire scope of Bureau activities is divided into 13 categories, each category carrying its own range of numbered publications. The word "Special" is no longer used in the designation. General publications of Bureau-wide scope are in the "10" category, Hydrography is in the "20" category, etc. Thus, the designation for *Shore and Sea Boundaries* is "Publication 10-1," which indicates it is the first publication in the "10" category.

Numerical Method.—A method of applying a datum correction to a survey sheet from the differences in the numerical values of the geographic positions of triangulation stations on the two datums (fig. 36). See *Datum Correction, Graphic Method.*

Numerical Scale.—The scale of a survey (or chart) expressed in terms of the distance on the earth represented by one unit on the survey, e.g., "1 inch equals 20 miles," "3 inches to the mile."

O

Obiter Dictum (also called Dictum).—That which is said in passing. Any statement of the law enunciated by a court merely by way of illustration, argument, analogy, or suggestion, not necessarily involved nor essential to the determination of the case in hand. Lacks the force of an adjudication, and does not fall within the doctrine of stare decisis. See *Stare Decisis.*

Oblate Spheroid (also called Ellipsoid of Revolution).—A sphere flattened at the poles and generated by an ellipse revolving about its minor axis; the geometric figure used as a surface of reference for the computation of geodetic surveys. In this spheroid, any section parallel to the equator is a circle, and any section through the poles is an ellipse. The lengths of the degrees of latitude increase from the equator to the poles. See *Prolate Spheroid.*

Occultation.—The disappearance of a heavenly body behind another body of larger apparent size. The occultation of a star by the moon furnished a method of determining longitude.

Ocean.—One of the greater tracts of water that covers the globe, such as the Atlantic Ocean.

Ocean Nomenclature.—The generic names assigned to the water areas of the world. Except for the oceans, there are no exact criteria for defining the secondary features. What is called a "gulf" in one locality may be termed a "sea" in another. In many cases, the nomenclature represents long, historic usage which has not been deemed advisable to disturb. See *Sea, Gulf, Bay* (General).

Official Document.—See *Public Document.*

Offshore Wind.—A wind blowing from the land toward the sea. See *Onshore Wind.*

Oklahoma ex. rel. Phillips v. Guy F. Atkinson Co. (313 U.S. 508).—A 1941 case which further broadened the navigability concept to include the non-navigable upper reaches of an entire watershed for the purpose of flood control and waterway development and the promotion of navigation downstream as constitutional objectives of Congress. Such control now extends to a program for the development of an entire watershed, and not merely to

the navigable portions of streams in that watershed. See *Legal Concept of Navigability, United States* v. *Appalachian Electric Power Co.*

Old Hawaiian Datum.—The standard datum for the work in the main Hawaiian group between Hawaii and Kaula (*see* fig. 95).

One-Quarter, One-Tenth Rule.—A method of graphically determining the height of the tide at any time of the day from information found in the *Tide Tables* (*see* fig. 21).

Onshore Wind.—A wind blowing from the sea toward the land. See *Offshore Wind.*

Open Bay.—*See* Volume One, Appendix A.

Open Sea.—The water area of the open coast seaward of the ordinary low-water mark, or seaward of inland waters.

Opinions and Award of Arbitrators.—The findings of the Arbitrators of 1877 in the Maryland–Virginia boundary dispute.

Opisometer.—A recording device designed to measure by revolutions of a small wheel continuous linear distances on a map. Used in measuring the length of shoreline by closely following all the indentations and sinuosities of the shore.

Optional Protocol of Signature.—*See* Volume One, Appendix A.

Op. Cit. Supra.—An abbreviation for *opus citum supra* meaning "in the work cited above." Used when referring to a book previously cited to avoid repeating the full citation.

Opus Citum Supra.—See *Op. Cit. Supra.*

Ordinance of 1641–1647.—A colonial ordinance of Massachusetts under which title of the owner of land bounded by tidewater extends from high-water mark over the shore or flats to low-water mark, if not beyond 100 rods (1,650 feet) from the high-water mark.

Ordinary High Water.—See *Ordinary Tides, Mean High Water.*

Ordinary High-Water Mark.—Same as *Mean High-Water Line.* See *Ordinary Tides.*

Ordinary High-Water Mark (River).—Along a navigable river above the ebb and flow of the tide, the line to which high water ordinarily reaches, not the line reached in unusual floods nor by the great annual rises of the river.

Ordinary Low Water.—See *Ordinary Tides, Mean Low Water.*

Ordinary Low-Water Mark.—Same as *Mean Low-Water Line.* See *Ordinary Tides.*

Ordinary Low-Water Mark (River).—The usual or ordinary stage of a river when the volume of water is not increased by rains or melted snows nor diminished below such stage by long continued drought.

Ordinary Polyconic Projection.—Same as *Polyconic Projection.*

Ordinary Tides.—This term is not used in a technical sense by the Coast and Geodetic Survey, but the word "ordinary" when applied to tides may be taken as the equivalent of the word "mean." See *Borax Consolidated, Ltd.* v. *Los Angeles.*

Oregon Territory Cession.—The territory now occupied by the States of Idaho, Oregon, and Washington, and parts of Montana and Wyoming ceded by Great Britain in 1846 (*see* fig. 96).

Organization and Functions of the Coast and Geodetic Survey (1960).—A realignment of the functions of the Bureau designed to streamline and strengthen its organizational structure in order to meet the needs of modern science and technology (*see* fig. 8).

Orientation of Planetable.—Placing the planetable in such position that every line drawn on the survey sheet from the point which represents the position of the table on the ground to any other point on the sheet is parallel to the corresponding line in nature.

Original Jurisdiction.—*See* Volume One, Appendix A.

Original Limits of District of Columbia.—An area 10 miles square (on both sides of the Potomac River) ceded to the Federal Government by Maryland and Virginia, and the exact boundaries proclaimed by President Washington on Mar. 30, 1791. See *County of Washington, County of Virginia.*

Original States.—Same as *Thirteen Original States.*

Orthodromic Curve.—Same as *Great Circle.*

Orthographic Projection.—A map projection produced by straight parallel lines through points on the sphere and perpendicular to the plane of projection. See *Perspective Projection.*

Orthometric Correction.—The correction to elevations which takes into account the spheroidal shape of the earth and brings the elevations to their true height above mean sea level.

Outer Continental Shelf Lands Act.—*See* Volume One, Appendix A.

Outer Edge of Marsh.—The line delineated on topographic surveys as the dividing line between land and water, rather than the high-water line, for use on nautical charts of the Coast Survey. See *Surveyed Line, Apparent Shoreline.*

Ovaloid.—A figure of the earth with the southern hemisphere somewhat larger than the northern.

Overflowed Lands.—Lands which are permanently overflowed and will remain so without reclamation or drainage. The term has also been regarded as synonymous with swamp lands.

Ownership Below the Surface.—The right which an owner of the surface of land has to the soil or mineral deposits to the center of the earth. This ownership cannot ordinarily be interfered with, but it has also been held that the owner's title does not extend beyond a depth which he can reasonably use.

Ownership of Airspace.—See *Ad Coelum Doctrine.*

Ozalid Prints.—Photographic contact prints developed by a dry process and have a low distortion percentage. The developed print shows a colored line on a white background.

P

Pacific Coast Pilot of 1889.—*See* Volume One, Appendix A.

Panama-Colon Datum.—An independent datum adopted in 1911 for triangulation in the Canal Zone. This work is now tied to the North American 1927 Datum.

Panchromatic Photography.—*See* Volume One, Appendix A.

Pantograph.—An instrument designed to reduce or enlarge maps or drawings to any desired scale.

Parallels.—Imaginary planes passing through the earth parallel to the equator and measure latitudes north or south of the equator.

Paramount Rights.—*See* Volume One, Appendix A.

Parol Testimony.—Given by word of mouth; oral. See *Statute of Frauds.*

Patent Ambiguity.—An ambiguity which appears on the face of the instrument and arises from the use of defective or obscure language. See *Latent Ambiguity.*

Patent (Land).—A document that vests in the transferee the complete legal title to the land transferred, or furnishes evidence of the transfer. A patent is necessary to pass a perfect legal title to public lands. Also issued by the state governments to transfer title to state lands.

Per Curiam Opinion.—*See* Volume One, Appendix A.

Perigean Tide.—Tides of increased range occurring monthly as the result of the moon being in perigee or nearest the earth. The perigean range is larger than the mean range where the type of tide is either semidiurnal or mixed, and is of no practical significance where the type of tide is diurnal.

Permanent Court of Arbitration.—*See* Volume One, Appendix A.

Perspective Projection (also called Geometric Projection).—A map projection produced by straight lines radiating from a selected point and passing through points on the sphere to the plane of projection (fig. 76). See *Orthographic Projection.*

Persuasive Authority.—Authority which may or may not be followed by the courts. A court of one rank is not bound to follow a decision of another court of the same rank. Thus, decisions of the intermediate Federal appellate courts, while binding on all lower Federal courts within its circuit, are only persuasive in other Federal appellate courts and in the lower Federal courts outside its circuit. See *Mandatory Authority.*

Petitioner (also called Appellant).—In appellate courts, the person who institutes an appeal. See *Respondent.*

Petitioner-Plaintiff.—Where the plaintiff in the lower court is the petitioner or appellant in the appellate court.

Philippine Rehabilitation Act of 1946.—The act which continued Coast and Geodetic Survey operations in the islands until June 30, 1950.

Photogrammetric Survey.—In Coast Survey usage, a survey of a portion of the land surface utilizing aerial photographs and reduced to map form by stereoscopic or other instrumental equipment. See *Topographic Survey.*

Photographic Method.—A method which uses photography as a means of changing the scale of one survey sheet for transfer to another survey or to a chart.

Photolithography.—A reproduction process that made possible the use of colors for emphasizing important navigational features on nautical charts—the coloring of buoys to correspond to their colors in the water, the accentuation of lighted aids to navigation by using a color overprint, and the use of tints for the land and the shoal-water areas.

Photostat.—A direct photographic process used in the Coast Survey for making copies of original surveys without the use of an intervening film or plate. The normal photostat

has a black background with white detail. Photostats are limited in size to 18 by 24 inches and can include only a portion of the average topographic or hydrographic survey. See *Bromide, Positive Photostat.*

Pier.—A structure extending from the solid land out into the water to afford convenient passage for persons and property to and from vessels alongside the pier; a projecting wharf. See *Wharf, Dock.*

Pierhead Line.—The line fixing the boundaries of the fairway to which wharf or pier structures (of open construction) may be built (fig. 105). See *District of Columbia–Virginia Boundary Line, Bulkhead Line, Harbor Line.*

Pilot.—One who directs the movements of a vessel through pilot waters; usually, one who has demonstrated extensive knowledge of channels, aids to navigation, dangers to navigation, etc., in a particular area and is licensed for that area.

Pilotage (General).—Pilots at ports are regulated in conformity with the laws of the states as Congress has not legislated other than to indicate an intention to leave such regulations to the states. See *Pilotage* (Great Lakes).

Pilotage (Great Lakes).—Placed under federal control by the Great Lakes Pilotage Act of 1960, which is administered by the Secretary of Commerce and delegated to the Great Lakes Pilotage Administration. See *Pilotage* (General).

Plane of Reference (also called Sounding Datum).—The vertical plane or tidal datum to which the soundings on a hydrographic survey are reduced; the elevation of the water surface from which the depths on the survey or the nautical chart are reckoned. See *Tidal Datums.*

Plane Rectangular Coordinates.—The perpendicular distances (coordinates) of a point from a pair of axes which intersect at right angles, reckoned in the plane defined by those axes. See *State Coordinate Systems.*

Planetable.—A surveying instrument used in topographic mapping by which the surveyor plots his survey in the field directly from the observations without the necessity of keeping notes for later office plotting (*see* fig. 41). It consists essentially of a drawing board on a tripod to which the survey sheet is clamped and adjusted in the horizontal plane, an alidade (a telescope mounted on a metal, straight-edge ruler) for measuring directions and distances to salient features of the terrain, and a telemeter rod graduated for the optical measurement of distances from the observer. See *Topographic Survey, Praetorius (Johann).*

Planetable Traverse.—A sequence of lengths and directions of lines measured with a planetable between two stations of known positions. See *Planetable.*

Planimeter.—A mechanical integrator for measuring the area of a plane surface. The one most generally used in map work is the polar type.

Planimetric Map.—A map which presents the horizontal positions only for the features represented; distinguished from a topographic map by the omission of relief.

Planimetric Survey.—A survey which presents the horizontal positions only for the features represented; distinguished from a topographic map by the omission of relief.

Plan of 1843.—A plan of reorganization of the Survey of the Coast, formulated by a board of officers from the Survey, Navy, and Army, under authority of the Act of Mar.

3, 1843, and approved by President Tyler on Apr. 29, 1843. The plan governed the operations of the Coast Survey for more than a century until passage of the Act of Aug. 6, 1947. See *Act of Aug. 6, 1947.*

Plat.—In land surveying, a map, or representation on paper, of a tract of land subdivided into blocks, lots, etc., usually drawn to a scale. In the survey of the public lands, the term plat refers to the drawing which represents the particular area included in a survey, such as a township, private land claim, or mineral claim.

Plenary Power.—Full; entire; complete; absolute; perfect; unqualified.

Plumb-Line Deflection.—Same as *Deflection of the Vertical.*

"Point of Beginning".—A point on the west boundary of the State of Pennsylvania at the north bank of the Ohio River and is the "point of beginning" for the survey of the public lands. The point was marked by a stake on Aug. 20, 1785. See *Land Ordinance of 1785.*

Polyconic Projection.—A modification of the simple conic by developing each parallel of latitude as the circumference of the base of a right cone tangent to the sphere along that parallel. Its characteristics are a straight central meridian with all other meridians concave toward it, nonconcentric arcs of circles for the parallels except the equator, and nonorthogonality of intersections except near the middle portion of the projection or on maps of large scale and limited extent (*see* fig. 32). The scale along all parallels is correct as it is along the central meridian. The origin of the projection, at least in concept, is credited to Ferdinand R. Hassler, the first Superintendent of the Coast Survey, and is used for all the topographic and hydrographic surveys of the Bureau. See *Simple Conic Projection.*

Portolano Charts.—A type of chart which flourished toward the close of the middle ages. In place of a projection, networks of straight lines were used which radiated from common centers like the spokes of a wheel and corresponded to the points of the compass. These lines enabled the navigator to set his course at and to any point by aid of the magnetic needle. The Cosa chart of 1500 was a form of "Portolano." See *Cosa Chart of 1500.*

Port Series.—A series of books, published jointly by the Corps of Engineers and the Maritime Administration, which contains pilotage information for the principal ports of the United States.

Position Angles.—The two sextant angles observed on the survey vessel for determining its position.

Position Numbers.—Numbers assigned to the survey boat's positions, starting with number 1 at the beginning of each day's work and continuing consecutively to the end of the day's work. See *Day Letters, Position Angles, Identification Letters and Numbers.*

Positive Photostat.—A photostat in which the background is white and the detail black, as distinguished from the normal photostat which has a black background with the detail white.

Potomac River Compact of 1958.—Supersedes the Maryland–Virginia Compact of 1785, but makes no change in the boundary along the Potomac River as defined in the Black-Jenkins Award of 1877 and as laid out in the Mathews–Nelson Survey in 1927. See *Award of the Arbitrators of 1877.*

Power to Acquire Territory.—A power, recognized by all civilized States, that dominion over new territory may be acquired by discovery and occupation and by cession and conquest.

Praetorius, Johann.—Credited with having developed the prototype of the modern planetable in the latter part of the 16th century (fig. 68). See *Planetable.*

Precise Dead Reckoning.—The name given to a type of accurate dead reckoning used in depths where the survey ship could be anchored for current observations. Every known element affecting the vessel's position was carefully observed, but notwithstanding the precautions taken, there were enough indeterminable factors to make the results anything but precise. See *Dead Reckoning.*

Precise Leveling.—Same as *First-Order Leveling.*

Predicted Tides.—The expected times and heights of the tide as given in the *Tide Tables* in advance of their occurrence. See *Tide Tables.*

Preliminary Charts.—In early Coast Survey usage, the same as "sketches" but covered a greater area. They differed from the "finished" chart in the amount of information they furnished, showing only the shoreline and soundings and not the topography. During World War II this designation applied to charts constructed from unverified hydrographic surveys. See *Sketches.*

Preliminary Survey.—As used in early Coast Survey terminology, it was of higher order than reconnaissance, but did not have the detail of a complete survey. See *Reconnaissance Survey.*

Prescription (Land).—A right acquired in land by one who uses it adversely for a required statutory period.

Present Planes of Reference.—The planes of reference for soundings, in use in 1963, along the various coasts of the United States: mean low water for the Atlantic Ocean and the Gulf of Mexico; mean lower low water for the Pacific Ocean, except the Pacific entrance to the Panama Canal where it is mean low water springs; special planes for certain of the larger navigable rivers and lakes.

Prima Facie Evidence.—Evidence good and sufficient on its face, or which suffices for the proof of a particular fact until contradicted and overcome by other evidence.

Primary Tide Station.—Same as *Control Tide Station.*

Primary Triangulation.—See *Triangulation Classification.*

Principal Meridian.—A true north-south line (a meridian) extending both north and south of the initial point in the rectangular system of surveys. Together with the base line they constitute the axes of a system and the initial point the origin of that system (*see* fig. 97). Subdivisions of the public lands are referenced to their appropriate principal meridian which is designated by name or number. See *Initial Point, Base Line* (Public Lands Surveys), *Rectangular System of Surveys.*

Principle of Equidistance.—A principle applied in drawing a seaward boundary between two adjacent coastal nations through the territorial sea in such a manner that the sea area will be equitably divided between them. See *Median Line.*

Private Land Ownership.—Comprises those lands that formerly belonged to the Federal Government, to an individual state, or to a foreign government.

Progressive Wave Theory.—The theory that the tides of the world are due principally to the action of the tidal forces on the broad and deep waters of the "Southern Ocean" where it was assumed these forces raised two tidal waves, 180° apart in longitude, which traversed this belt of water from east to west, forced by the moon to keep step with its own motion. These waves, sweeping around the southern latitudes, were supposed to generate secondary waves in the Atlantic and Pacific Oceans, which traveled northward across the equator and into the Northern Hemisphere, impressing minor waves into all the water areas in their paths. See *Stationary Wave Theory, Southern Ocean.*

Projection.—The lines representing the parallels of latitude and meridians of longitude drawn on a survey sheet, map, or chart.

Projection Constructed After Survey.—Applies to some of the early hydrographic and topographic surveys which were executed prior to the determination of the geographic positions of the triangulation stations. Two methods are used for reconstructing a projection on such a survey sheet—a rigid one for surveys on scales smaller than 1: 10,000 (*see* fig. 38), and a graphic one for surveys on scales 1: 10,000 and larger (*see* fig. 39).

Projector.—An instrument by means of which the image of one survey sheet may be projected through a lens onto another survey sheet of a different scale.

Prolate Spheroid.—A sphere elongated through the polar axis and generated by an ellipse revolving about its major axis. In this spheroid, the lengths of the degrees of latitude decrease from the equator to the poles. See *Oblate Spheroid.*

Proof of Navigability.—The type of evidence that needs to be adduced as to whether a body of water is navigable or non-navigable; ordinarily a question of fact to be established by appropriate evidence, including opinions of persons who by training and experience are competent, and to be resolved by a jury. See *Navigable Waters.*

Proportional Dividers.—An instrument used chiefly for transferring details from one survey to another where the scales are different.

Proportionate Shoreline Method.—A method of dividing accretion between adjacent owners of riparian land so as to give to each proprietor a width at the new shoreline proportional to that which he had at the old shoreline before accretion took place.

Proprietary Interest.—*See* Volume One, Appendix A.

Provisional Charts.—Pertains to charts for which there is an urgent need and which are smooth-drafted for direct reproduction.

Ptolemy, Claudius.—Greco-Egyptian astronomer, geographer, and geometer who lived in the 2d century and who is credited with devising the conic projection. His *Geographia* represented the sum of all geographic learning of the time and served as a groundwork for future cartographers.

Publication Note.—The note shown in the lower center margin when a new chart is published. This carries the information that the chart was compiled and printed at Washington, D.C., by the Coast and Geodetic Survey of the U.S. Department of Commerce. When space is available, the names of the Secretary of Commerce and the Director of the Survey are also included.

Public Document (also called Official Document).—One that records facts which may have been inquired into or taken notice of for the benefit of the public by an agent

authorized for the purpose. Applies to official letters, official maps, reports and records generally of official surveyors, and naval charts.

Public Domain (also called Public Lands).—The term applied to those areas of land that were turned over to the General Government by the Original States and to such other lands as were later acquired by treaty, purchase, or cession, and are disposed of under authority of Congress. The submerged lands granted to the states under Public Law 31 have been held to be part of the public domain. See *Public Law 31, Public Land States.*

Publici Juris.—Of public right; open to or exercisable by all persons.

Public Lands.—Same as *Public Domain.*

Public Land States.—Alabama, Alaska, Arizona, Arkansas, California, Colorado, Florida, Idaho, Illinois, Indiana, Iowa, Kansas, Louisiana, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, Nevada, New Mexico, North Dakota, Ohio, Oklahoma, Oregon, South Dakota, Utah, Washington, Wisconsin, and Wyoming.

Public Land Surveys.—See *Rectangular System of Surveys.*

Public Law 31.—*See* Volume One, Appendix A.

Public Use of Navigable Waters.—The right of the public to the use of navigable waters, irrespective of who owns the soil below.

Public Use of Shores.—The rights which the public has, equal with the riparian owner, to a reasonable use of the shore of a tidal stream between high- and low-water marks. Where the shore belongs to the state, the public right extends to all lands below high-water mark not used, built on, or occupied, and include passing, fishing, bathing, hunting, and navigation.

Published Maps (District of Columbia–Virginia Boundary Line).—A series of seven planimetric maps (lithographic prints in black and white) at a scale of 1: 4,800, numbered consecutively from Register No. T–8600 to Register No. T–8606 inclusive (*see* fig. 104).

Puerto Rico Datum.—Derived from observations on Puerto Rico and the Virgin Islands and adopted in 1901 as the best geographic datum for Puerto Rico, Mona Island, Vieques, Culebra, and the Virgin Islands. This work is now tied to the North American 1927 Datum.

Pythagoras.—Greek philosopher who lived about 540 B.C., and who gave the first clear statement regarding the spherical shape of the earth.

Q

Quadrangle Maps.—Topographic maps published by the United States Geological Survey which in general cover the same angular measure in both latitude and longitude. The usual values of the quadrangles are 7½ minutes, 15 minutes, 30 minutes, and 1 degree by 1, 2, or 3 degrees.

Quid Pro Quo.—Something for something; the mutual consideration which passes between parties to a contract, and which renders it valid and binding.

R

Radial-Line Method.—A method of transferring one survey to another of different scale (fig. 28). See *Method of Squares.*

Radio Acoustic Ranging (R.A.R.).—A method of position determination in offshore hydrographic surveying which utilized underwater sound transmission and radio to determine the distance of the survey vessel from two or more known stations (*see* fig. 7). This method was discontinued during World War II and has since been superseded by electronic methods. See *Shoran, Electronic Position Indicator, Raydist.*

Range Lines.—True meridians 6 miles apart laid out along the base line and each standard parallel in the same way as the guide meridians are laid out (fig. 97). See *Township, Twenty-Four-Mile Tracts.*

Range of Tide.—The difference in height between consecutive high and low waters. The *mean range* is the difference in height between mean high water and mean low water. The *diurnal range* is the difference in height between mean higher high water and mean lower low water.

Raydist.—A phase-type electronic system for controlling offshore hydrographic surveys, in which the determination of distance is based on the measurement of a phase difference in two radio signals, one emanating from the survey vessel and the other from a transmitter at one of two fixed stations ashore. To obtain the distances to both ground stations, the phase difference is measured at three places—aboard ship and at each ground station.

Reclaim (according to Riparian Law).—To reduce marshy or swamp land to a state fit for cultivation and habitation. In a number of states, the owner of land on tide water may make use of the shore, though it belongs to the state for the purpose of reclaiming the shore to low-water mark, so long as it does not interfere with the public rights of fishing and navigation, and in so doing conforms to all regulations imposed by the state. The made land then becomes an integral part of the owner's upland and his title extends to the new high-water mark.

Reconnaissance Charts.—Charts based on reconnaissance surveys and published for exploratory purposes (usually on a very small scale) as a preliminary to the making of detailed surveys. See *Reconnaissance of the Western Coast of the United States.*

Reconnaissance of the Western Coast of the United States (1853).—A noteworthy example of a reconnaissance chart. It covers the coastline from San Diego to San Francisco at a scale of 1: 1,200,000. See *Reconnaissance Survey.*

Reconnaissance Survey.—A hasty, preliminary survey of a region made to provide advance information regarding the area, which may be useful pending the execution of a more complete survey.

Rectangular Polyconic Projection.—A modification of the ordinary polyconic but with only a selected parallel truly divided, and meridian lines drawn through the points of division so as to cut all parallels at right angles; hence, the name rectangular polyconic (fig. 33). See *Polyconic Projection.*

Rectangular System of Surveys.—A system inaugurated by the Continental Congress on May 20, 1785, for the survey of the public lands of the United States. Its distinguish-

ing characteristic is that in the main, and in all cases where practicable, its units are in rectangular form (fig. 97). See *Township.*

Rectification.—In photogrammetry, the process of projecting a tilted or oblique photograph onto a horizontal reference plane, the angular relation between the photograph and the plane being determined by ground measurements.

Reduction of Soundings.—In surveys with the leadline, the correction of the observed depths for height of tide above the plane of reference and for leadline correction (departure of leadline from true length).

Reef.—A rocky or coral elevation dangerous to surface navigation which may or may not uncover at the sounding datum. A rocky reef is always detached from shore; a coral reef may or may not be connected with the shore (*see* fig. 62).

Registry Numbers.—Numbers assigned to topographic and hydrographic surveys of the Coast Survey for identification and filing purposes. Topographic surveys (sometimes referred to as "T" sheets) are identified by the letter "T" annexed to the registry number, and hydrographic surveys (sometimes referred to as "H" sheets) by the letter "H." A complete identification of a topographic survey, including the date of survey, would be "Register No. T–52 (1838)."

Regulations.—Rules promulgated by executive officers or boards or commissions for the practical administration of statutes enacted by Congress or a state legislature after having laid down the general rules of action.

Reliction (also known as Dereliction).—The gradual and imperceptible recession of the water resulting in an uncovering of land once submerged. See *Accretion.*

Report of Special Master.—*See* Volume One, Appendix A.

Representative Fraction.—A term applied to a fractional scale where the numerator is unity. Also called the "R.F." of the map. See *Fractional Scale.*

"R.F." of Chart or Map. See *Representative Fraction.*

Respondent (also called Appellee).—In appellate courts, the party who contends against an appeal. See *Petitioner.*

Respondent–Defendant.—One who in the lower court was the defendant and is the respondent in the appellate court. See *Respondent.*

Review.—The final step in the processing of the field data of a hydrographic survey. Its purpose is to consider the survey in its broader aspects, to correlate it with all prior surveys of the Bureau covering the same area, with historical data that may have been received from other sources, and to lay the foundation for future surveys in the area because of indicated changes, inadequate development, or conflicting information. See *Basic Survey.*

Rhumb Line (also called Loxodromic Curve).—A continually curving line on the earth which cuts all the meridians at the same angle and always approaches the pole but theoretically never reaches it. A ship sailing a "rhumb" is on one course continuously. The rhumb line is a straight line only on the Mercator projection (fig. 87). See *Mercator Projection.*

Right Bank (River).—The bank on the right-hand side as one proceeds downstream. See *Left Bank.*

Right of Access.—A fundamental riparian right; the right which a riparian owner has of reaching navigable water, in the absence of an otherwise controlling local law limiting such right. See *Riparian Rights.*

Right of Discovery.—One of the powers which a sovereign nation has to acquire territory by discovery and occupation. See *Guano Act.*

Right of Eminent Domain.—The power which inheres in every politically organized society to condemn private property for a public use. It is vested in each of the several states, and by the fifth amendment to the Constitution it is implied that the United States possesses the power but the property cannot be taken without just compensation. See *Taking of Private Property.*

Right-of-Way.—Right to use or cross over the property of another.

Ripa.—*See* Volume One, Appendix A.

Riparian Boundaries.—*See* Volume One, Appendix A.

Riparian Lands.—In strictness, lands bordering on a river. The term "riparian" is also used as relating to the shore of the sea or other tidal water, or of a lake or other considerable body of water not having the character of a watercourse.

Riparian Law.—The branch of the law which deals with the rights in land bordering on a river or the sea.

Riparian Owner.—*See* Volume One, Appendix A.

Riparian Rights.—The rights of an owner of land contiguous to a navigable body of water and include principally the right of access to the water; the right to build piers, wharves, docks, and other improvements to the line of navigation; the right to reclaim land, and the right to accretions.

River.—A natural stream of water, of greater volume than a creek or rivulet, flowing in a more or less permanent bed or channel, between defined banks or walls, with a current which may either be continuous in one direction or affected by the ebb and flow of the tide. See *Boundary River, International River, National River.*

River Boundaries.—See *Boundary River, Medium Filum Acquae, Thalweg, River Boundary* (Bank).

River Boundary (Bank).—Where the entire river is part of the domain of one state the further bank or shore is the boundary line between the two states.

River Boundary (Shore).—Same as *River Boundary* (Bank).

Rock Awash.—In Coast Survey terminology, a rock exposed at any stage of the tide between the datum of mean high water and the sounding datum, or one just bare at these datums. For cartographic purposes, in order that the charted symbols may reflect the most probable condition of the rock as seen by the mariner, rocks the summits of which are in the zone between 1 foot above mean high water and 1 foot below the sounding datum on the Atlantic and Gulf coasts and 2 feet on the Pacific coast are shown as rocks awash (fig. 65). See *Bare Rock, Sunken Rock.*

Rock Symbolization.—The progressive changes in rock symbols between 1840 and 1960, as developed in the Coast Survey for use on surveys and charts (*see* fig. 64).

Rodded Points.—Points in a planetable survey that are located by a direction and measured distance. See *Telemeter Rod.*

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Rule of Property.—A settled legal principle governing ownership and disposition of real property, which courts are reluctant to change because many titles may be injuriously affected. The existence of the doctrine of the rule of property is one of the reasons why early court decisions are often cited as authority in modern cases involving land ownerships. See *Stare Decisis*.

Rule of the Thalweg.—In river boundaries, the rule which holds that where a navigable river separates two nations, the middle of the main channel is the boundary between them, as distinguished from the geographic middle of the river. See *Medium Filum Acquae*.

Rules for Representing Certain Topographical and Hydrographical Features, etc. (1860).—The first publication pertaining to the drawing and engraving of Coast Survey maps and charts. Every detail of the finished chart was covered by the rules from the symbols and dimensions for topographic features to the style and gage of lettering.

Rules of Comparative Dignity.—Rules for the order of precedence to be followed in resolving conflicts in land descriptions: (1) natural monuments or objects, (2) artificial marks or objects, (3) maps and plats, (4) courses and distances, and (5) recitals of quantity.

Rules of Construction.—Rules developed by the courts for the resolution of ambiguities in land conveyances in order to determine the intent of the parties to the conveyance.

Rules of the Road.—Established by the U.S. Coast Guard for preventing collisions at sea, and cover requirements for lights, sound signals, steering, and sailing. Set out in a pamphlet titled "Rules of the Road, International-Inland" (CG–169). See *Inland Rules of the Road, International Rules of the Road*.

Rules of the Road Boundary Lines.—Lines (descriptive or charted) established by the U.S. Coast Guard for separating areas of the sea where the Inland Rules of the Road apply from those where the International Rules apply (figs. 82–85). See *Inland Rules of the Road, International Rules of the Road, Act of Feb. 19, 1895*.

"Rules of the Road, International-Inland".—A pamphlet published by the U.S. Coast Guard under the designation "CG–169." See *Rules of the Road*.

S

Sailing Charts.—Charts of scales 1: 600,000 and smaller for planning and for fixing the mariner's position as he approaches the coast from the open ocean, or for sailing between distant coastwise ports.

Sailing Directions.—Publications similar in scope to the *Coast Pilots* of the Coast Survey published by hydrographic offices of the world.

Sanding.—An irregular dot pattern used on some of the early hydrographic surveys to accentuate the area between the high- and low-water lines (*see* Register No. H–500 (1855)).

Scale.—The relation that a measured distance on a survey, map, or chart bears to the corresponding actual distance on the earth—for example, if 1 inch on the survey or chart corresponds to 1,000 feet (12,000 inches) on the ground, the scale would be expressed

as 1 inch = 1,000 feet. Expressed as a ratio this would be a scale of 1 : 12,000. See *Fractional Scale.*

Scale Factor.—A multiplier for reducing a distance obtained from a map by computation or scaling to the actual distance on the datum of the map. In the State Coordinate Systems, scale factors may be applied to grid lengths to obtain geodetic accuracy.

Scale of a Mercator Chart.—The variation of scale with latitude due to the characteristics of the Mercator projection (*see* fig. 77). Mercator charts are designed in two ways with respect to scale: by maintaining a uniform construction scale at a selected latitude for each chart (the 1200 series along the Atlantic and Gulf coasts on a scale of 1: 80,000), and by holding the adopted scale correct for a selected latitude of a series of charts (the 1100 series along the Atlantic and Gulf coasts based on a scale of 1: 400,000 at latitude 40°). See *Mercator Projection.*

Scribing.—See *Negative Engraving.*

Sea.—A large or considerable body of oceanic water partly or almost entirely enclosed by land, as, for example, the Bering Sea and the Mediterranean Sea. See *Ocean Nomenclature.*

Seal.—An impression upon wax to serve as an authentication of an instrument—a deed, for example, in land transfers. By statute in many states, a mere scroll or any other device marked on the paper, on which the conveyance is written, is sufficient, and the writing of the word "Seal" in connection with the signature is regarded as a sufficient sealing. See *Deed.*

Sea Level Datum.—See *Mean Sea Level.*

Sea Level Datum of 1929.—An adjusted datum and the basis for the level net of the United States. See *Mean Sea Level.*

Seaward Boundaries (Submerged Lands Act).—The seaward boundaries of the coastal states for purposes of exploring the submerged lands of the open sea—9 geographic miles (3 leagues) for Texas and for Florida in the Gulf of Mexico, and 3 geographic miles for the rest of the states. See *United States* v. *Louisiana et al.*

Secondary Authority.—Comprises indexes to authority, such as digests and legal encyclopedias, and textbooks, law review articles, and other treatises. These can be highly persuasive and are frequently cited in judicial decisions.

Secondary Tides.—Refers to those additional tides—higher low waters and lower high waters—that occur twice a month (when the moon is over the equator) in a general pattern of diurnal tides. See *Diurnal Tides.*

Secondary Triangulation.—See *Triangulation Classification.*

Second-Order Leveling.—Leveling that is run in one direction only except on lines 25 miles or more in length, when they are double run. For a 25-mile circuit, the error of closure is about 2 inches on an average. The accuracy of this class of leveling satisfies the requirements of the International Union of Geodesy and Geophysics for "leveling of precision."

Section.—The final subdivision in the rectangular system of surveys under the original ordinance. Each township contains 36 sections, each 1 mile square, or 640 acres. The sections are formed by straight lines, 1 mile apart, run parallel to the eastern

range line of the township and by straight east-west lines, 1 mile apart, run parallel to the south township line. (*See* figs. 97 and 98.)

Semicircular Rule.—A geometric method, using the pattern of a semicircle, for determining when an indentation of a coast should be regarded as part of the inland waters of a country, and when it should be regarded as part of the open sea. The borderline case is a semicircle with a diameter equal to the distance between the headlands of the indentation—if the area of the indentation is equal to or greater than the area of the semicircle, the indentation is part of the inland waters; if it is less, the indentation is part of the open sea. *See also* Volume One, Appendix A.

Semidiurnal Tides.—*See* Volume One, Appendix A.

S. 1109.—A bill, introduced in the 88th Cong., 1st sess., to establish the seaward boundaries of Alabama, Mississippi, and Louisiana at 3 marine leagues into the Gulf of Mexico. See *Seaward Boundaries.*

S. 1988.—A bill, introduced in the 88th Cong., 1st sess., prohibiting (with certain exceptions) any foreign vessel from taking fish within the territorial waters of the United States (including the territories and possessions and the Commonwealth of Puerto Rico) or from taking any fishery resources of the continental shelf which appertain to the United States. The bill was approved by the Senate on Oct. 1, 1963, and sent to the House for action. It was signed by the President on May 20, 1964, as Public Law 88–308.

S. Rept. 500.—The Senate committee report on S. 1988, 88th Cong., 1st sess. See *S. 1988.*

Servitude.—The right in respect to land owned by one person by virtue of which it is subject to a certain use or enjoyment by another person. Frequently applied to the right which foreign vessels have to travel through the territorial sea of another country. See *Easement.*

Seven Seas.—Figuratively, all the waters or oceans of the world. Applied generally to the seven oceans—Arctic, Antarctic (not now considered by hydrographers as having definite boundaries), North Atlantic, South Atlantic, North Pacific, South Pacific, and Indian.

Sextant.—An instrument used in hydrographic surveying for measuring the horizontal angle between two objects (*see* fig. 59). It is constructed on the optical principle that when a ray of light undergoes two successive reflections in the same plane, the angle measured is actually twice the angle through which the index arm has passed. The markings on the graduated arc are therefore doubled at the time of manufacture. See *Three-Point Fix Method.*

Sextant Fix.—A position determined by measuring with a sextant two adjacent angles between three objects whose relative positions (latitudes and longitudes) are known. See *Three-Point Problem.*

Shifting Boundary Theory.—See *Shifting Riparian Boundary.*

Shifting Riparian Boundary.—Where the sea or an arm thereof is a boundary, changes brought about by erosion or accretion operate to change the boundary. This is sometimes referred to as the ambulatory nature of a water boundary. See *Fixed Riparian Boundary, Erosion, Accretion.*

Shoran.—A pulse-type electronic ranging system, originally designed for the positioning of bombing aircraft and later adapted for use in hydrographic surveying and other procedures.

Shore (according to Coastal Engineering).—The zone over which the line of contact between land and sea migrates; the landward limit of effective wave action. Extends from the low-water mark inshore to the base of the cliff (fig. 86). See *Shore* (according to Riparian Law).

Shore (according to Riparian Law).—The land between ordinary high- and low-water marks, where the common law prevails; the land over which the daily tides ebb and flow (*Borax Consolidated, Ltd.* v. *Los Angeles*, 296 U.S. 10, 22–23 (1935)). The civil-law concept of shore has been interpreted as extending to the line of mean higher high tide (*Luttes* v. *State of Texas*, 324 S.W. 2d 167, 191 (1958)). See *Tidelands, Ordinary Tides.*

Shore Development Cycle.—The progressive changes in the shore from the time when the water first assumes its level and rests against the new shore to the time when it has brought its boundaries into harmony with its movements.

Shore Lands.—Same as *Tidelands.*

Shoreline.—The line of contact between the land and a body of water. On Coast and Geodetic Survey nautical charts and surveys the shoreline approximates the mean high-water line. In Coast Survey usage the term is considered synonymous with "coastline." See *Mean High-Water Line.*

Shore Processes.—The forces of nature, such as winds, waves, tides, and currents, that contribute to the development of a shore. See *Shore* (according to Coastal Engineering).

Short-Series Tide Station.—A station established as a necessary part of a hydrographic survey operation to provide data for determining the reference datum and for reducing the soundings to that datum. The results from such stations are brought to 19-year means by comparisons with simultaneous observations at suitable control stations where mean values are available from long-series records. See *Comparison of Simultaneous Observations, Mean Values.*

Simple Conic Projection.—A map projection which utilizes as the medium of projection a right cone tangent to the sphere at the middle latitude (the standard parallel) of the area to be mapped. Its characteristics are straight meridians and concentric arcs of circles for parallels, the two intersecting at right angles. The scale of the projection is true along the standard parallel and along all meridians but not along the parallels above and below the standard parallel, which makes the projection unsuitable for areas with considerable north-south extent.

Sixth Report of the United States Geographic Board (1933).—The latest complete, published report of the board and covers decisions between 1890 and 1932, in one consecutive alphabetical list.

Sketches.—In early Coast Survey usage, charts based on reconnaissance or regular surveys but covering a very limited area and published as soon as possible after the surveys were made. They were engraved by the apprentices in the Survey and served as subjects for practice. See *Preliminary Charts.*

Small-Craft Charts.—A series of charts begun in 1959 (at scales 1: 40,000 and 1: 80,000) and designed for maximum usefulness to the yachtsman and the small-boat operator in the active coastal boating areas of the country. They contain information in tabular and pictorial form not included on the standard charts.

Small-Scale (Survey or Chart).—A relative term, but generally one covering a large area on the ground. In Coast Survey usage, a scale of 1: 100,000 (1 inch on survey or chart = 100,000 inches on the ground) or smaller would fall in this classification. See *Large-Scale.*

Smooth Sheet.—The name given to the hydrographic survey when reduced to plot form (*see* fig. 56). Essentially, it is a record of the soundings taken during the field survey but contains other data necessary for a proper interpretation of the survey, such as depth curves, bottom characteristics, names of geographic features, and control stations. After verification and review, it becomes the official permanent record of the field survey, and subsequent reference to the original sounding records is seldom necessary except for some special investigation. Corresponds to what was termed in the early instructions for hydrographic work as "finished" hydrographic sheet. See *Hydrographic Survey.*

Sofar.—A signaling system for distress calls at sea which utilizes the existence of certain depth layers where the combined factors of temperature and pressure cause a velocity inversion, resulting in a channeling effect that conserves energy and sends the sound signals over great distances to be picked up by shore listening stations.

Sounding Datum.—See *Plane of Reference.*

Sounding-Line Crossings.—The intersection of two systems of sounding lines at which the depths must agree within specified limits. See *Cross Lines.*

Sounding Pole.—A graduated pole with a disk on the lower end, to prevent it sinking into muddy bottom, for sounding in shoal depths.

Sounding Records.—Bound record books in which all of the data taken on a hydrographic survey are entered, and become part of the permanent records of the Bureau. A typical sounding record of a launch hydrographic survey using an echo sounder and three-point fix control contains the following data: position numbers, times of taking the soundings, uncorrected soundings, corrections to be applied, reduced soundings, boat's headings by compass, position control data, and pertinent remarks (*see* fig. 61).

Soundings.—The depths obtained on a hydrographic survey—uncorrected when first recorded in the sounding record but corrected for tide and other factors when plotted on the smooth sheet. See *Sounding Records, Tide Reducer.*

Southeast Alaska Datum.—An independent datum established toward the end of 1901 by joining together nine different groups of triangulation to form one continuous scheme on one datum. Applied to all triangulation in Alaska between Dixon Entrance and Mount St. Elias. Although all the triangulation is now computed on the North American 1927 Datum, many of the hydrographic and topographic surveys in this area are still on the old datum. See *North American 1927 Datum.*

Southern Ocean.—The Antarctic facies of the Atlantic, Indian, and Pacific Oceans which some consider as a Southern Ocean. See *Progressive Wave Theory.*

South Magnetic Pole.—See *Magnetic Pole.*

Sovereign States.—States whose subjects or citizens are in the habit of obedience to them, and which are not themselves subject to any other State in any respect. After the American Revolution the Thirteen Original Colonies became sovereign States. With the adoption of the Constitution and the formation of the Federal Government, the latter succeeded only to such rights as the States chose to surrender. See *National External Sovereignty.*

Specialized Symbolization.—Used in photogrammetric mapping and nautical charting of the Laguna Madre area in Texas and similar areas elsewhere where very little of an astronomic tide exists and the variation in water level is due primarily to meteorological conditions (*see* Part 2, 452).

Special Master.—*See* Volume One, Appendix A.

Specimens of Topographical Drawing (1879 and 1883).—A series of 16 lithographed plates, with contours in color, of topographic features most prevalent along the coasts of the United States to serve as guides for the office draftsmen who were to ink the planetable surveys. The plates were published in the Annual Report for 1883.

Specimen Topographic Symbols (1865).—A specimen sheet of conventional symbols accompanying the first comprehensive treatise on the planetable included in the Annual Report of the Coast Survey for 1865 (*see* figs. 49 and 50).

Spherical Excess.—The amount by which the sum of the three angles of a triangle on a sphere exceeds 180°.

Spheroid.—In general, any figure differing but little from a sphere. In geodesy, a mathematical figure closely approaching the geoid in form and size, and used as a surface of reference for geodetic surveys. See *Oblate Spheroid, Prolate Spheroid, Figure of the Earth.*

Spirit Leveling.—The determination of elevations of points with respect to each other, or with respect to a common vertical datum, by means of an instrument using a spirit level to establish a horizontal line of sight.

Spring Range (Tidal).—The average semidiurnal range occurring semimonthly as a result of the moon being new or full. It is larger than the mean range where the type of tide is either semidiurnal or mixed, and is of no practical significance where the type of tide is diurnal. See *Spring Tides.*

Spring Tides.— *See* Volume One, Appendix A.

Stadia.—The plural form of stadium, a Greek measure of length somewhat greater than 600 feet.

Stadia Rod.—See *Telemeter Rod.*

Standard.—A copy of a new edition or a new chart on which is indicated in outline form all new information, except aids to navigation, to be applied to the chart before printing. See *New Edition, Standards File.*

Standard Disk.—A metal tablet, about 3½ inches in diameter, which may be set in a concrete monument, rock outcrop, or building, and used as a station marker. The type of station (triangulation, bench mark, etc.) is inscribed on the surface of the disk together with the designation of the particular station (*see* figs. 11 and 17).

Standard Geographic Datum.—The best theoretical value (latitude, longitude, and azimuth) for a point on the adopted spheroid of reference to which all other points in the triangulation net are tied.

Standard Parallels.—See *Twenty-Four Mile Tracts.*

Standards File.—A file begun about 1908 by means of which a record is kept of all incoming charting information. The file consists of a complete set of the published charts. See *Standard.*

Standards Symbols (1928).—Included in the Topographic Manual of 1928 (Special Publication No. 144) and based on the symbols published by the Board of Surveys and Maps in 1925 (*see* figs. 53, 54, and 55).

Stare Decisis (also called the Doctrine of Precedent).—Literally, to stand by decided matters, or let the decision stand. The doctrine of stare decisis is a creation of the common-law system of jurisprudence and is based on the theory that the principle underlying the decision in one case should control decisions in like cases in the same court or in lower courts within the same jurisdiction. *See also* Volume One, Appendix A.

State Coordinate Systems.—The plane rectangular coordinate systems established by the Coast and Geodetic Survey, beginning in 1933, in which the unit of area is, in general, the state, and which are used for defining positions of control stations in terms of plane rectangular (X and Y) coordinates. Each state is covered by one or more zones, over each of which is placed a grid imposed upon a conformal map projection, the relationship between the two being established by mathematical analysis. See *Lambert Conformal Conic Projection, Transverse Mercator Projection.*

State Judiciaries.—The state systems of courts established to settle suits arising under the state constitutions or under the laws enacted by the state legislatures. The arrangement is hierarchical with trial courts at the base, intermediate appellate courts at the middle, and final appellate courts at the top. See *Federal Judiciary.*

State of Hawaii.—Includes all the islands of the Territory of Hawaii except Palmyra Island. See *Territory of Hawaii.*

State Plane Coordinates.—Data defining the locations of horizontal control stations (triangulation and traverse) in terms of State Plane Coordinates include their plane coordinates and the plane or grid azimuth to an azimuth mark. See *State Coordinate Systems.*

State Waters (according to Sixteenth Census).—Waters (coastal and Great Lakes) adjacent to the states (other than inland) which, under rules adopted by the Bureau of the Census, were used in setting the outer limits of the United States for purposes of measuring the area for the Sixteenth Census in 1940 (*see* Table 3).

Stationary Wave Theory.—A theory of tidal phenomena evolved at the beginning of this century, replacing the older progressive wave theory which considered the tide as a single world phenomenon. The new theory substitutes the idea of regional oscillating basins, each with its own natural period, and their responses to the tide-producing forces imposed by the sun and moon, as the origin of the dominant tide in each basin. The resulting tide in the basin will depend on the relation between the natural and the imposed periods. The tide-producing force consists principally of two parts, a semidiurnal force with a period approximating a half day and a diurnal force with a period of a whole day.

Although the tidal movement as a whole is somewhat complicated by the overlapping of oscillating basins, the theory is consistent with observational data. See *Progressive Wave Theory, Tide-Producing Force.*

Station Error.—Same as *Deflection of the Vertical.*

Station Pointer.—Same as *Three-Arm Protractor.*

Statute Mile.—5,280 feet, 1,609.3 meters, or 80 chains. See *Chain.*

Statute of Frauds.—A celebrated English statute, enacted in 1677, and adopted in nearly all of the states, which prohibits any suit being brought on certain classes of contracts or engagements unless there is a note or memorandum in writing signed by the party to be charged or by his authorized agent. See *Parol Testimony.*

Statutory Law.—The enacted law, including written constitutions and treaties. In relation to the common law, statutes may declare or supplement, or they may supersede.

Stereoplanigraph.—An advanced stereoscopic plotting instrument, utilizing full-size diapositives (contact prints from the aerial film onto $\frac{3}{16}$-inch glass plates).

Storm High Water.—The highest level to which the sea rises during a storm and usually marked by a line of debris high up on the beach. Should not be confused with the mean high-water line or with the spring high-water line.

Straight Baselines.—*See* Volume One, Appendix A.

Submarine Relief.—The formation of the sea bottom as developed by depth contours on hydrographic surveys and nautical charts (fig. 74). See *Depth Contours.*

Submarine Valley (also called Seavalley).—*See* Volume One, Appendix A.

Submerged Lands Act.—*See* Volume One, Appendix A.

Submerging Shoreline.—A downwarping of the earth's crust or a raising of sea level.

Summer Solstice.—That instant at which the sun reaches the point of maximum northerly declination, about June 21.

Sunken Rock.—In Coast Survey terminology, a rock covered at the sounding datum that is a potential danger to navigation. For cartographic purposes, it is a rock whose summit is below the lower limit of the zone for a rock awash (fig. 65). See *Rock Awash.*

Superintendent of the Coast Survey.—The title of the directing head of the Survey until changed by the Act of June 5, 1920, to "Director."

Superior Call.—A call higher in the order of precedence for resolving conflicts in land descriptions. A call for a natural monument is superior to a call for a course and distance. See *Call.*

Supplementary Adjustments (Leveling).—Adjustments of elevations of bench marks made after the 1929 General Adjustment, as a result of the rapid expansion of the level net and because of movements of bench marks in some areas, in order to fit the new work to the old. These elevations are characterized as "Standard elevations based on the 1929 General Adjustment through the medium of the _____ Supplementary Adjustment." See *1929 General Adjustment.*

Supra.—Above. The word when used in a book has reference to a previous part of the book—for example, a reference in note 12 to note 6 would be given as "*supra* note 6." See *Infra.*

Supreme Court of the United States.—The highest court of the land, and the court of last resort in the federal and state judiciaries. Its jurisdiction is essentially appellate, but it has irrevocable original jurisdiction in cases affecting ambassadors, public ministers, and consuls, or cases in which a state is a party. See *Original Jurisdiction, Appellate Jurisdiction.*

Survey.—The result of the field operation, as distinguished from map or chart which results from a compilation. See *Hydrographic Survey.*

Surveyed Line.—Refers to the high-water line which the Coast Survey topographer delineated on his planetable survey from the physical appearance of the beach and a knowledge of the tide in an area. See *Line of Mean High Water.*

Survey Index (Photogrammetric).—Printed sheets showing the areas covered, scales, and dates of aerial photographs upon which the surveys are based for photogrammetric surveys. Classification of the surveys (planimetric, shorelines, topographic) is indicated by color. See *Survey Indexes* (Topographic and Hydrographic).

Survey Indexes (Topographic and Hydrographic).—Printed sheets showing the dates, areas covered, and scales of planetable and hydrographic surveys along the Atlantic, Gulf, and Pacific coasts (exclusive of Alaska and Hawaii). See *Survey Index* (Photogrammetric).

Survey of the Coast.—See *Coast and Geodetic Survey.*

Swamp and Overflowed Lands.—Lands that are wet and unfit for cultivation. See *Swamp Lands, Overflowed Lands.*

Swamp Lands.—Lands that require drainage to fit them for cultivation. The term has also been regarded as synonymous with overflowed lands.

Swamp Lands Act.—The Act of Sept. 28, 1850, by which Congress granted to the public-land states then in the Union all the swamp and overflowed lands within the state which the Government owned for the purpose of aiding in reclamation. See *Swamp and Overflowed Lands, Public Land States.*

Symbolization of Aids on Nautical Charts.—The symbols and colors by which buoys and lighted aids to navigation are represented on the charts.

Symbolization on Nautical Charts.—The symbols and abbreviations used for the topographic and hydrographic features on the nautical charts of the Coast Survey—the high-water line, the low-water line, shoal areas, rocks and wrecks, aids to navigation, etc. *See* Appendix F.

Systems of Sounding Lines.—The predetermined lines that the survey vessel is to follow for the best development of the depth contours in an area (*see* fig. 57).

T

Tables for a Polyconic Projection of Maps (Special Publication No. 5, U.S. Coast and Geodetic Survey).—Contain the true lengths in meters of meridional arcs and arcs of the parallels, as they appear on the Clarke spheroid of 1866, for use in the construction of projections, together with the X and Y coordinates for plotting the intersection of parallels and meridians in constructing a polyconic projection. The tables are based on the legal

value of the meter in the United States which is 39.3700 inches and corresponds to 1 meter=3.2808333 feet and 1 foot=0.3048006 meter.

Taking of Private Property.—An important element in the doctrine of eminent domain. Any interference with ownership, enjoyment, or the value of private property is usually considered a "taking" that falls within the fifth amendment. See *Right of Eminent Domain.*

Technical Bulletins, U.S. Coast and Geodetic Survey.—A series of technical papers published at irregular intervals for the dissemination of the results of research and operational studies (in field and office) pertaining to the activities of the Coast Survey. The series was begun in January 1958, superseding The Journal, and as of January 1964, 23 such bulletins had been issued. See *Journal Coast and Geodetic Survey.*

Telegraphic Method.—A method of determining the longitude of a place by the telegraphic exchange of time signals with a station of known longitude. First used by the Coast Survey on Oct. 10, 1846, 2 years after Morse flashed his first telegraphic message. Superseded by the radio method in 1922.

Telemeter Rod.—Part of the planetable equipment for the indirect measurement of distances by means of the telescopic alidade. The rod is graduated so that the number of divisions intercepted between two horizontal wires in the eyepiece of the alidade are equal to the number of units in the distance between the observer and the rod (*see* figs. 40 and 41).

Ten-Mile Rule.—*See* Volume One, Appendix A.

Termini at Headlands.—The points on shore (the low-water mark in the international law of the sea) between which the closing line at indentations is drawn to mark the seaward limits of inland waters. See *Closing Line, Headland-to-Headland Line, Inland Waters.*

Territorial Limits.—The seaward limits of a littoral nation over which it has exclusive jurisdiction. See *Territorial Sea.*

Territorial Sea (also called Marginal Sea, Adjacent Sea, Marine Belt, Maritime Belt, and 3-Mile Limit).—The water area bordering a nation over which it has exclusive jurisdiction, except for the right of innocent passage of foreign vessels. It is a creation of international law, although no agreement has thus far been reached by the international community regarding its width. It extends seaward from the low-water mark along a straight coast and from the seaward limits of inland waters where there are embayments. The United States has traditionally claimed 3 nautical miles as its width and has not recognized the claims of other countries to a wider belt.

Territorial Waters.—Includes the territorial sea (marginal sea) and the inland waters of a country (lakes, rivers, bays, etc.). Sometimes used as synonymous with Territorial Sea.

Territory Northwest of the Ohio River.—The territory bounded on the west by the Mississippi River and a line running north from its source to the international boundary, on the north by the boundary line between the United States and the British possessions, on the east by the Pennsylvania and New York State lines, and on the south by the Ohio River. It was made up of claims of Virginia, Connecticut, and Massachusetts, and comprised an area of approximately 278,000 square miles. From this territory were formed

the States of Ohio, Indiana, Illinois, Michigan, and Wisconsin, that part of Minnesota east of the Mississippi River, and the northwest corner of Pennsylvania.

Territory of Hawaii.—Includes the islands of the Hawaiian Archipelago (except the Midway Islands) and Palmyra Island (fig. 95). See *Hawaiian Archipelago, State of Hawaii.*

Tertiary Triangulation.—See *Triangulation Classification.*

Texas Accession.—Republic of Texas admitted as a State in 1845. Part of this territory was purchased by the United States in 1850, and is now included in the States of Kansas, Colorado, New Mexico, Oklahoma, and Wyoming (*see* fig. 96).

Thalweg.—The "downway," meaning the course taken by boats going downstream in a river. See *Rule of the Thalweg.*

The Genesee Chief v. Fitzhugh (12 How. 443).—An 1851 leading case on navigability in which the Supreme Court overruled its former decisions based on the tidal test of navigability and adopted the test of the actual navigable capacity of a waterway. See *Navigability Test.*

Theodolite.—A precision surveying instrument consisting of an alidade with telescope, mounted on an accurately graduated circle, equipped with necessary levels and reading devices. Sometimes, the alidade carries a graduated vertical circle.

The Trust Territory.—Islands in the Western Pacific (Caroline, Marshall, and Mariana (except Guam)), formerly under Japanese mandate, placed under the administration of the United States through an agreement with the United Nations following World War II.

Thirteen Original Colonies.—See *Thirteen Original States.*

Thirteen Original States.—*See* Volume One, Appendix A.

Three-Arm Protractor (also called Station Pointer).—An instrument (metal or plastic) for plotting sextant fixes in hydrographic surveying (*see* fig. 60). It consists of a graduated circle with a fixed center arm and right and left movable arms pivoted at its center so that the extension of each fiducial edge always passes through the precise center of the graduated circle. The observed left angle is set with the left arm and the right angle with the right arm, and each fiducial edge is made to pass through the corresponding control station on the survey sheet. The center of the protractor marks the position of the survey boat. See *Three-Point Fix Method.*

Three-Mile Limit.—See *Territorial Sea.*

Three-Point Fix Method.—One of the principal methods used on inshore hydrographic surveys for establishing the position of the survey boat. It involves the measurement with sextants of two angles between three known stations, the middle station being common to both angles, and plotting the boat's position graphically with a three-arm protractor. See *Three-Point Problem, Sextant, Three-Arm Protractor.*

Three-Point Problem.—The determination of the horizontal position of a point of observation from the known positions of three other points. In planetable surveying, the position of the planetable is determined by a graphic solution of the three-point problem. See *Orientation of Planetable.*

Tidal Bench Mark.—See *Bench Mark* (Tidal).

Tidal Bench-Mark Data.—Compilations published separately for each tide station in loose leaf form. These data include descriptions of all bench marks and their elevations above the basic hydrographic datum for the area, the date and length of the tidal series on which the bench-mark elevations are based, and a table showing the relation between the basic datum and other tidal datums in use—mean higher high water, mean high water, half-tide level, mean low water, and mean lower low water. In addition, heights of observed or estimated highest and lowest water levels in relation to the basic datum are included with their dates of occurrence.

Tidal Boundary.—A boundary of land determined by the course of the tide and tied in with a specific phase of the tide—for example, mean high water. See *Mean High-Water Line, Mean Low-Water Line.*

Tidal Characteristics.—Primarily refers to the type of tide in a locality, that is, whether it is diurnal, semidiurnal, or mixed, for purposes of reducing short-period observations to mean values. In considering the characteristics at a particular place, they would include the range and the time. See *Type of Tide, Range of Tide.*

Tidal Corrections.—Corrections given in the *Tide Tables* which the mariner uses in conjunction with the nautical chart to determine the depth of water at a specified time and place. See *Tide Reducer.*

Tidal Current Charts.—Publications consisting of a set of 12 charts for each waterway which depict the direction and velocity of the current for each hour of the tidal cycle. Eight waterways are presently covered by these publications.

Tidal Current Tables.—Tables issued annually in advance of the year for which they are prepared, and give daily predictions of the times of slack water and the times and velocities of the strength of flood and ebb currents for a number of waterways, together with differences for obtaining predictions at numerous other places.

Tidal Datums.—Vertical datums defined by a phase of the tide—for example, high water—and used as a reference plane for heights on land and depths in the sea, and in the demarcation of waterfront boundaries. The Coast and Geodetic Survey level net is based on the datum of mean sea level, but in its hydrographic work, including soundings on charts and tidal predictions, a low-water datum is used—mean low water for the Atlantic and Gulf coasts and mean lower low water for the Pacific coast. For defining tidal boundaries, mean high water and mean low water are used. See *Mean Sea Level.*

Tidal Difference.—Difference in time or height of a high or low water at a subordinate station and at a reference station for which predictions are given in the *Tide Tables.* The difference applied according to sign to the prediction at the reference station gives the corresponding time or height for the subordinate station. See *Tide Tables.*

Tidal Planes.—See *Tidal Datums.*

Tidal Shoreline of United States (Detailed).—Determined by using a recording measure on the largest scale maps and charts available. Shoreline of bays, sounds, and other bodies of water are included to the head of tidewater, or to a point where such waters narrow to a width of 100 feet. Both shores of a stream are measured if over 200 yards wide, but streams between 30 yards and 200 yards in width are measured as a single line through the middle of the stream. (*See* Table 4.)

Tidal Shoreline of United States (General).—Determined by using a unit measure of 3 statute miles on charts of 1 : 200,000 and 1 : 400,000 scale when available. The shoreline of islands is included, and of bays, sounds, and other bodies of water to a point where the waters narrow to a width of 3 statute miles, the distance across at such points being included. (*See* Table 4.)

Tidal Test.—A test of navigability based upon the presence of tidal influence in a waterway. First enunciated by Chancellor Kent, of the New York Supreme Court, who ruled in the early case of *Palmer* v. *Mulligan,* 3 Caines 307 (1805), that according to the common law of England only tidal streams were navigable waterways. See *Navigability* (English Doctrine), *Navigability Test.*

Tide.—The periodic rising and falling of the waters of the earth that result mainly from the gravitational attraction of the moon and sun acting upon the rotating earth. See *Tide-Producing Force.*

Tidelands.—The land that is covered and uncovered by the daily rise and fall of the tide. More specifically, it is the zone between the mean high-water line and the mean low-water line along a coast, and is commonly known as the "shore" or "beach." Referred to in legal decisions as between ordinary high-water mark and ordinary low-water mark. Tidelands presuppose a high-water line as the upper boundary. See *Ordinary Tides, Borax Consolidated, Ltd.* v. *Los Angeles.*

Tide Notes.—Notes included on the nautical charts which give information on the mean range or the diurnal range of the tide, mean tide level, and extreme low water at key places on the chart (*see* figs. 78 and 79). Formerly, the notes also furnished information for tide predicting purposes when used in conjunction with the Nautical Almanac. See *Extreme Low Water.*

Tide Predicting Machine No. 2.—An instrument designed in the Coast and Geodetic Survey for tide prediction by mechanically summing the harmonic constituents of which the tide is composed (*see* fig. 22). The machine was put in operation in 1912. See *Ferrel Tide Predicting Machine.*

Tide Prediction.—The mathematical process by which the times and heights of the tide are determined in advance from the harmonic constituents at a place. See *Harmonic Analysis, Harmonic Constituent.*

Tide-Producing Force.—That part of the gravitational attraction of a heavenly body which is effective in producing the tides on earth. The sun and moon are the principal astronomic bodies that have a tide-producing effect. The force varies approximately as the mass of the attracting body and inversely as the cube of its distance. The tide-producing force exerted by the sun is a little less than one-half that of the moon. See *Tide.*

Tide Reducer.—The correction that must be applied to a recorded sounding for the height of the tide above or below the plane of reference at the time of sounding. See *Plane of Reference.*

Tide Roll.—A roll of plain paper used with a standard automatic gage for recording the rise and fall of the tide. Each roll generally contains the record for a calendar month.

Tide Staff.—A tide gage consisting of a vertical graduated staff from which the height of the tide can be read directly. See *Automatic Tide Gage.*

Tide Tables.—Tables which give the predicted times and heights of high and low water for every day in the year for a number of reference stations, and tidal differences and constants by which additional predictions can be obtained for numerous other places. From these values it is possible to interpolate by a simple procedure the height of the tide at any hour of the day (*see* fig. 21). The coasts of the United States are covered in two volumes: East Coast, North and South America; and West Coast, North and South America. See *Tide Prediction, Tidal Difference, One-Quarter One-Tenth Rule.*

Tidewaters.—Waters subject to the rise and fall of the tide. Sometimes used synonymously with tidelands, but would be better to limit tidewaters to areas always covered with water. The amount of tide is immaterial. See *Tidelands.*

Tier Lines.—True parallels 6 miles apart which join corners on the principal meridian, guide meridians, and range lines (fig. 97). See *Township.*

Tinted Areas.—Those areas on the nautical chart that are symbolized by a flat color to indicate the nature of the area, such as buff for the land area, blue for the water area considered to be within the danger curve for a particular chart, and yellow-green for marsh areas and for low-water areas. See *Low-Water Area.*

Topographical Conference of 1892.—A conference convened in the Coast Survey for studying the state of the science and art of topography and looking toward improvement and standardization of the methods of survey and representation of the results. The conference adopted a set of conventional symbols, cancelling or modifying previous ones and adding some new ones (*see* figs. 51 and 52).

Topographic Survey (Coast and Geodetic Survey).—A record of a survey, *of a given date,* of the natural features and the culture of a portion of the land surface and their delineation by means of conventional symbols. As used in this publication, it is the *original field survey sheet* and is the authority for the high-water line and all information inshore of that line including geographic names of topographic features (fig. 44). See *Photogrammetric Survey, Registry Numbers.*

Tort.—A private or civil wrong or injury independent of contract. See *Federal Tort Claims Act, Maritime Tort.*

Township.—The unit of survey in the rectangular system, normally a quadrangle approximately 6 miles on a side with boundaries conforming to meridians and parallels, located with reference to the initial point of a principal meridian and base line. Townships are numbered consecutively as Township 1 North (T1N), Township 1 South (T1S), etc., north and south of the base line, and east and west of the principal meridian as Range 1 West (R1W), Range 1 East (R1E), etc., to the limit of the system controlled by an initial point. (*See* fig. 97.)

Township Plats.—Plats prepared by the Bureau of Land Management of the Department of the Interior showing the results of the public land surveys. Plats are generally drawn to a scale of 1 : 31,680, but scales of 1 : 15,840, or larger, may be used. The sheet size is always 19 by 24 inches, regardless of the scale.

Tracing-Paper Method.—A method of transferring one survey to another where small differences in scale exist due to distortion.

Transcontinental Arc of Triangulation.—The arc of triangulation along the 39th parallel that was completed in 1899 and which connected the various detached systems

into one continuous triangulation. Its completion laid the foundation for establishing a single geographic datum for the whole country. See *Independent Datum, United States Standard Datum.*

Transformation.—In photogrammetry, the special process of rectifying the oblique images from a multiple-lens camera to equivalent vertical images by projection into a plane perpendicular to the camera axis. See *Rectification.*

Transverse Mercator Projection.—A conformal map projection in which the normal Mercator projection is rotated (transversed) 90° in azimuth, the central meridian corresponding to the line which represents the equator on the normal Mercator. The characteristics as to scale are identical to those of the normal Mercator, except that the scale is dependent on distances east or west of the meridian instead of north or south of the equator. The projection is used as the base for the State Coordinate Systems for states whose greatest extent is in a north-south direction. See *State Coordinate Systems, Mercator Projection.*

Treaty of 1818.—*See* Volume One, Appendix A.

Treaty of Guadalupe Hidalgo.—The peace treaty signed Feb. 2, 1848, at the close of the Mexican War, and proclaimed July 4, 1848. See *Mexican Cession.*

Treaty of Paris.—See *Treaty of Sept. 3, 1783.*

Treaty of Sept. 3, 1783 (also called Treaty of Paris).—The treaty by which Great Britain recognized the independence of the United States.

Triangulation.—A method of surveying in which the stations are points on the ground at the vertices of a chain or network of triangles, whose angles are observed instrumentally and whose sides are derived by computation from selected triangle sides called base lines, the lengths of which are obtained from direct measurement on the ground. See *Trilateration, Basic Geodetic Networks of the Country.*

Triangulation Classification.—First-order, second-order, and third-order triangulation, according to the closure of the triangles. In first-order work, the average closure (variation from 180°) is not in excess of 1 second; in second-order work it does not exceed 3 seconds; and in third-order it does not exceed 5 seconds. For the basic first-order work, the computed length through the network must agree with the measured base within 1 part in 50,000, as a minimum, and averages about 1 in 75,000, or better. First-, second-, and third-order triangulation were prior to 1921 called primary, secondary, and tertiary triangulation, respectively.

Triangulation Mark.—A bronze disk set in the ground to identify a point whose latitude and longitude have been determined by triangulation. See *Triangulation.*

Tributary Waterway.—Any body of water that flows into a larger body—a creek in relation to a river, a river in relation to a bay, a bay in relation to the open sea (*see* fig. 92).

Trilateration.—A method of extending horizontal control where the sides of triangles are measured rather than the angles as in triangulation. See *Triangulation.*

Tripartite System.—A system in which the exercise of legislative, executive, and judicial powers are vested in separate and independent branches. A characteristic of the federal and state governments.

Tropic Tides.—Tides occurring semimonthly when the effect of the moon's maximum declination is greatest. At these times there is a tendency for an increase in the diurnal range.

True Bay.—*See* Volume One, Appendix A.

True Bearings.—Those related to the true meridian. See *True Meridian.*

True Meridian.—The line that passes through a given place and the geographical poles; the observer's plane that passes through the earth's axis of rotation. See *Magnetic Meridian.*

True North.—Geographic or astronomic north; coincides with the true meridian. See *Due North.*

"T" Sheets.—See *Registry Numbers.*

Twenty-Four-Mile Rule.—The rule adopted by the First Geneva Conference in 1958 as the closing line for bays in place of the former Ten-Mile Rule. See *Ten-Mile Rule, Closing Line.*

Twenty-Four-Mile Tracts.—The largest unit in the rectangular system of surveys. Each area, controlled by a principal meridian and a base line, is divided into tracts by means of standard parallels or correction lines (true parallels of latitude) located at intervals of 24 miles to the north and south of the base line and by means of guide meridians (true meridians) spaced at intervals of 24 miles east and west of the principal meridian. Because of the convergence of the meridians, the distance between the guide meridians is 24 miles only at the starting points; at all other points, the distance is less by the amount of the convergence. (*See* fig. 97.)

Type of Tide.—The characteristic form of the tide, with special reference to the relation of the diurnal and semidiurnal waves. Tides are usually classified as diurnal, semidiurnal, and mixed, but there are no sharply defined limits separating the groups.

U

Unalaska Datum.—An independent datum in Alaska used along the south coast of the Alaska Peninsula from Cape Kuyuyukak to Umnak Island.

Unilateral Action.—*See* Volume One, Appendix A.

Unincorporated Territory.—A territory where there is no general applicability of the Constitution with respect to the civil and private rights of the inhabitants, and where Congress, in legislating for such territory, is bound by but few of the limitations which apply in the case of incorporated territories. See *Incorporated Territory.*

United Nations Conferences on the Law of the Sea.—*See* Volume One, Appendix A.

United States.—Includes continental United States plus Hawaii. See *Continental United States.*

United States Board on Geographic Names.—Created by President Harrison on Sept. 4, 1890, for the purpose of standardizing usage in regard to geographic nomenclature in the executive departments of the Government, particularly on the maps and charts issued by the various agencies. See *United States Geographic Board.*

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United States–Canadian Boundary.—Held to be a fixed boundary because the Treaty of Apr. 11, 1908, between the United States and Great Britain contained the following statement: "The line so defined and laid down shall be taken and deemed to be the international boundary." See *Fixed Riparian Boundary.*

United States Geographic Board.—Established on Aug. 10, 1906, by President Roosevelt as an enlargement of the duties of the United States Board on Geographic Names to include advisory powers concerning, among other things, the unification of symbols and conventions used on maps. See *United States Board on Geographic Names.*

United States Reports.—The official reports of the decisions of the Supreme Court and are printed by the Government. Prior to 1882, the volumes of these reports were designated by the name of the official reporter and a number. Later a serial number was added which carries through to the present time.

United States–Russian Convention Line.—A charted line of allocation in the Bering Sea and Bering Strait marking the western limit of the territories ceded to the United States by Russia under the convention of Mar. 30, 1867. See *Lines of Allocation.*

United States Standard Datum.—The first standard geographic (geodetic) datum adopted by the Coast and Geodetic Survey for all the triangulation in the United States. It was adopted on Mar. 13, 1901, and is defined by station *Meades Ranch,* whose position on the Clarke spheroid of 1866 is: Latitude 39°13′26″.686, longitude 98°32′30″.506, and azimuth to station *Waldo* 75°28′14″.52. See *Transcontinental Arc of Triangulation, North American 1927 Datum.*

United States v. Alaska (Civil Action No. A–51–63).—A case pending in Mar. 1964 in the District Court of Alaska for the purpose of confirming title of the United States to certain submerged lands in Yakutat Bay.

United States v. Appalachian Electric Power Co. (311 U.S. 377).—A 1940 case which reaffirmed the doctrine of *The Daniel Ball* v. *United States,* 10 Wall. 557 (1871), but extended the legal concept of navigability to include waterways that may be made available for navigation through future reasonable improvements. See *Legal Concept of Navigability.*

United States v. California (332 U.S. 19).—*See* Volume One, Appendix A.

United States v. Causby (328 U.S. 256).—A 1946 case in which the Supreme Court rejected the *ad coelum* doctrine of unlimited ownership of the airspace above a landowner's property as having no place in the modern air age. However, if the flights of government aircraft are so low and so frequent as to be a direct and immediate interference with the enjoyment and use of the land, then there is a "taking of private property" under the fifth amendment for which there must be compensation. See *Taking of Private Property.*

United States v. Louisiana et al. (363 U.S. 1).—*See* Volume One, Appendix A.

United States v. Muniz and Winston (374 U.S. 150).—A 1963 case and the most recent pronouncement by the Supreme Court on the scope and construction of the Federal Tort Claims Act. By a unanimous vote, the Court refused to read into the act an implied exception which would have barred federal prisoners from recovery for the negligent conduct of prison employees.

United States v. Newark Meadows Improvement Co. (173 Fed. 426).—A 1909 case which held that the lines established by the U.S. Coast Guard to separate the areas where the Inland Rules of the Road apply from those where the International Rules apply have no application other than the purpose of determining what rules of navigation are to be followed. They do not define the limits of inland waters. See *Inland Rules of the Road, International Rules of the Road, Act of Feb. 19, 1895.*

Unrecoverable Station.—A triangulation station that cannot be found and cannot be included in the triangulation to connect it with a new datum. Sometimes referred to as a "lost" station.

Upland.—Land above mean high-water mark and subject to private ownership, as distinguished from tidelands, the ownership of which is prima facie in the state but also subject to divestment under state statutes. See *Tidelands.*

V

Valdez Datum.—An independent datum used in Alaska for the work on the south coast of Alaska from Controller Bay in the vicinity of Cape St. Elias to Wide Bay on the Alaska Peninsula, and for the triangulation around Kodiak Island.

Variation.—See *Magnetic Declination.*

Velocity of Sound in Sea Water.—A function of the temperature, salinity, and depth of the water through which the sound wave passes. See *Echo Sounding.*

Verification.—The process by which the hydrographic survey undergoes in effect a complete check of the field observations and of the accuracy of the smooth plotting. It deals primarily with a specific survey and its accompanying records, and with correlating it to other contemporary surveys—the hydrographic surveys which adjoin it, and the contemporary planetable or photogrammetric survey. See *Review.*

Vertical Control.—See *Leveling.*

W

Waterfront Boundaries.—See *Riparian Boundaries.*

Water Leveling.—A method of obtaining relative elevations by observing heights with respect to the surface of a body of still water, such as a lake. The relative elevations of objects along its shores are obtained by taking the differences of their heights with respect to the surface of the water.

Western Adjustment.—The unified adjustment made in 1927 of the triangulation west of the 98th meridian. See *North American 1927 Datum.*

Wharf.—An artificial landing place for the purpose of loading or unloading goods. It may be built out from the upland and form an extension thereof or it may be made on the land at the water's edge. See *Dock, Pier.*

Wharfing Out.—The right to construct and maintain a wharf, dock, or pier from riparian land to the navigable portion of adjoining waters, subject to the general rules

imposed by the legislature. The right of access includes the right to wharf out to deep water. See *Right of Access.*

Wire Drag.—An apparatus, developed in the Coast and Geodetic Survey, for surveying rocky areas where the normal sounding methods are insufficient to ensure the discovery of all existing obstructions, pinnacle rocks, etc. The drag consists of a horizontal wire which is towed through the water and which will catch on any obstruction rising above the depth at which it is set.

Wire-Dragged Areas.—Areas in Alaska that have been covered to a safe depth with the wire drag, but which have not been adequately sounded. Symbolized on the nautical charts by a bright green tint. See *Wire Drag.*

Witness Monument.—A marked point established on firm ground at a measured distance and direction from a boundary line which may be so situated that it cannot be permanently marked. The Maryland-Virginia boundary line which followed the low-water mark on the Virginia side of the Potomac River was demarcated by establishing 58 boundary witness monuments above the high-water line and their geographic positions determined, points on the low-water line (the boundary) being determined by measured distances and directions.

Wrecks.—Charted wrecks are of two kinds: *Stranded wreck,* where any portion of the hull is above the chart datum; and *sunken wreck,* where the hull is below the chart datum or where the masts only are visible. For symbolization, *see* fig. 81.

Writ of Error.—A writ or order issued from a court of appellate jurisdiction directing the judge or judges of a court of record to send to the appellate court the record of an action in which a final judgment has been entered, in order that examination may be made of certain errors alleged to have been committed, and that judgment may be reversed, corrected, or affirmed. See *Certiorari.*

Writ of Mandamus.—An order issued from a court of competent jurisdiction directing the performance of a particular act.

Y

Yard.—A fundamental unit of length in the English system of measurement. The metric equivalent prior to July 1, 1959, was 1 yard=0.91440183 meter. On that date the value was changed to 1 yard=0.9144 meter. This change will not apply to any data expressed in feet derived from and published as a result of geodetic surveys within the United States until such time as the basic geodetic survey networks are readjusted. See *Nautical Mile.*

Youth, Maturity, Old Age (Shore Development).—Stages in the development of a shoreline.

Yukon Datum.—An independent datum used for the triangulation along the 141st meridian, the boundary between Canada and Alaska, and covers the area from Mount St. Elias to the Arctic Ocean. It is based on one astronomic station near the crossing of the 141st meridian and the Yukon River. The Yukon Datum will remain the official datum for treaty purposes for the 141st meridian work, even though the connection to the North American 1927 Datum changed the geographic positions of the boundary monuments.

Z

"Zero" Soundings.—Soundings that reduce to heights above the sounding datum but are shown on the smooth sheet as zero soundings, regardless of height—a practice followed prior to 1860. See *"Minus" Soundings.*

Zone (State Coordinate Systems).—The unit into which states are divided in the State Coordinate Systems in order to avoid too great an error being introduced when passing from geographic to plane coordinates. A new origin is used for each zone. To maintain an accuracy of 1 part in 10,000, a single zone may not exceed 158 miles in a north-south direction on the Lambert projection and in an east-west direction on the transverse Mercator before a new origin is required. See *State Coordinate Systems.*

APPENDIX B

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(In the following bibliography, books and journals are identified by capitals and small capitals, and articles are identified by italics. This follows the form used in the text.)

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APPENDIX C

Selected Statutes Pertaining to the Coast and Geodetic Survey

Act of February 10, 1807 (2 Stat. 413).

AN ACT

To provide for surveying the coasts of the United States.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the President of the United States shall be, and he is hereby authorized and requested, to cause a survey to be taken of the coasts of the United States, in which shall be designated the islands and shoals, with the roads or places of anchorage, within twenty leagues of any part of the shores of the United States; and also the respective courses and distances between the principal capes, or head lands, together with such other matters as he may deem proper for completing an accurate chart of every part of the coasts within the extent aforesaid.

SEC. 2. *And be it further enacted,* That it shall be lawful for the President of the United States to cause such examinations and observations to be made, with respect to St. George's bank, and any other bank or shoal and the soundings and currents beyond the distance aforesaid to the Gulf Stream, as in his opinion may be especially subservient to the commercial interests of the United States.

SEC. 3. *And be it further enacted,* That the President of the United States shall be, and he is hereby authorized and requested, for any of the purposes aforesaid, to cause proper and intelligent persons to be employed, and also such of the public vessels in actual service, as he may judge expedient, and to give such instructions for regulating their conduct as to him may appear proper, according to the tenor of this act.

SEC. 4. *And be it further enacted,* That for carrying this act into effect there shall be, and hereby is appropriated, a sum not exceeding fifty thousand dollars, to be paid out of any monies in the treasury, not otherwise appropriated.

APPROVED, *February 10, 1807.*

Act of July 10, 1832 (4 Stat. 570).

AN ACT

To carry into effect the act to provide for a survey of the coast of the United States [Act of February 10, 1807].

Be it enacted by the Senate and House of Representatives of the United States of America, in Congress assembled, That for carrying into effect the act, entitled "An act to provide for surveying the coasts of the United States," approved on the tenth day of February, one thousand eight hundred and seven, there shall be, and hereby is, appropriated, a sum not exceeding twenty thousand dollars, to be paid out of any money in the treasury not otherwise appropriated; and the said act is hereby revived, and shall be deemed to provide for the survey of the coasts of Florida, in the same manner as if the same had been named therein.

SEC. 2. *And be it further enacted,* That the President of the United States be, and he is hereby authorized, in and about the execution of the said act, to use all maps, charts, books, instruments, and apparatus, which now, or hereafter may belong to the United States, and employ all persons in the land or naval service of the United States, and such astronomers and other persons as he shall deem proper: *Provided,* That nothing in this act, or the act hereby revived, shall be construed to authorize the construction or maintenance of a permanent astronomical observatory.

APPROVED, *July 10, 1832.*

Act of March 3, 1843 (5 Stat. 630, 640).

AN ACT

Making appropriations for the civil and diplomatic expenses of Government for the fiscal year ending the thirtieth day of June, eighteen hundred and forty-four.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the following sums be, and hereby are, appropriated to the objects hereinafter expressed, for the fiscal year ending on the thirtieth of June, one thousand eight hundred and forty four, to be paid out of any unappropriated money in the treasury, namely:

* * * * * * *

For survey of the coast of the United States, including compensation of superintendent and assistants, one hundred thousand dollars: *Provided,* That this, and all other appropriations hereafter to be made for this work, shall, until otherwise provided by law, be expended in accordance with a plan of reorganizing the mode of executing the survey, to be submitted to the President of the United States by a board of officers which shall be organized by him, to consist of the present superintendent, his two principal assistants, and the two naval officers now in charge of the hydrographical parties, and four from among the principal officers of the corps of topographical engineers; none of whom shall receive any additional

compensation whatever for this service, and who shall sit as soon as organized. And the President of the United States shall adopt and carry into effect the plan of said board, as agreed upon by a majority of its members; and the plan of said board shall cause to be employed as many officers of the army and navy of the United States as will be compatible with the successful prosecution of the work; the officers of the navy to be employed on the hydrographical parts, and the officers of the army on the topographical parts of the work; and no officer of the army or navy shall hereafter receive any extra pay out of this, or any future appropriations for surveys.

* * * * * * *

APPROVED, *March 3, 1843.*

Act of June 3, 1844 (5 Stat. 660).

AN ACT

Directing a disposition of maps and charts of the Survey of the Coast.

Be it it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Secretary of the Treasury be, and he is hereby, authorized to dispose of the maps and charts of the survey of the coast of the United States at such prices and under such regulations as may from time to time be fixed by the said Secretary; and that a number of copies of each sheet, not to exceed three hundred, be presented to such foreign governments, and departments of our own government, and literary and scientific associations as the Secretary of the Treasury may direct.

APPROVED, *June 3, 1844.*

Act of March 3, 1871 (16 Stat. 495, 508).

AN ACT

Making Appropriations for sundry civil Expenses of the Government for the fiscal Year ending June thirty, eighteen hundred and seventy-two, and for other Purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the following sums be, and the same are hereby, appropriated, for the objects hereinafter expressed, for the fiscal year ending the thirtieth June, eighteen hundred and seventy-two viz.:—

* * * * * * *

For extending the triangulation of the coast survey so as to form a geodetic connection between the Atlantic and Pacific coasts of the United States, including compensation of

civilians engaged in the work, fifteen thousand dollars: *Provided,* That the triangulation shall determine points in each State of the Union which shall make requisite provisions for its own topographical and geological surveys.

* * * * * * *

APPROVED *March 3, 1871.*

Act of June 20, 1878 (20 Stat. 206, 215).

AN ACT

Making appropriations for sundry civil expenses of the government for the fiscal year ending June thirtieth, eighteen hundred and seventy-nine, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the following sums be, and the same are hereby, appropriated for the objects hereinafter expressed for the fiscal year ending June thirtieth, eighteen hundred and seventy-nine, namely:

* * * * * * *

COAST AND GEODETIC SURVEY

Survey of the Atlantic and Gulf coasts: For every purpose and object necessary for and incident to the continuation of the survey of the Atlantic and Gulf coasts of the United States, the Mississippi, and other rivers, to the head of ship-navigation or tidal influence; soundings, deep-sea temperatures, dredgings, and current-observations along the above-named coasts, and in the Gulf of Mexico and the Gulf Stream, including its entrance into the Gulf of Mexico and east end of the Carribean Sea; the triangulation toward the Western coast and furnishing points for State surveys; the preparation and publication of charts, the Coast Pilot, and other results of the work, with the purchase of materials therefor, including compensation of civilians engaged in the work, three hundred thousand dollars.

Survey of the Western (Pacific) coasts: For every purpose and object necessary for and incident to the continuation of the survey of the Pacific coasts of the United States, including the resurvey of San Pablo Bay and Suisun Bay, California, the Columbia and other rivers, to the head of ship-navigation or tidal influence; soundings, deep-sea temperatures, dredgings, and current-observations along and in the branch of the Japan Stream flowing off the above-named coasts, with observations of other currents along the same coasts; the triangulation toward the eastern coast, and furnishing points for State surveys; the preparation and publication of charts, the Coast Pilot, and other results of the work, with the purchase of materials therefor, including compensation of civilians engaged in the work, one hundred and eighty thousand dollars.

* * * * * * *

APPROVED *June 20, 1878.*

Act of May 22, 1917 (40 Stat. 84, 87).

AN ACT

To temporarily increase the commissioned and warrant and enlisted strength of the Navy and Marine Corps, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the authorized enlisted strength of the active list of the Navy is hereby temporarily increased from eighty-seven thousand to one hundred and fifty thousand, including four thousand additional apprentice seamen.

* * * * * * *

SEC. 16. That the President is hereby authorized, whenever in his judgment a sufficient national emergency exists, to transfer to the service and jurisdiction of the War Department, or of the Navy Department, such vessels, equipment, stations, and personnel of the Coast and Geodetic Survey as he may deem to the best interest of the country, and after such transfer all expenses connected therewith shall be defrayed out of the appropriations for the department to which transfer is made: *Provided,* That such vessels, equipment, stations, and personnel shall be returned to the Coast and Geodetic Survey when such national emergency ceases, in the opinion of the President, and nothing in this Act shall be construed as transferring the Coast and Geodetic Survey or any of its functions from the Department of Commerce except in time of national emergency and to the extent herein provided: *Provided further,* That any of the personnel of the Coast and Geodetic Survey who may be transferred as herein provided shall, while under the jurisdiction of the War Department or Navy Department, have proper military status and shall be subject to the laws, regulations, and orders for the government of the Army or Navy, as the case may be, in so far as the same may be applicable to persons whose retention permanently in the military service of the United States is not contemplated by law: *And provided further,* That the President is authorized to appoint, by and with the advice and consent of the Senate, the field officers of the Coast and Geodetic Survey, who are now officially designated assistants and aids, as follows: Officers now designated assistants and receiving a salary of $2,000 or more per annum shall be appointed hydrographic and geodetic engineers; officers now designated assistants and receiving a salary of $1,200 or greater but less than $2,000 per annum shall be appointed junior hydrographic and geodetic engineers; officers now designated aids shall be appointed aids: *Provided,* That no person shall be appointed aid or shall be promoted from aid to junior hydrographic and geodetic engineer or from junior hydrographic and geodetic engineer to hydrographic and geodetic engineer until after passing a satisfactory mental and physical examination conducted in accordance with regulations prescribed by the Secretary of Commerce, except that the President is authorized to nominate for confirmation the assistants and aids in the service on the date of the passage of this Act.

Nothing in this Act shall reduce the total amount of pay and allowances they were receiving at the time of transfer. While actually employed in active service under direct orders of the War Department or of the Navy Department members of the Coast and Geodetic Survey shall receive the benefit of all provisions of laws relating to disability incurred in line of duty or loss of life.

When serving with the Army or Navy the relative rank shall be as follows:

Hydrographic and geodetic engineers receiving $4,000 or more shall rank with and after colonels in the Army and captains in the Navy.

Hydrographic and geodetic engineers receiving $3,000 or more but less than $4,000 shall rank with and after lieutenant colonels in the Army and commanders in the Navy.

Hydrographic and geodetic engineers receiving $2,500 or more but less than $3,000 shall rank with and after majors in the Army and lieutenant commanders in the Navy.

Hydrographic and geodetic engineers receiving $2,000 or more but less than $2,500 shall rank with and after captains in the Army and lieutenants in the Navy.

Junior hydrographic and geodetic engineers shall rank with and after first lieutenants in the Army and lieutenants (junior grade) in the Navy.

Aids shall rank with and after second lieutenants in the Army and ensigns in the Navy.

And nothing in this Act shall be construed to affect or alter their rates of pay and allowances when not assigned to military duty as hereinbefore mentioned.

The Secretary of War, the Secretary of the Navy, and the Secretary of Commerce shall jointly prescribe regulations governing the duties to be performed by the Coast and Geodetic Survey in time of war, and for the cooperation of that service with the War and Navy Departments in time of peace in preparation for its duties in war, which regulations shall not be effective unless approved by each of the said Secretaries, and included therein may be rules and regulations for making reports and communications between the officers or bureaus of the War and Navy Departments and the Coast and Geodetic Survey.

* * * * * * *

APPROVED, *May 22, 1917.*

Act of August 6, 1947 (61 Stat. 787).

AN ACT

To define the functions and duties of the Coast and Geodetic Survey, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That, to provide charts and related information for the safe navigation of marine and air commerce, and to provide basic data for engineering and scientific purposes and for other commercial and industrial needs, the Director of the Coast and Geodetic Survey, hereinafter referred to as the Director, under direction of the Secretary of Commerce, is authorized to conduct the following activities in the United States, its Territories, and possessions:

(1) Hydrographic and topographic surveys of coastal water and land areas (including surveys of offlying islands, banks, shoals, and other offshore areas);

(2) Hydrographic and topographic surveys of lakes, rivers, reservoirs, and other inland waters not otherwise provided for by statute;

(3) Tide and current observations;

(4) Geodetic-control surveys;

(5) Field surveys for aeronautical charts;

(6) Geomagnetic, seismological, gravity, and related geophysical measurements and investigations, and observations for the determination of variation in latitude and longitude.

SEC. 2. In order that full public benefit may be derived from the operations of the Coast and Geodetic Survey by the dissemination of data resulting from the activities herein authorized and of related data from other sources, the Director is authorized to conduct the following activities:

(1) Analysis and prediction of tide and current data;

(2) Processing and publication of data, information, compilations, and reports;

(3) Compilation and printing of aeronautical charts of the United States, its Territories, and possessions; and, in addition, the compilation and printing of such aeronautical charts covering international airways as are required primarily by United States civil aviation;

(4) Compilation and printing of nautical charts of the United States, its Territories, and possessions;

(5) Distribution of aeronautical charts and related navigational publications required by United States civil aviation;

(6) Distribution of nautical charts and related navigational publications for the United States, its Territories, and possessions.

SEC. 3. To provide for the orderly collection of geomagnetic data from domestic and foreign sources, and to assure that such data shall be readily available to Government and private agencies and individuals, the Coast and Geodetic Survey is hereby designated as the central depository of the United States Government for geomagnetic data, and the Director is authorized to collect, correlate, and disseminate such data.

SEC. 4. To improve the efficiency of the Coast and Geodetic Survey and to increase engineering and scientific knowledge, the Director is authorized to conduct developmental work for the improvement of surveying and cartographic methods, instruments, and equipments; and to conduct investigations and research in geophysical sciences (including geodesy, oceanography, seismology, and geomagnetism).

SEC. 5, The Director is authorized to enter into cooperative agreements with, and to receive and expend funds made available by, any State or subdivision thereof, or any public or private organization, or individual, for surveys or investigations authorized herein, or for performing related surveying and mapping activities, including special-purpose maps, and for the preparation and publication of the results thereof.

SEC. 6. The Director is authorized to contract with qualified organizations for the performance of any part of the authorized functions of the Coast and Geodetic Survey when he deems such procedure to be in the public interests.

SEC. 7. The Secretary of Commerce is hereby authorized to accept and utilize gifts or bequests of money and other real or personal property for the purpose of aiding or facilitating the work of the Coast and Geodetic Survey and such gifts and bequests and the income therefrom shall be exempt from Federal taxes.

SEC. 8. The President is authorized to cause to be employed such of the public vessels as he deems it expedient to employ, and to give such instructions for regulating their conduct as he deems proper in order to carry out the provisions of this Act.

SEC. 9. There are hereby authorized to be appropriated such funds as may be necessary to acquire, construct, maintain, and operate ships, stations, equipment, and facilities and

for such other expenditures, including personal services at the seat of government and elsewhere and including the erection of temporary observatory buildings and lease of sites therefor, as may be necessary for the conduct of the activities herein authorized.

SEC. 10. The following statutes are hereby repealed:

(1) The Act of January 31, 1925 (ch. 121, 43 Stat. 802; 33 U.S.C. 866).

(2) Section 4681 of the Revised Statutes (33 U.S.C. 881).

(3) Section 4682 of the Revised Statutes (33 U.S.C. 882).

(4) Section 4683 of the Revised Statutes (33 U.S.C. 883).

(5) Section 4684 of the Revised Statutes (33 U.S.C. 883).

(6) Section 4686 of the Revised Statutes (33 U.S.C. 885).

APPROVED *August 6, 1947.*

Act of April 5, 1960 (74 Stat. 16).

AN ACT

To remove geographical limitations on activities of the Coast and Geodetic Survey, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the first section of the Act entitled "An Act to define the functions and duties of the Coast and Geodetic Survey, and for other purposes", approved August 6, 1947 (33 U.S.C., sec. 883a), is amended—

(1) by striking out "in the United States, its Territories, and possessions";

(2) by striking out "of coastal water and land areas (including survey of offlying islands, banks, shoals, and other offshore areas)"; and

(3) by striking out all of paragraph (2), and by renumbering paragraphs (3), (4), (5), and (6) as (2), (3), (4), and (5) respectively.

APPROVED *April 5, 1960.*

APPENDIX D

Selected Cases Dealing With Tidal Boundaries

(*The following three cases were selected for inclusion in this Appendix because of their impact on the law of tidal boundaries in this country: The first,* Attorney-General *v.* Chambers, *is a leading English case in which the word "ordinary," as applied to tides, was first construed as meaning the medium tides between the springs and the neaps; the second,* Borax Consolidated, Ltd. *v.* Los Angeles, *established for the Federal courts the common law concept of "ordinary high-water mark" as "the mean high-tide line"; and the third,* Luttes *v.* The State of Texas, *established the civil (Spanish) law concept of "seashore" as extending to the line of "mean higher high tide."*)

ATTORNEY-GENERAL *v.* CHAMBERS

Before the Lord Chancellor Lord CRANWORTH, assisted by
Mr. Baron ALDERSON and Mr. Justice MAULE
4 De G. M. & G. 206 (1854)

In this case an information was filed by the Attorney-General against the owners and lessees of a district abutting on and extending along the sea-shore of the parish of Llanelly, in the county of Carmarthen. The information alleged that by the royal prerogative the sea-shore, and the soil of all arms and creeks of the sea, and of all public ports and havens round this kingdom as far as the sea flows and reflows between high and low water mark, and the soil of the navigable rivers of this kingdom, and all mines and minerals lying under the sea, sea-shore, arms and creeks of the sea, and all profits arising from the shore and soil belonged to her Majesty, and have at all times belonged to her and her royal predecessors, kings and queens of this realm. The information stated that there were very valuable and extensive veins, seams or strata of coal and culm lying under that part of the parish of Llanelly which was contiguous to the sea-shore, and particularly under the land belonging to the defendant David Lewis, called or known by the name of Old Castle Farm, and that such veins, seams, or strata of coal and culm continued and extended also under the contiguous sea-shore below the line of high-water mark and under the sea.

The information charged that the sea-shore, which was vested in her Majesty by virtue of her prerogative, extended landwards as far as high-water mark at ordinary monthly spring-tides, or at all events far beyond high-water mark at neap-tides, and up to the medium line of high-water mark between neap and spring tides. The information charged that encroachments had been made by the defendants on the shore by means of embankments; and that valuable coal mines were worked under that part of the shore that lay to the seaward of high water mark at ordinary neap-tides before the sea was excluded by the embankment.

The information prayed that the right of her Majesty to the sea-shore of the parish of Llanelly below high-water mark might be established; that the leaves or licenses to embank,

or build, or dig, or raise coal from the said sea-shore might be declared null void, and delivered up to be cancelled, and that the boundary or mark to which the sea flowed at high ordinary tides upon the shore of the parish of Llanelly, adjoining the lands in the occupation or possession of the defendant D. Lewis, before the embankments were erected, and also those portions of the works or mines from which coal or culm were gotten, which lay under land belonging to her Majesty, might be ascertained and distinguished, and that the nuisances arising from the erection of the works might be abated.

Answers were put in by the several defendants, controverting the right asserted by the Crown, and submitting that at the utmost the Crown's right did not extend landwards beyond the line of high-water mark of ordinary neap-tides, and did not embrace any alluvium of gradual formation.

The cause originally came on to be heard before the Master of the Rolls, and on the 21st January, 1852, his Honor directed certain issues to be tried between the Crown and Lord Cawdor, and Mr. Chambers (two of the defendants and principal owners of the shore); no issue, however, was directed as between the Crown and the defendant D. Lewis, who was also an owner, the Attorney-General having been of opinion that the issues between the Crown and the two principal defendants should be first disposed of. The issues came on to be tried on a trial at bar before a jury at the Queen's Bench, sitting *in banco* on the 19th February, 1854, when a verdict by agreement was entered for the Crown. The Act 15 & 16 Vict. c. 86, having in the mean time passed (by the 62d section of which a Court of Equity is empowered to determine the legal rights of parties without directing a trial at law), and the question, so far as regarded the rights of the defendant Lewis, being still undecided, it was arranged that the cause should be set down on further directions, to be heard by consent of the Lord Chancellor, before his Lordship in the first instance, assisted by two of the Judges of the Courts of Common Law. His Lordship having accordingly invited the attendance of Mr. Baron ALDERSON and Mr. Justice MAULE to assist in the determination of the question, those learned Judges now attended.

The following passages from Lord Chief Justice HALE's Treatise De Jure Maris (Hargrave's Tracts 12, 25, 26) were much commented upon in the argument, and by the learned Judges and Lord Chancellor, and are here inserted for the convenience of reference:—

> "The shore is that ground that is between the ordinary high-water and low-water mark. This doth *prima facie* and of common right belong to the King, both in the shore of the sea, and the shore of the arms of the sea.
>
> "And herein there will be these things examinable,—
>
> "1st. What shall be said the shore or *littus maris?*
>
> "2d. What shall be said an arm or creek of the sea?
>
> "3d. What evidence there is of the King's propriety thereof.
>
> "I. For the first of these it is certain that that which the sea overflows, either at high spring-tides, or extraordinary tides, comes not as to this purpose under the denomination of *littus maris;* and consequently the King's title is not of that large extent, but only to land that is usually overflowed at ordinary tides. And so I have known it ruled in the Exchequer Chamber in the case of Vanhaesdanke, on prosecution by information against Mr. Whiting, about 12 Car. 1, for lands in the county of Norfolk, and accordingly ruled, 15 Car. B. R., Sir Edward Heron's case and Pasch, 17 Car. 2, *in Scaccario* upon evidence between the Lady Wansford's lessee and Stephens, in an

ejectione firmae for the town of Cowes, in the Isle of Wight. That therefore I call the shore that is between the common high-water and low-water mark, and no more.

* * * * * * *

"There seems to be three sorts of shores or *littora marina* according to the various tides (Hargrave's Tracts 25); viz.,—

"(1st) The high spring-tides, which are the fluxes of the sea at those tides that happen at the two equinoctials; and certainly this doth not *de jure communi* belong to the Crown. For such spring-tides many times overflow ancient meadows and salt marshes, which yet unquestionably belong to the subject. And this is admitted of all hands.

"(2d) The spring-tides which happen twice every month, at full and change of the moon, and the shore in question, is by some opinion not denominated by these tides neither, but the land overflowed with these fluxes ordinarily belong to the subject *prima facie,* unless the King hath a prescription to the contrary. And the reason seems to be, because for the most part the lands covered by these fluxes are dry and maniorable; for at other tides the sea doth not cover them, and therefore touching these shores, some hold that common right speaks for the subject, unless there be an usage to entitle the Crown; for this is not properly *littus maris.* And therefore it hath been held that where the King makes his title to land as *littus maris,* or *parcella littoris marini,* it is not sufficient for him to make it appear to be overflowed at spring-tides of this kind, P. 8, Car. 1, *in Camera Scaccarii,* in the case of Vanhaesdanke for lands in Norfolk; and so I have heard it was held, P. 15, Car. B. R., Sir Edward Heron's case, and Tr. 17, Car. 2, in the case of the Lady Wandesford, for a town called the Cowes, in the Isle of Wight, *in Scaccario.*

"(3d) Ordinary tides or neap-tides, which happen between the full and change of the moon; and this is that which is properly *littus maris,* sometimes called *marettum,* sometimes *warettum.* And touching this kind of shore, viz., that which is covered by the ordinary flux of the sea, is the business of our present inquiry."

The Solicitor-General, Mr. James, and *Mr. Hansen,* for the Crown.—By the feudal law all the real property of this country was vested in the Crown, and the sea-shore appertaining to the sovereign commences with that portion of the shore where the interests of the public may be said to begin; and therefore the rights of the adjacent freeholders are bounded not merely by the ordinary flux and reflux of the tide, but the Crown for the benefit of the public has a right to all the intervening space between the highest and the ordinary high-water mark; for though the soil of the sea between high and low water mark may be parcel of the manor of a subject, *Constable's Case* (5 Rep. 107 *a*), yet, as Lord HALE, in his Treatise De Jure Maris, says, p. 22 this "*jus privatum* that is acquired to the subject either by patent or prescription must not prejudice the *jus publicum* where with public rivers or arms of the sea are affected for public use." Mr. Justice BAYLEY, in the case of *Scratton* v. *Brown* (4 B. & C. 485, 495), observes, "The property in such land *prima facie* is in the Crown," and it is quite clear that if the sea encroach upon the land of a subject gradually, the land thereby covered by water belongs to the Crown; in *The Matter of the Hull and Selby Railway* (5 M. & W. 327), *Rex* v. *Lord Yarborough* (3 B. & C. 91; S. C., 2 Bligh, N. S. 147). The limit to which the Crown would be entitled by the rule of the civil law will give us more than we claim; by that law the shore is defined to be so far as the greatest winter tides do run.

[ALDERSON, B., referred to the observations of HOLROYD, J., in the case of *Blundell* v. *Catteral* (5 B. & A. 268, 292), as to the variance between the common law and civil law in

regard to maritime rights, showing that the civil law was not any guide in such matters.]

With reference to the word "ordinary," that must be intended to comprehend such phenomena as are of the most constant recurrence, and the word itself is just as applicable to spring as neap tides (Anon., Dyer, 326*b*).

They referred to *Berry* v. *Holden* (3 Dun. & Bell. 205), *Attorney-General* v. *Burridge* (10 Price 350), and *Attorney-General* v. *Parmeter* (10 Price 378), Lord Stair's Institutes, Vol. II. p. 190. They also relied upon the observations attributed to Lord BROUGHAM in the case of *Smith* v. *The Earl of Stair* (6 Bell. Ap. Ca. 847), indicating a preference for the former of the opinions which is to be found in p. 12 of the Treatise De Jure Maris.

Mr. R. Palmer, Mr. Goldsmid, and *Mr. Mellish,* for Mr. Lewis.—We submit that the neap-line best fulfils the definition of "ordinary" high-water mark, inasmuch as that line would include land covered every day in the year by the sea. Lord HALE, defining the shore to be that space usually overflowed at ordinary tides, p. 26, excludes all spring-tides. On this principle PARKE, J., says, in the case of *Lowe* v. *Govett* (3 B. & Ad. 863, 871), "In the absence of proof to the contrary, the presumption as to such land (meaning land above the ordinary high-water mark) is in favour of the adjoining proprietor." The only case in which the Crown was held to be entitled is *Attorney-General* v. *Parmeter* (10 Price 378); but that was the case of a nuisance, and there the parties were claiming under the Crown, and the decision was that the grant was bad.

If the right of conservancy is attributed to the Crown to the extent asserted by the information, the consequence will be directly repugnant to the doctrine laid down by Lord HALE, in p. 26 of the Treatise De Jure Maris, and would include lands which, by reason of their being uncovered for the greatest part of the year are dry and maniorable.

Mr. Roupell and *Mr. Dickinson* appeared for Messrs. Sims, Williams, & Co., lessees under Mr. Lewis.

Mr. James, in reply.—In *Lowe* v. *Govett* the Crown was not a party; and even granting the presumption in favour of the adjacent proprietors, still this will not deprive the Crown of the right here asserted, nor dispense with the obligations of protecting the interests of the public for the purposes of navigation.

At the conclusion of the argument the learned Judges desired time to consider the question which had been submitted to them; and on the 8th July, 1854, Mr. Baron ALDERSON, on behalf of Mr. Justice MAULE and himself, delivered the following joint opinion:—

MY LORD CHANCELLOR.—In this case, on which your Lordship has requested the assistance of my brother MAULE and myself, I am now to deliver our joint opinion on the only question argued before us. That question, as I understand it, is this: What, in the absence of all evidence of particular usage, is the limit of the title of the Crown to the sea-shore? The Crown is clearly in such a case, according to all the authorities, entitled to the *littus maris* as well as to the soil of the sea itself adjoining the coasts of England. What then, according to the authorities in our law, is the extent of this *littus maris?*

This, in the absence of any grant, or usage from which a grant may be presumed, is according to the civil law defined as the part of the shore bounded by the extreme limit to which the highest natural tides extend, "Quatenus hybernus fluctus maximus excurrit," i.e., the highest natural tide; for according to Lord STAIR's exposition, the definition does not include the highest actual tides, for these may be produced by peculiarities of wind or other temporary or accidental circumstances, concurring with the flow produced by the action of the sun and moon upon the ocean.

But this definition (even thus expounded by the authorities) of the civil law is clearly not the rule of the common law of England.

Mr. Justice HOLROYD, no mean authority, in his very elaborate judgment in the case of *Blundell* v. *Catterall* (5 B. & A. 268, 290), mentions this as one of the instances in which the common law differs from the civil law, and says that it is clear that according to our law it is not the limit of the highest tides of the year, but the limit reached by the highest ordinary tides of the sea, which is the limit of the shore belonging *prima facie* to the Crown. What, then, are these "highest ordinary tides"? Now we know that in fact the tides of each day, nay, even each of the tides of each day, differ in some degree as to the limit which they reach. There are the spring-tides at the equinox, the highest of all. These clearly are excluded in terms by Lord HALE, both in p. 12 and in p. 26 of his Treatise De Jure Maris. For though in one sense these are ordinary, i.e. according to the usual order of nature, and not caused by accidents of the winds and the like, yet they do not ordinarily happen but only at two periods of the year. These, then, are not the tides contemplated by the common law, for they are not "ordinary tides," not being "of common occurrence." This may perhaps apply to the spring tides of each month, exclusive of the equinoctial tides; and indeed, if the case were without distinct authority on this point, that is the conclusion at which we might have arrived. But then we have Lord HALE's authority, p. 26, De Jure Maris, who says, "Ordinary tides or neap-tides which happen between the full and change of the moon" are the limit of "that which is properly called *littus maris*," and he excludes the spring-tides of the month, assigning as the reason that the "lands covered with these fluxes are for the most part of the year dry and maniorable," i.e., not reached by the tides. And to the same effect is the case of *Lowe* v. *Govett* (3 B. & Ad. 863), which excludes these monthly spring-tides also.

But we think that Lord HALE's reason may guide us to the proper limit. What are then the lands which for the most part of the year are reached and covered by the tides? The same reason that excludes the highest tides of the month (which happen at the springs) excludes the lowest high tides (which happen at the neaps), for the highest or spring-tides and the lowest high tides (those at the neaps) happen as often as each other. The medium tides, therefore, of each quarter of the tidal period afford a criterion which we think may be best adopted. It is true of the limit of the shore reached by these tides that it is more frequently reached and covered by the tide than left uncovered by it. For about three days it is exceeded, and for about three days it is left short, and on one day it is reached. This point of the shore therefore is about four days in every week, i.e., for the most part of the year, reached and covered by the tides. And as some not indeed perfectly accurate construction, but approximate, must be given to the words "highest ordinary tides" used by Mr. Justice HOLROYD, we think, after fully considering it, that this best fulfils the rules and the reasons for it given in our books.

We therefore beg to advise your Lordship that, in our opinion, the average of these medium tides in each quarter of a lunar revolution during the year gives the limit, in the absence of all usage, to the rights of the Crown on the sea-shore.

THE LORD CHANCELLOR.—The question for decision is, what is the extent of the right of the Crown to the sea-shore? Its right to the *littus maris* is not disputed. But what is the *littus?* Is it so much as is covered by ordinary spring-tides, or is it something less? The rule of the civil law was, "Est autem littus maris quatenus hybernus fluctus maximus excurrit." This is certainly not the doctrine of our law. All the authorities concur in the

conclusion that the right is confined to what is covered by "ordinary" tides, whatever be the right interpretation of that word. By "hybernus fluctus maximus" is clearly meant extraordinary high tides, though, speaking with physical accuracy, the winter tide is not in general the highest.

Land covered only by these extraordinary tides is not what is meant by the sea-shore; such tides may be the result of wind, or other causes independent of what ordinarily regulates flux and reflux. Setting aside these accidental tides, the question is, What is the meaning of ordinary? It is evidently a word of doubtful import. In one sense, the highest equinoctial spring tides are "ordinary;" i.e., they occur in the natural order of things. But this is evidently not the sense in which the word ordinary is used when designating the extent of the Crown's right to the shore. Treatise De Jure Maris, pp. 12, 25.

Disregarding, then, extreme tides, we next come to the ordinary spring-tides, i.e., the spring-tides of each lunar month. No doubt, speaking scientifically, they probably all differ; but practically this may be disregarded. Lord HALE gives no absolutely decided opinion; but he evidently leans very strongly against the right to the land covered only by spring-tides (Treatise De Jure Maris, p. 26), and refers to decisions which support his views. Then he describes ordinary tides as if synonymous with neap-tides.

This leaves the question very much at large, and there is very little of modern authority. In *Blundell* v. *Catterall* (5 B. & A. 268), Mr. Justice HOLROYD says, by the common law, i.e., the shore, is confined to the flux and reflux of the sea at ordinary tides, meaning the land covered by such flux and reflux.

Still the question remains, What are ordinary tides? The nearest approach to direct authority is *Lowe* v. *Govett* (3 B. & Ad. 863). There certain recesses on the coast, covered by the high water of ordinary spring-tides, but not by the medium tides between spring and neap tides, were held not to pass under an Act vesting in a company an arm of the sea daily overflowed by it. Lord TENTERDEN held that these recesses were not ordinarily overflowed by the sea, which shows clearly that he did not consider the overflowing by ordinary spring-tides to be what is meant by ordinarily overflowing; and both Mr. Justice LITTLEDALE and Mr. Justice (now Baron) PARKE concur in saying that the recesses in question were above ordinary high-water mark, clearly showing their opinion to be that what is meant by ordinary high-water mark is not so high as the limit of high water at ordinary spring-tides.

There is, in truth, no further authority to guide us; for the question did not arise in either of the cases of *Attorney-General* v. *Burridge* (10 Price 350), or *Attorney-General* v. *Parmeter* (10 Price 378), as to the buildings at Portsmouth.

In this state of things, we can only look to the principle of the rule which gives the shore to the Crown. That principle I take to be that it is land not capable of ordinary cultivation or occupation, and so is in the nature of unappropriated soil. Lord HALE gives as his reason for thinking that lands only covered by the high spring-tides do not belong to the Crown, that such lands are for the most part dry and maniorable; and taking this passage as the only authority at all capable of guiding us, the reasonable conclusion is, that the Crown's right is limited to land which is for the most part not dry or maniorable.

The learned Judges whose assistance I had in this very obscure question point out that the limit indicating such land is the line of the medium high tide between the springs and the neaps. All land below that line is more often than not covered at high water,

and so may justly be said, in the language of Lord HALE, to be covered by the ordinary flux of the sea. This cannot be said of any land above that line; and I therefore concur with the able opinion of the Judges, whose valuable assistance I had, in thinking that medium line must be treated as bounding the right of the Crown.

BORAX CONSOLIDATED, LTD. ET AL. *v.* LOS ANGELES

In the Supreme Court of the United States
296 U.S. 10 (1935)

MR. CHIEF JUSTICE HUGHES delivered the opinion of the Court.

The City of Los Angeles brought this suit to quiet title to land claimed to be tideland of Mormon Island situated in the inner bay of San Pedro now known as Los Angeles Harbor. The City asserted title under a legislative grant by the State. Stats. Cal. 1911, p. 1256; 1917, p. 159.[1] Petitioners claimed under a preemption patent issued by the United States on December 30, 1881, to one William Banning. The District Court entered a decree, upon findings, dismissing the complaint upon the merits and adjudging that petitioner, Borax Consolidated, Limited, was the owner in fee simple and entitled to the possession of the property. 5 F. Supp. 281. The Circuit Court of Appeals reversed the decree. 74 F. (2d) 901. Because of the importance of the questions presented, and of an asserted conflict with decisions of this Court, we granted certiorari, June 3, 1935.

In May, 1880, one W. H. Norway, a Deputy Surveyor, acting under a contract with the Surveyor General of the United States for California, made a survey of Mormon Island. The surveyor's field notes and the corresponding plat of the island were approved by the Surveyor General and were returned to the Commissioner of the General Land Office. The latter, having found the survey to be correct, authorized the filing of the plat. The land which the patent to Banning purported to convey was described by reference to that plat as follows: "Lot numbered one, of section eight, in township five south, of range thirteen west of San Bernardino Meridian, in California, containing eighteen acres, and eighty-eight hundredths of an acre, according to the Official Plat of the Survey of the said Lands, returned to the General Land Office by the Surveyor General."

The District Court found that the boundaries of "lot one," as thus conveyed, were those shown by the plat and field notes of the survey; that all the lands described in the complaint were embraced within that lot; and that no portion of the lot was or had been

1. The Act of 1911 (Stats. 1911, c. 656, p. 1256) provided: "There is hereby granted to the city of Los Angeles, a municipal corporation of the State of California, and to its successors, all the right, title and interest of the State of California, held by said state by virtue of its sovereignty, in and to all tide lands and submerged lands, whether filled or unfilled, within the present boundaries of said city, and situated below the line of mean high tide of the Pacific ocean, or of any harbor, estuary, bay or inlet within said boundaries, to be forever held by said city, and by its successors, in trust for the uses and purposes, and upon the express conditions following, to wit:" The conditions which followed are not material here.

The granting clause above quoted is the same in the Act of 1917 (Stats. 1917, p. 159).

tideland or situated below the line of mean high tide of the Pacific Ocean or of Los Angeles Harbor. The District Court held that the complaint was a collateral, and hence unwarranted, attack upon the survey, the plat and the patent; that the action of the General Land Office involved determinations of questions of fact which were within its jurisdiction and were specially committed to it by law for decision; and that its determinations, including that of the correctness of the survey, were final and were binding upon the State of California and the City of Los Angeles, as well as upon the United States.

The Circuit Court of Appeals disagreed with this view as to the conclusiveness of the survey and the patent. The court held that the Federal Government had neither the power nor the intention to convey tideland to Banning, and that his rights were limited to the upland. The court also regarded the lines shown on the plat as being meander lines and the boundary line of the land conveyed as the shore line of Mormon Island. The court declined to pass upon petitioners' claim of estoppel *in pais* and by judgment, upon the ground that the question was not presented to or considered by the trial court, and was also of the opinion that the various questions raised as to the failure of the City to allege and prove the boundary line of the island were important only from the standpoint of the new trial which the court directed. 74 F. (2d) p. 904. For the guidance of the trial court the Court of Appeals laid down the following rule: The "mean high tide line" was to be taken as the boundary between the land conveyed and the tideland belonging to the State of California, and in the interest of certainty the court directed that "an average for 18.6 years should be determined as near as possible by observation or calculation." *Id.*, pp. 906, 907.

Petitioners contest these rulings of the Court of Appeals. With respect to the ascertainment of the shore line, they insist that the court erred in taking the "mean high tide line" and in rejecting "neap tides" as the criterion for ordinary high water mark.

1. The controversy is limited by settled principles governing the title to tidelands. The soils under tidewaters within the original States were reserved to them respectively, and the States since admitted to the Union have the same sovereignty and jurisdiction in relation to such lands within their borders as the original States possessed. *Martin* v. *Waddell,* 16 Pet. 367, 410; *Pollard* v. *Hagan,* 3 How. 212, 229, 230; *Goodtitle* v. *Kibbe,* 9 How. 471, 478; *Weber* v. *Harbor Commissioners,* 18 Wall. 57, 65, 66; *Shively* v. *Bowlby,* 152 U.S. 1, 15, 26. This doctrine applies to tidelands in California. *Weber* v. *Harbor Commissioners, supra; Shively* v. *Bowlby, supra,* pp. 29, 30; *United States* v. *Mission Rock Co.,* 189 U.S. 391, 404, 405. Upon the acquisition of the territory from Mexico, the United States acquired the title to tidelands equally with the title to upland, but held the former only in trust for the future States that might be erected out of that territory. *Knight* v. *United States Land Assn.,* 142 U.S. 161, 183. There is the established qualification that this principle is not applicable to lands which had previously been granted by Mexico to other parties or subjected to trusts which required a different disposition,—a limitation resulting from the duty resting upon the United States under the treaty of Guadalupe Hidalgo (9 Stat. 922), and also under principles of international law, to protect all rights of property which had emanated from the Mexican Government prior to the treaty. *San Francisco* v. *LeRoy,* 138 U.S. 656, 671; *Knight* v. *United States Land Assn., supra; Shively* v. *Bowlby, supra.* That limitation is not applicable here, as it is not contended that Mormon Island was included in any earlier grant. See *DeGuyer* v. *Banning,* 167 U.S. 723.

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It follows that if the land in question was tideland, the title passed to California at the time of her admission to the Union in 1850. That the Federal Government had no power to convey tidelands, which had thus vested in a State, was early determined. *Pollard* v. *Hagan, supra; Goodtitle* v. *Kibbe, supra.* In those cases, involving tidelands in Alabama, the plaintiffs claimed title under an inchoate Spanish grant of 1809, an Act of Congress confirming that title, passed July 2, 1836, and a patent from the United States, dated March 15, 1837. The Court held that the lands, found to be tidelands, had passed to Alabama at the time of her admission to the Union in 1819, that the Spanish grant had been ineffective, and that the confirming Act of Congress and the patent conveyed no title. The Court said that "The right of the United States to the public lands, and the power of Congress to make all needful rules for the sale and disposition thereof, conferred no power to grant to the plaintiffs the land in controversy." *Pollard* v. *Hagan, supra.* See also *Shively* v. *Bowlby, supra,* at pp. 27, 28; *Mobile Transportation Co.* v. *Mobile,* 187 U.S. 479, 490; *Donnelly* v. *United States,* 228 U.S. 243, 260–261.

2. As to the land in suit, petitioners contend that the General Land Office had authority to determine the location of the boundary beween upland and tideland and did determine it through the survey in 1880 and the consequent patent to Banning, and that this determination is conclusive against collateral attack; in short, that the land in controversy has been determined by competent authority not to be tideland and that the question is not open to reexamination. Petitioners thus invoke the rule that "the power to make and correct surveys belongs to the political department of the government and that, whilst the lands are subject to the supervision of the General Land Office, the decisions of that bureau in all such cases, like that of other special tribunals upon matters within their exclusive jurisdiction, are unassailable by the courts, except by a direct proceeding." R.S., §§ 453, 2395–2398, 2478; 43 U.S.C. 2, 751–753, 1201. *Cragin* v. *Powell,* 128 U.S. 691, 698, 699; *Heath* v. *Wallace,* 138 U.S. 573, 585; *Knight* v. *United States Land Assn., supra; Stoneroad* v. *Stoneroad,* 158 U.S. 240, 250, 252; *Russell* v. *Maxwell Land Grant Co.,* 158 U.S. 253, 256; *United States* v. *Coronado Beach Co.,* 255 U.S. 472, 487, 488.

But this rule proceeds upon the assumption that the matter determined is within the jurisdiction of the Land Department. *Cragin* v. *Powell, supra.* So far as pertinent here, the jurisdiction of the Land Department extended only to "the public lands of the United States." The patent to Banning was issued under the preemption laws, which expressly related to lands "belonging to the United States." R.S. 2257, 2259. Obviously these laws had no application to lands which belonged to the States. Specifically, the term "public lands" did not include tidelands. *Mann* v. *Tacoma Land Co.,* 153 U.S. 273, 284. "The words 'public lands' are habitually used in our legislation to describe such as are subject to sale or other disposal under general laws." *Newhall* v. *Sanger,* 92 U.S. 761, 763; *Barker* v. *Harvey,* 181 U.S. 481, 490; *Union Pacific R. Co.* v. *Harris,* 215 U.S. 386, 388.

The question before us is not as to the general authority of the Land Department to make surveys, but as to its authority to make a survey, as a basis for a patent, which would preclude the State or its grantee from showing in an appropriate judicial proceeding that the survey was inaccurate and hence that the patent embraced land which the United States had no power to convey. Petitioners' argument in substance is that while the United States was powerless as against the State to pass title to tidelands in the absence of a survey (*Pollard* v. *Hagan, supra*), the question whether or not the land was tideland would be foreclosed by a departmental survey, although erroneous. This contention encounters the

principle that the question of jurisdiction, that is, of the competency of the Department to act upon the subject matter, is always one for judicial determination. "Of course," said the Court in *Smelting Co.* v. *Kemp*, 104 U.S. 636, 641, "when we speak of the conclusive presumptions attending a patent for lands, we assume that it was issued in a case where the department had jurisdiction to act and execute it; that is to say, in a case where the lands belong to the United States, and provision had been made by law for their sale. If they never were public property, or had previously been disposed of, or if Congress had made no provision for their sale, or had reserved them, the department would have no jurisdiction to transfer them, and its attempted conveyance of them would be inoperative and void, no matter with what seeming regularity the forms of law may have been observed." The Court added that questions of that sort "may be considered by a court of law"; for in such cases "the objection to the patent reaches beyond the action of the special tribunal, and goes to the existence of a subject upon which it was competent to act." *Id.* See, also, *Polk* v. *Wendall*, 9 Cranch 87, 99; *Moore* v. *Robbins*, 96 U.S. 530, 533; *Wright* v. *Roseberry*, 121 U.S. 488, 519; *Doolan* v. *Carr*, 125 U.S. 618, 625; *Hardin* v. *Jordan*, 140 U.S. 371, 401; *Crowell* v. *Benson*, 285 U.S. 22, 58, 59. Here, the question goes to the existence of the subject upon which the Land Department was competent to act. Was it upland, which the United States could patent, or tideland, which it could not? Such a controversy as to title is appropriately one for judicial decision upon evidence, and we find no ground for the conclusion that it has been committed to the determination of administrative officers.

Petitioners urge a distinction in that at the time of the survey no private right in the property had yet attached and the question lay between the Federal Government and the State of California. But the distinction is immaterial. If tideland, the title of the State was complete on admission to the Union. No transfer to private parties was necessary to perfect or assure that title and no power of disposition remained with the United States.

To support their contention as to the conclusiveness of the survey and patent, petitioners largely rely upon our decision in *Knight* v. *United States Land Assn., supra.* But that decision is not in point, as it related to land which, albeit tideland, had been the subject of a Mexican grant made prior to statehood. What had there been done by the Federal Government was found to be in pursuance of the duty of the United States, imposed by the treaty of Guadalupe Hidalgo and the principles of international law, to protect the rights of property which had previously been created by the Mexican Government. The contest related to land in Mission Creek, an estuary of the bay of San Francisco. The plaintiffs claimed under a tideland grant from the State. The defendant's claim rested upon the title of the City of San Francisco as successor to the Mexican pueblo of that name. Following the procedure prescribed by statute with respect to the confirmation of such titles (Acts of March 3, 1851, 9 Stat. 631; July 1, 1864, 13 Stat. 332), the City had obtained a confirmatory decree from the United States Circuit Court in May, 1865. The statutes required that such a decree should be followed by a survey under the supervision of the General Land Office, and patent was to issue to the successful claimant when such survey had been finally approved. *Id.* Accordingly, after the decree in favor of the City, a survey was made, which was approved by the Surveyor General and the Commissioner of the General Land Office. The line of that survey ran along the line of ordinary high water mark of the bay of San Francisco, but in the case of the estuary followed the tideline up the creek end, crossing over, ran down on the other side. The City objected to that

method, insisting that the line should have crossed the mouth of the estuary, and, on appeal, that contention was sustained by the Secretary of the Interior. A second survey was made pursuant to that decision and a patent was issued. 142 U.S. pp. 162–172. The plaintiffs contended that the first survey was correct and the second unauthorized. Reviewing that branch of the case, the Court decided that the Secretary of the Interior had power to set aside the first survey and direct another, and that the departmental action in that particular was unassailable. But that conclusion was not sufficient to meet the plaintiffs' claim under the state grant, unless it could be held that title to the land had not passed to the State. Upon that question the court found that the case of *San Francisco* v. *LeRoy,* 138 U.S. 656, 670, 672, was "directly in point," as the Court had there decided that "if there were any tide lands within the pueblo the power and duty of the United States under the treaty to protect the claims of the City of San Francisco as successor to the pueblo were superior to any subsequently acquired rights of California." 142 U.S. pp. 183–185. In discharge of that duty, provision had been made by Congress for the investigation and confirmation of the property rights of pueblos equally with those of individuals. The rights of the pueblo "were dependent upon Mexican laws, and when Mexico established those laws she was the owner of tide lands as well as uplands, and could have placed the boundaries of her pueblos wherever she thought proper." It was for the United States to ascertain those boundaries when fixing the limits of the claim of the City as successor to the pueblo. *Id.,* pp. 186, 187. The obligation of protection was "political in its character, to be performed in such manner and on such terms as the United States might direct." Accordingly, Congress had established a special tribunal to consider claims derived from Mexico, had authorized determinations by the court upon appeal, and "had designated the officers who should in all cases survey and measure off the land when the validity of the claim presented was finally determined." *Id.,* pp. 202, 203. The survey upon which the patent rested in the *Knight* case was thus made pursuant to the authority reserved to the United States to enable it to discharge its international duty with respect to land which, although tideland, had not passed to the State. See *Shively* v. *Bowlby, supra,* pp. 30, 31; *United States* v. *Coronado Beach Co., supra.*

The distinguishing features of the instant case are apparent. No prior Mexican grant is here involved. We conclude that the State was not bound by the survey and patent, and that its grantee was entitled to show, if it could, that the land in question was tideland.

In this view it is not necessary to consider whether the lines designated in the plat of the Norway survey as "meander" lines were intended as boundaries.

3. As the District Court fell into a fundamental error in treating the survey and patent as conclusive, it was not incumbent upon the Court of Appeals to review the evidence and decide whether it showed, or failed to show, that the land in question was tideland. The court remanded the cause for a new trial in which the issues as to the boundary between upland and tideland, and as to the defenses urged by petitioners, are to be determined. In that disposition of the case we find no error.

4. There remains for our consideration, however, the ruling of the Court of Appeals in instructing the District Court to ascertain as the boundary "the mean high tide line" and in thus rejecting the line of "neap tides."

Petitioners claim under a federal patent which, according to the plat, purported to convey land bordering on the Pacific Ocean. There is no question that the United

States was free to convey the upland, and the patent affords no ground for holding that it did not convey all the title that the United States had in the premises. The question as to the extent of this federal grant, that is, as to the limit of the land conveyed, or the boundary between the upland and the tideland, is necessarily a federal question. It is a question which concerns the validity and effect of an act done by the United States; it involves the ascertainment of the essential basis of a right asserted under federal law. *Packer* v. *Bird,* 137 U.S. 661, 669, 670; *Brewer-Elliott Oil Co.* v. *United States,* 260 U.S. 77, 87; *United States* v. *Holt Bank,* 270 U.S. 49, 55, 56; *United States* v. *Utah,* 283 U.S. 64, 75. Rights and interests in the tideland, which is subject to the sovereignty of the State, are matters of local law. *Barney* v. *Keokuk,* 94 U.S. 324, 338; *Shively* v. *Bowlby, supra,* p. 40; *Hardin* v. *Jordan,* 140 U.S. 371, 382; *Port of Seattle* v. *Oregon & Washington R. Co.,* 255 U.S. 56, 63.

The tideland extends to the high water mark. *Hardin* v. *Jordan, supra; Shively* v. *Bowlby, supra; McGilvra* v. *Ross,* 215 U.S. 70, 79. This does not mean, as petitioners contend, a physical mark made upon the ground by the waters; it means the line of high water as determined by the course of the tides. By the civil law, the shore extends as far as the highest waves reach in winter. Inst. lib. 2, tit. 1, § 3; Dig. lib. 50, tit. 16, § 112. But by the common law, the shore "is confined to the flux and reflux of the sea at ordinary tides." *Blundell* v. *Catterall,* 5 B. & A. 268, 292. It is the land "between ordinary high and low-water mark, the land over which the daily tides ebb and flow. When, therefore, the sea, or a bay, is named as a boundary, the line of ordinary high-water mark is always intended where the common law prevails." *United States* v. *Pacheco,* 2 Wall. 587, 590.

The range of the tide at any given place varies from day to day, and the question is, how is the line of "ordinary" high water to be determined? The range of the tide at times of new moon and full moon "is greater than the average," as "high water then rises higher and low water falls lower than usual." The tides at such times are called "spring tides." When the moon is in its first and third quarters, "the tide does not rise as high nor fall as low as on the average." At such times the tides are known as "neap tides." "Tidal Datum Planes," U.S. Coast and Geodetic Survey, Special Publication No. 135, p. 3.[2] The view that "neap tides" should be taken as the ordinary tides had its origin in the statement of Lord Hale. *De Jure Maris,* cap. VI; Hall on the Sea Shore, p. 10, App. XXIII, XXIV. In his classification, there are "three sorts of shores, or *littora marina,* according to the various tides," (1) "The high spring tides, which are the fluxes of the sea at those tides that happen at the two equinoxials"; (2) "The spring tides, which happen twice every month at full and change of the moon"; and (3) "Ordinary tides, or nepe tides, which happen between the full and change of

2. See "The Tide," H. A. Marmer, Assistant Chief, Division of Tides and Currents, U.S. Coast and Geodetic Survey, pp. 9, 10. "There is generally an interval of one or two days between full moon or new moon and the greatest range of the tide. And a like interval is found between the first and third quarters of the moon and the smallest tides." *Id.,* p. 11.

The origin of the terms spring and neap tides "is probably due to the fact that as the moon leaves the meridian of the sun in her orbital round the earth and approaches the quarters the tides begin to 'fall off' or are 'nipped,' and neap tides ensue. As she leaves the quarters for the meridian they begin to 'lift,' or 'come on,' or 'spring up,' and when the meridian is reached spring tides ensue." "A Practical Manual of Tides and Waves," W. H. Wheeler, p. 49.

the moon." The last kind of shore, said Lord Hale, "is that which is properly *littus maris.*" He thus excluded the "spring tides" of the month, assigning as the reason that "for the most part the lands covered with these fluxes are dry and maniorable," that is, not reached by the tides.

The subject was thoroughly considered in the case of *Attorney General* v. *Chambers,* 4 DeG. M. & G. 206. In that case Lord Chancellor Cranworth invited Mr. Baron Alderson and Mr. Justice Maule to assist in the determination of the question as to "the extent of the right of the Crown to the seashore." Those judges gave as their opinion that the average of the "medium tides in each quarter of a lunar revolution during the year" fixed the limit of the shore. Adverting to the statement of Lord Hale, they thought that the reason he gave would be a guide to the proper determination. "What," they asked, are "the lands which for the most part of the year are reached and covered by the tides?" They found that the same reason that excluded the highest tides of the month, the spring tides, also excluded the lowest high tides, the neaps, for "the highest or spring-tides and the lowest high tides (those at the neaps) happen as often as each other." Accordingly, the judges thought that "the medium tides of each quarter of the tidal period" afforded the best criterion. They said: "It is true of the limit of the shore reached by these tides that it is more frequently reached and covered by the tide than left uncovered by it. For about three days it is exceeded, and for about three days it is left short, and on one day it is reached. This point of the shore therefore is about four days in every week, i.e. for the most part of the year, reached and covered by the tides." *Id.,* p. 214.

Having received this opinion, the Lord Chancellor stated his own. He thought that the authorities had left the question "very much at large." Looking at "the principle of the rule which gives the shore to the Crown," and finding that principle to be that "it is land not capable of ordinary cultivation or occupation, and so is in the nature of unappropriated soil," the Lord Chancellor thus stated his conclusion: "Lord Hale gives as his reason for thinking that lands only covered by the high spring-tides do not belong to the Crown, that such lands are for the most part dry and maniorable; and taking this passage as the only authority at all capable of guiding us, the reasonable conclusion is that the Crown's right is limited to land which is for the most part not dry or maniorable. The learned Judges whose assistance I had in this very obscure question point out that the limit indicating such land is the line of the medium high tide between the springs and the neaps. All land below that line is more often than not covered at high water, and so may justly be said, in the language of Lord Hale, to be covered by the ordinary flux of the sea. This cannot be said of any land above that line." The Lord Chancellor therefore concurred with the opinion of the judges "in thinking that the medium line must be treated as bounding the right of the Crown." *Id.,* p. 217.[3]

This conclusion appears to have been approved in Massachusetts. *Commonwealth* v. *Roxbury,* 9 Gray 451, 483; *East Boston Co.* v. *Commonwealth,* 203 Mass. 68, 72; 89 N.E. 236. See, also, *New Jersey Zinc Co.* v. *Morris Canal Co.,* 44 N.J. Eq. 398, 401; 15 Atl. 227; Gould on Waters, p. 62.

3. See, also *Tracey Elliott* v. *Earl of Morley,* Ch. Div. 51 Sol. Journal (1907), 625.

In California, the Acts of 1911 and 1917, upon which the City of Los Angeles bases its claim, grant the "tidelands and submerged lands" situated "below the line of mean high tide of the Pacific Ocean." [4] Petitioners urge that "ordinary high water mark" has been defined by the state court as referring to the line of the neap tides.[5] We find it unnecessary to review the cases cited or to attempt to determine whether they record a final judgment as to the construction of the state statute, which, of course, is a question for the state courts.

In determining the limit of the federal grant, we perceive no justification for taking neap high tides, or the mean of those tides, as the boundary between upland and tideland, and for thus excluding from the shore the land which is actually covered by the tides most of the time. In order to include the land that is thus covered, it is necessary to take the mean high tide line which, as the Court of Appeals said, is neither the spring tide nor the neap tide, but a mean of all the high tides.

In view of the definition of the mean high tide, as given by the United States Coast and Geodetic Survey,[6] that "Mean high water at any place is the average height of all the high waters at that place over a considerable period of time," and the further observation that "from theoretical considerations of an astronomical character" there should be "a periodic variation in the rise of water above sea level having a period of 18.6 years," [7] the Court of Appeals directed that in order to ascertain the mean high tide line with requisite certainty in fixing the boundary of valuable tidelands, such as those here in question appear to be, "an average of 18.6 years should be determined as near as possible." We find no error in that instruction.

The decree of the Court of Appeals is

Affirmed.

Mr. Justice McReynolds is of opinion that *Knight* v. *United States Land Assn.*, 142 U.S. 161, is controlling and that the decree of the District Court should be affirmed.

4. See Note 1.

5. See *Teschemacher* v. *Thompson*, 18 Cal. 11, 21; *Ward* v. *Mulford*, 32 Cal. 365, 373; *Eichelberger* v. *Mills Land & Water Co.*, 9 Cal. App. 628, 639; 100 Pac. 117; *Forgeus* v. *County of Santa Cruz*, 24 Cal. App. 193, 195; 140 Pac. 1092; *F. A. Hihn Co.* v. *City of Santa Cruz*, 170 Cal. 436, 442; 150 Pac. 62; *Oakland* v. *Wood Lumber Co.*, 211 Cal. 16, 23; 292 Pac. 1076; *Otey* v. *Carmel Sanitary District*, 219 Cal. 310, 313; 26 P. (2d) 308. In a number of cases the state court has referred to the limit of the shore as the "ordinary" high water mark. See *Wright* v. *Seymour*, 69 Cal. 122, 126; 10 Pac. 323; *Long Beach Co.* v. *Richardson*, 70 Cal. 206; 11 Pac. 695; *Oakland* v. *Oakland Water Front Co.*, 118 Cal. 160, 183; 50 Pac. 277; *Pacific Whaling Co.* v. *Packers' Association*, 138 Cal. 632, 635, 636; 72 Pac. 161; *People* v. *California Fish Co.*, 166 Cal. 576, 584; 138 Pac. 79. See, also, *Strand Improvement Co.* v. *Long Beach*, 173 Cal. 765, 770; 161 Pac. 975; *Miller & Lux* v. *Secara*, 193 Cal. 755, 761, 762; 227 Pac. 171.

6. "Tidal Datum Planes," Special Publication No. 135, p. 76.

7. *Id.* p. 81.

LUTTES ET AL. *v.* THE STATE OF TEXAS

(Excerpts)

In the Supreme Court of Texas

324 S.W. 2d 167 (1958)

GARWOOD, Justice.

The ultimate issue in this dispute between the State of Texas (defendant below, by consent, and respondent here) and the plaintiffs, Luttes et al. (our petitioners) is the title to some 3,400 acres of mud flats or former sea bottom in Cameron County lying along, and alleged to be accretions to, the mainland or westerly edge of the long, narrow lagoon known as Laguna Madre, about fifteen or twenty miles north of Port Isabel and the mouth of the Rio Grande River, and about fifteen miles south of Port Mansfield on the Laguna. The Laguna, of course, lies between the mainland on the west and, on the east, the long, narrow, sandy island called Padre, the eastwardly side of which latter is the shore of the Gulf of Mexico.

The flats abut to the west upon a line of the upland or mainland characterized by a steep angle of elevation, although the altitude of the land along this line is hardly enough to justify the name "bluff line" which the parties call it. This line was the original easterly boundary of the now admittedly valid 1829 grant of lands on the mainland from the Mexican State of Tamaulipas to Manuel de la Garza Sosa, to whose rights the petitioners-plaintiff have succeeded. The grant, known as Potrero de Buena Vista, stipulated as its easterly or seaward boundary the westerly "shore" of the Laguna.

In a trial to the court and upon elaborate fact findings by the trial judge, judgment went for the State and was affirmed by the Waco Court of Civil Appeals upon transfer. 289 S.W. 2d 357.

The property claim of the State in the premises is, of course, that of successor (since 1836) to the Mexican nation or state, which latter, prior to the grant, admittedly owned the bottoms and shores of public waters such as the Laguna, as well as the upland granted. At the date of the grant, and, indeed, for well over half a century thereafter, the area in suit was always covered by the waters of the Laguna and thus admittedly did not pass to the grantee at the time of the grant nor thereafter, unless at some time about the first quarter of the present century. Accordingly, had this suit occurred some half century sooner than it did, the result would admittedly have favored the State.

However, since some obscure date in the past, the area has been progressively rising in relation to the Laguna waters, with the result that it is now from 0.25 feet to 1 foot above mean sea level, in greater part above the line of "mean high tide" (as hereinafter explained) and covered by the waters, not as a regular daily, weekly or even monthly matter, but only at irregular intervals and in irregular amounts, although, from the rather meager record in this behalf, it cannot be said that the presence of sea water in substantial quantity is rare.

The petitioners-plaintiff say that under the evidence and applicable principles of law, the land has become, since some forty years ago, a part of the upland as distinguished from sea bottom or seashore and, having become such by a *genuine* process of accretion to the earlier upland, the title to it has accordingly passed from the State to them as upland owners. On the other hand, the respondent-defendant State contends: first, that, although the area in dispute may have long since ceased to be mere sea bottom, it is, nevertheless, not

upland or fast land, but seashore, as the latter term is defined by the Mexican (Spanish) law, which was admittedly in force at the date of the grant and thus controls thereafter the effect of the grant; that accordingly the area still belongs to the State, as admittedly it does if it is properly seashore. In the same connection, the State asserts that by the governing Mexican (Spanish) law, the landward or upper line of the "shore" is not the line of "mean high tide" (or "mean high water"; see "Tide and Current Glossary", Special Publication No. 228; Revised (1949) Ed., U.S. Dept. of Com., Coast & Geodetic Survey, p. 23), which applies only in respect of grants made by Texas after she adopted the common law in 1840, but a higher or more landward line. We are not certain as to the State's view of just what this line is in terms of practical determination, but the contention seems to be that it is either the highest—most landward—line reached by the waters on any one occasion that can be proved or perhaps the average of single highest annual lines for such years as to which proof is available. Storm high waters are admittedly not to be taken into consideration.

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Going back to the matter of sea water levels, there has never been any permanent measuring device ("tide gauge") at the particular area, the two nearest ones being each some 15 miles away in opposite directions, to wit, the tide gauge of the United States Government operated at Port Isabel since April, 1954 and a similar apparatus at Port Mansfield operated by the Humble Oil & Refining Company since June, 1947. These gauges reflect the changes in the water levels at all times, regardless of the cause of the change, and in such manner that the levels so determined with reference to mean sea level can be, as they were, accurately correlated with the corresponding levels of the flats in controversy.

Properly speaking the term "tide" means the regular and predictable perpendicular daily rise (or rises) and fall (or falls) of the waters as a result of astronomical forces, to wit, the gravitational pull of the sun and moon (mostly the latter) upon the earth. See Tide and Current Glossary, supra. The levels reached by tides vary from day to day and as between all other fixed periods of time, however long, and also as between different geographical areas. But water levels are also influenced by weather conditions, such as wind, temperature and atmospheric pressures, as well as by other factors not connected with astronomical forces and, of course, by combinations of all or part of the former. Thus water level changes, whether produced by astronomical or nonastronomical forces or by combination between the former and the latter are reflected by the tide gauges, which record the different levels attained, although they do not, as to any given level or reading, purport to record the cause as astronomical, nonastronomical or both.

As found by the trial court, and admitted by the parties to the suit, there is in the Laguna Madre relatively little tide in the true sense, although there are undoubtedly substantial and frequent, but irregular, variations in water levels during each day or longer period due to the influence of nonastronomical forces and conditions, sometimes in combination with astronomical tide conditions in the Gulf of Mexico. One of the factors causing, or substantially contributing to, higher water levels in the general area in suit is the presence of northerly winds in the period from early Fall to Spring, although, on the other hand, there have been recent instances of sea water overrunning the flats in midsummer. There is also present, and due in at least some part to astronomical forces, a progressive, slow

rise over the years of the general ("mean") sea level at an average rate of about 0.02 feet per year.

Thus, while on any one day we have the single variation between a highest level to a lowest, we have also the variation from what was the highest (or lowest) on that day and what is the highest (or lowest) on the next day. Similarly if we take the highest (or lowest) single instance that occurred in an entire year, it will ordinarily be different from a corresponding instance of the next or preceding year. And, of course, when we speak in general terms of the "highest water" *for* a given period longer than two days, we may mean that highest level of a particular day which is also higher than that reached on any other day of the period, or we may mean, perhaps, the sum of all the daily highs of the period (e.g., 365 in number for a year) divided by the number of days of the period (e.g., 365 in number for a year). If we mean the latter, such an average figure will necessarily be lower than the one highest annual level above mentioned. Moreover, the average figure, while it will vary from a similar average figure for a comparable period before or after that in question, will vary less than the single high of one such period varies from another, averages being always lower than a single highest as well as higher than a single lowest.

In the instant case, the trial court, either as a primary or secondary basis of his conclusion that the area in dispute was still "shore", under the Mexican (Spanish) law, took the one highest reading of the Humble gauge at Port Mansfield for each of the four years of gauge operation, added these four individual footage readings and divided the total by four, the result being a footage of 2.24 feet above mean sea level, or more than high enough to inundate the area in dispute. A similar result (2.64 feet) followed his similar calculation based on the ten-year Port Isabel gauge. (On account of the reference to the supposedly higher tides or waters *of winter* occurring in some statements as to the Mexican (Spanish) law of the seashore, it is interesting to note at this point that similar readings, and similar calculations therefrom by the trial judge, but using only the one highest reading during the *winter* of each year, produced substantially lower figures (1.56 feet, Humble, and 2.03 feet, Port Isabel) than those first above mentioned, although still high enough to inundate the flats.)

On the other hand, if the court had based his averages, not on the single highest reading of each year, i.e., one reading per year, but on day by day highest readings, i.e., 365 of them for one year, 1,460 for four years, 3,650 for ten years—adding them all together and dividing by the corresponding number of days, the resultant levels would have been much lower than those above mentioned upon which he actually relied and would have been, by and large, lower than the level of the flats. This is demonstrated by the court's own and uncontested findings to the effect that "mean high tide" or "mean high water" at the Humble gauge was only 0.416 feet above mean sea level and at the Port Isabel gauge only 0.56 feet, these levels being somewhat lower than the levels prevailing over most of the disputed area, especially at the perimeter thereof.

The terms last mentioned, as employed by the court and as universally understood, mean an average of all the daily highest readings over a long period. The proper period is one of approximately 19 years, since within such a period the astronomic forces affecting the water level go through a complete cycle. In localities in which tide gauge readings for so long a period are not available the accepted practice for determining "mean high tide" or "mean high water" is to take the daily local tide gauge readings for such periods as they

are available, provided it is not less than one year, and correct them by comparison with the nearest gauge which affords a record for 19 years, the corrected result being a substantially accurate approximation of true mean high tide at the locality in question over the 19-year cycle. See Tidal Datum Planes, U.S. Dept. of Com., Coast and Geod. Survey, Special Publication No. 135, Rev. Ed. (1951) p. 86 et seq.; Borax Consolidated v. City of Los Angeles, 296 U.S. 10, 56 S. Ct. 23, 80 L. Ed. 9.

Thus the difference between this "mean high tide", found by the court to be but about half a foot above mean sea level, and the much higher figure of about two and a half feet upon which he relied and which he found to represent the "highest" water levels (excluding storm conditions) is but a difference between the number of different highest water readings taken and averaged out in each instance. This difference of method, although both methods involve to lesser or greater degree an average or mean of highest levels, was undoubtedly intended by the court to reflect his view of the difference between the Anglo-American law concept of "shore" (as the area below the line of "mean high tide", "mean high water" or "ordinary high tide") and the alleged Mexican (Spanish) law concept (as, generally speaking, the area below the "highest" reach of the waters, limited only to the extent that such level be not due to storm type conditions).

As above indicated, and as more fully reflected in the opinion of the Court of Civil Appeals (289 S.W. 2d 357, 361 et seq.), the trial court made elaborate findings of fact, including amendments following his review of his original findings at the behest of the petitioners-plaintiff. These findings and his corresponding conclusions of law largely favored the contentions of the respondent-defendant State as heretofore outlined.

As to whether the area in dispute is or is not "shore", as distinguished from upland or fast land, there was evidence introduced by both sides, including some expert testimony. However, the petitioners-plaintiff are, in our opinion, correct in saying that this particular question, as now presented to us, is really a question or questions of law, to wit: (a) Was it error for the courts below to apply the Mexican (Spanish) law, as distinguished from the common law, and (b) if not, was the Mexican (Spanish) law yet correctly interpreted and applied with regard to the instant situation? If the views of the courts below on (a) and (b) are correct, the judgment below must be affirmed, regardless of the questions concerning accretion, because such fact findings as are relevant to the "shore" phase of the case are admittedly not without support in the evidence. Such findings, of course, include some that, on this aspect of the case, are conceivably the basis of ultimate rulings in favor of the petitioners-plaintiff, such as the mentioned finding that "mean high tide (or water)" as determined by the two mentioned tide gauges is lower than the level of the bulk of the area in controversy.

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We granted the writ of error largely in the hope of being able to eliminate the confusion that appears to exist at the Bar and otherwise as to what, in details of practical application to cases like the present, is the correct definition of the shore—the matter being obviously one of considerable public importance. We shall accordingly discuss that question first.

We harbor no doubt that the Mexican (Spanish) law, whatever it may be, in effect at the date of the grant, is what must furnish the applicable rule, and that such is the effect of every decision, observation or assumption that has ever been made by this Court on the subject, including those of as recent date as Rudder v. Ponder, 156 Tex. 185, 293 S.W. 2d

736; Giles v. Basore, 154 Tex. 366, 278 S.W. 2d 830, and State v. Balli, 144 Tex. 195, 190 S.W. 2d 71. We consider Humble Oil & Refining Co. v. Sun Oil Co., 5 Cir., 190 F. 2d 191, 191 F. 2d 705, certiorari denied 342 U.S. 920, 72 S. Ct. 367, 96 L. Ed. 687, as being to the same effect. Any confusion that may exist by reason of a previously somewhat unstudied use of the broad term "civil" law in texts and decisions, as distinguished from the applicable Mexican (Spanish) law, is confusion only as to what effect is to be given to the Roman law of Justinian's time in interpreting the vague terms of the Mexican (Spanish) law of several centuries later for application to the very practical question of fixing a line on the ground today.

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All this is not to deny, however, that since State v. Balli, and as a result thereof, a particular line, actually marked on the Laguna side of Padre Island, and which may actually be the line of mean high tide, is now the boundary of a large portion of the total shores of Laguna, that is, of the portion of such shores that was involved in the Balli case. Accordingly, should a line different from that of mean high tide be the result of the instant case, conceivably although not certainly, different kinds of boundaries will, as a matter of fact, prevail on the different sides of the Laguna.

There is, indeed, much to be said on principle for the thesis of substantial identity between the two rules in question in the light of modern conditions. The Mexican (Spanish) law provision, infra, with which we are mostly concerned, being written in the middle ages under circumstances vastly and variedly different from those under which we must now give it an exact application, a court can have no vast confidence in its own deductions, however "educated", as to the intent of the ancient Spanish law writers derivable from their few and quite general words, somewhat different in form from present day Spanish and conceivably different in meaning to their authors from what their formal modern counterpart would mean even to modern Spanish jurists. Nor can we rely with great confidence upon translations and interpretations made centuries later—often by non-Spaniards, whose expertness in the language and subject matter must largely be assumed from the fact that they presumed to write a tract or book about it or, being judges, had to write a judicial decision based on such relatively meagre knowledge as is, and has been, available. The inadequacy of all language, however wise and learned the source, is notorious when it comes to be applied to particular facts and conditions of a later and quite different age, which doubtless were not clearly contemplated by the authors.

The basic definition, of course, is that of the celebrated body of Spanish law known as *Las Siete Partidas,* which was evidently written in the 13th century and promulgated some three centuries later, and of which the critical portion of Partida 3, Title 28, Law 4 (from the so-called Lopez edition published at that time under governmental auspices at Salamanca) reads as follows:

> "* * * e todo aquel lugar es llamado ribera de la mar quanto se cubre el agua della, quanto mas crece en todo el ano, quier en tiempo del inuierno o del verano."

A rather literal translation of this ancient Spanish and 16th century printing thereof, according to our own modern ideas of what it says, is:

> "* * * and all that place is called shore of the sea insomuch as it is covered by the water of the latter, however most it grows in all the year, be it in time of winter or of summer."

The word "crece" (third person, singular, of the present tense of the intransitive verb "crecer", meaning, no doubt, to grow, increase, augment itself, expand or swell) does not seem of itself necessarily to imply either astronomical tide on the one hand or waves or "swells" on the other, although it is not necessarily inconsistent with either. At least in modern usage, and as far back as the first half of the eighteenth century, the related noun "creciente" sometimes means "rise of the water of the sea by effect of the tide (marea)". On the other hand, another related noun, "crecida", means a freshet, or sudden rise of a stream. See Diccionario de la Lengua Castellana by the Royal Spanish Academy (edition published during first half of the 18th century); also Vol. 1, p. 404, Diccionario Hispanico Universal, S.A. Horta de Impresiones y Ediciones, Barcelona; Velasquez, a New Pronouncing Dictionary of the Spanish and English Languages (1947).

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Rather obviously the original language does not define the upper line of the shore as the highest water levels of winter, whatever may have been stated to the contrary in some of our earlier opinions and in administrative pronouncements. Unless the sense has changed drastically with the centuries, it is inconsistent with such a construction in that it lays no more emphasis on winter than on summer.

Now whether the language confines the shore to that area regularly covered and uncovered by "tide" in the astronomical sense or permits it to be that highest "swell", wave or rise that may occur at this or that one particular hour or minute from whatever force other than storm conditions, the phrase, "in all the year" (en todo el ano), undoubtedly leaves a question as to *what year* is meant. Does it mean the last calendar year expiring before the litigation or other effort to fix the boundary on the ground, or some earlier year with a higher water level, or the kind of average of single highest annual levels over several years, on which the trial court alternatively relied in the instant case, or does it mean that where the *daily* highest levels over a period of years are of record and in evidence, these hundreds or thousands of highest levels should be averaged, and the average taken to be "however most it grows *in all the year*"?

Pretermitting for the moment the matter of interpretive authority, we think the language of the *partidas* of itself permits, and common sense suggests, a line based on a long term average of daily highest water levels, rather than a line based on some theory of occasional or sporadic highest waters. Indeed, such appears to us to be consistent with one of the primary arguments of the State itself to the effect that the true line should be one evidenced by more or less permanent markings on the ground of the kind ordinarily associated with the upper line of a shore. Whatever the aspect of the ground in the instant case, ordinarily a "shore line" is one characteristic of regular and frequent coverage by the sea, which in turn is much more closely related to an average of daily highest waters than to one, or an average of merely a few, highest annual readings.

While obviously the word, "average", or its equivalent, "mean", does not occur, both are suggested by the language as a whole, as the learned trial judge evidently recognized.

No particular year being indicated as that from which the so-called highest tide or water "in all the year" is to be taken, the inference is that a condition regularly prevailing over a number of years is what was intended, and this in turn suggests a mean taken over such a period. If, for example, the single highest water for each of the five years immediately prior to the litigation were in no instance higher than one foot above mean sea level, but were somehow shown to be three feet in one particular year long prior to the latest five years, it would hardly appear within the reasonable intendment of the law that we should forget the later years and fix the line at three feet according to the one more remote year. Conversely if the single highest reading for the year just preceding the trial were two feet, while those for each of nine or more years preceding the latest were not over one foot, it would seem unreasonable to require fixing the line at the two-foot level of the latest year, disregarding the lower "highest" levels of all the preceding years. And if we are to use some kind of "mean", as evidently we should, what is there in principle, or in the words of the basic law itself, to require such an average to be that of single highest annual readings for each of the several years in question, rather than one of daily highest readings for all of the days of such years? Both are averages of *highest water readings*. The only difference lies in the number of highest readings averaged.

The reference in the law to winter and summer does not necessarily require that some single highest water of which proof may be available shall determine the line. It appears simply to take care of a situation in which, by reason of a pronounced difference between seasonal levels, the area in question may over the years be regularly inundated, for example, each summer but only in summer. It has no significance in a situation such as the present in which such inundation as occurs is evidently irregular and with little regard for either summer or winter. It accordingly does not exclude the possibility of basing a line on an average of daily highest levels over a continuous and long period.

Obviously the greater the number of highest water readings averaged, the nearer we come to a figure, or level, which, applied to the ground as a line, will reflect a more regular and permanent shore characteristic than any other. The line will be the one at which the sea most regularly "stops with the shore", and, generally speaking, it will be the line at which the physical features commonly associated with the upper line of the shore most conspicuously appear. Thus it will normally be a more visible line, however it may be under the evidence of the instant case.

Of course, if the "highest" levels were substantially the same on every day, then there would be no such thing as a "single highest water", and thus "mean high water" would necessarily be the test under the Mexican (Spanish) law even as it is under the Anglo-American law. Actually, so far as real "tide" goes, that is the situation in the Laguna, since, as the trial court found, any astronomically inspired changes in levels are insignificant, and the variations are due to meteorological forces such as wind and air density. But these latter variations are quite substantial, both as between different periods of time and between different places with differing exposures to meteorological forces. The finding that the average of single annual highest water over periods of several years was several times as high as "mean high tide (water)" shows that the meteorologically inspired levels on which the former was based were quite extreme or exceptional with reference to the highest waters occurring from day to day. Thus should we base the line, as did the court, on these few exceptional levels, we are likely to have a line of shore which is not shore in the commonly accepted sense of being *regularly* covered and uncovered by water. It is

difficult to believe that the ancient writers of the *partidas* had in mind a shore which was different from the commonly accepted idea thereof. One thinks of shore more in terms of the water's edge than in terms of land which is only occasionally and irregularly inundated.

There are, moreover, sundry practical considerations presented in applying the ancient law to modern Texas, which the ancient writers, had they thought of them, would probably have considered relevant to a sound interpretation of their own words.

As before indicated, we believe it essential, as the learned trial judge seemed to suspect it might be, to proceed on the basis of averages over a period of years, whether the basis of the average be only a single highest reading for each of the years concerned or the vastly larger number of daily highest readings. This, in turn, necessitates the use of tide gauges in practically every case. Any proof of even the single highest annual levels from sources other than tide gauges will ordinarily be as unreliable as it will be difficult, and proof as to day by day highest levels would be impossible. At the same time, we know that the number of tide gauges along the hundreds of miles of Texas coast, much of which is remote from population centers, is relatively insignificant, while the number which has been operated as much as a year is smaller still. Obviously in a locality where there is no tide gauge that has been in existence for a good many years, there will be little reliable evidence of the various single highest annual levels upon which to base an average for all those years. So, in such instances, we would either have to rely upon the quite scarce and unreliable evidence from sources other than tide gauges or take the equally unreliable alternative of abandoning the system of averages altogether in favor of accepting proof of one or two instances of highest levels, which some eyewitness might claim to remember, as proof of what is the shore. Both alternatives seem undesirable.

A third and much more reliable alternative, however, is that of following the system of "mean high tide (water)", which in effect is but the average of highest water of each day rather than each year. If that rule is adopted, we can have, by installing a tide gauge for as little as one year near the area in question, the benefit of 365 highest readings upon which to base an average, that is, upon which to determine "mean high tide (water)" at that point for that one year. This mean level will obviously vary less from a corresponding level for earlier (or later) years than would a single highest annual level for one year vary from the respective highest annual levels of other years. Indeed, as before stated, upon the further and quite simple step of correction against the nearest tide gauge which has been in operation for the full 19-year tidal cycle, the one-year "mean high tide (water)" figure of the local gauge will reflect with reasonably close exactness the "mean high tide (water)" for the whole 19-year cycle. In other words, so far as most of the Texas coast is concerned, the only reliable way in which to obtain any sort of average of highest water levels is by use of the standard of "mean high tide (water)".

While this involves a delay of a year, it appears more practical than waiting several years in order to get an average of single highest annual waters over the longer period. In either event, the local tide gauge is necessary because, as stated, water levels vary considerably from place to place in the Laguna, particularly on account of varying exposures to meteorological forces, whereas, by adopting the "mean high tide (water)" standard, the period of tide gauge operation may be reduced to one year.

Now turning to the matter of authority, although there may be in the legal profession of this State a fairly widespread impression to the contrary, we do not consider the foregoing

interpretation or application of the *partidas* to encounter any insuperable obstacle in existing interpretive authority, whatever the source.

Actually much of the argument for the State rests on the Roman law as compiled, and no doubt rewritten, under the general title of *Corpus Juris Civilis* ("Body of the Civil Law") by order of the Emperor Justinian I, some fifteen hundred years before the present time and nearly a thousand years before publication of the *partidas*. Thus the law of the Romans, or at least Justinian's edition of it, is self-styled the "civil law" and is, moreover, today properly and actually referred to by that term, although the latter has also come to be often employed in a broader and somewhat loose sense, so as to include, besides the ancient Roman law, the laws of those nations of ancient Roman background, such as Italy, France, Spain and the so-called Latin-American offspring of the latter, all of which exist considerably more in code form than in court decisions. While as a matter of form, and possibly also of substance, there is, generally speaking, less similarity between the Corpus Juris Civilis and our Anglo-American decisional law (and statutes) than there is between the Corpus Juris Civilis and the codes of the other so-called "civil law" nations, the similarity in the latter instance is far from an identity, as counsel for the State properly concedes, and as State v. Grubstake Investment Association, 117 Tex. 53, 60, 297 S.W. 202, 204, expressly declares. And with particular reference to the sea shore, obviously the fact that the laws of two civilized nations separated by a thousand years both undertake to define such a universally familiar and important object as the shore does not indicate that the later law was intended by its authors to have the same meaning as the earlier, even were the terms respectively employed more similar than they actually are. Indeed, the contrary is suggested, when we consider that the Spanish law writers probably had access to the Roman law when they wrote their own in different terms. To say, as we did in State v. Balli, that certain provisions of the *partidas,* to wit, those dealing with alluvion and accretion, were "taken from" or "have their origin from" the Roman law, does not mean that even those particular provisions were intended as a mere paraphrase.

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The State not unnaturally relies also upon various opinions of this Court and other courts of this state, principally, and beginning with, City of Galveston v. Menard, 23 Tex. 349, from which the State and no doubt some portion of the Bar, deduced that the rule of "mean high tide" (average of the *daily highest tides* over a long period) which is the rule of the Anglo-American law, is not the rule of the Mexican (Spanish) law prevailing at the time we are considering; but that the latter rule declares for a higher line.

It cannot, of course, be denied that language in these opinions, especially in the Menard case, supports the State's position. But candor also requires the admission that this language is confusing as to exactly what the Mexican (Spanish) law rule is as applied to a case like the present or even as applied to the State's present view of what the rule exactly is. More importantly, it must also be conceded that in none of the cases in question did the decision turn on whether the Mexican (Spanish) rule was one other than "mean high tide".

In the first place, the Menard case and most of the others repeatedly speak of the Mexican (Spanish) rule (or "civil law" rule, as they generally call it) in terms of "tide", as distinguished from the State's present emphasis on "waves" and "swells". Moreover, they state the rule in terms of highest *winter* levels as if taking it from the Institutes, which, as we have stated, and as the State at one point seems to concede, is quite inconsistent with the

language of the governing law, to wit, the *partidas*. The language used is general, neither the Roman law nor the *partidas* being quoted or even referred to in specific terms, still less analyzed in critical fashion.

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Humble Oil & Refining Co. v. *Sun Oil Co.*, 5 Cir., 190 F. 2d 191, rehearing denied 191 F. 2d 705, a case somewhat similar to the present, was decided against the owners of the abutting Spanish and Mexican grants and in its opinions contains statements corresponding to the afore-mentioned dicta of our Texas courts as to a purported difference between the respective Mexican (Spanish) and Anglo-American definitions of the shore. However, after a thorough reconsideration of that decision, which we have previously considered in other litigation, we do not find it to be compelling authority on the point here under discussion. In the first place, we regard it as having rested primarily upon the fact findings of the trial judge to the effect that the accretions, upon which the private landowners had to rest their claim, were not accretions to their property, but to the property of the State—a matter hereinafter more fully discussed. In the second place, the language of the court concerning the definition of the shore was with reference to Texas lands, and thus necessarily influenced by the dicta on that subject in our own opinions. Our own interpretation of Mexican (Spanish) law as applied to Texas land titles is as binding on the federal courts in such a case as is our interpretation of any Texas land law in any matter of Texas land titles. And a federal court would naturally be more reluctant than we ourselves to disregard our language as dicta in a matter well within our exclusive competence.

It is, moreover, worth noting that the federal court did not adopt the interpretation which the State now seems to some extent to assert, to wit, that the definition in the *partidas* refers to the line of the highest "wave", as distinguished from tide. On the contrary, it used the same language of our own earlier decisions, "highest *tide* in *winter*", the "tide" and "winter" parts of which the State now appears to regard as less sacred than the one word "highest". The court, indeed, uses language indicating that it regards the shore like we have now concluded to regard it, to wit, as that part of the land regularly covered and uncovered by the tide, the upper line of which is best determined by the 19-year average of daily highest water readings.[2]

While several of our sister states were once subject to Spanish or Mexican rule and have accordingly had occasion to deal with Spanish or Mexican grants along tide water, we are cited to no decision from any of them applying, or declaring, the Spanish law definition as the dicta in our earlier decisions declare it or as the respondent-defendant would have us here declare and apply it. Indeed, the decisions from, or relating to, those states cited for the petitioners-plaintiff rather indicate their concept of the Spanish law rule to be the same as that of the Anglo-American law. Apalachicola Land & Development Co. v. McRae, Commissioner of Agriculture, 86 Fla. 393, 98 So. 505,

2. "The tide is the rising and falling of the waters of the sea that is produced by the attraction of the sun and moon, uninfluenced by special winds, seasons, or other circumstances * * * The tide delimits the shore, and it is no respecter of the conflict of laws. Meteorological influences may be inextricably involved with the rise and fall of the true astronomical tide, but we should distinguish them as meteorological tides. Other influences may be described as atmospheric meteorological tides, but such tides are undoubtedly very minute, in comparison with the true astronomical tide over a period of 18.6 years * * * Shore is sometimes said to be synonymous with 'flats' * * * but flats are not shore unless the tide ebbs and flows over them. * * *". 190 F. 2d 191, 195.

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517; Brickell v. Trammell, Governor, 77 Fla. 544, 82 So. 221, 227–229 (both by the Supreme Court of Florida); United States v. Pacheco, 2 Wall. 587, 17 L. Ed. 865; City and County of San Francisco v. Le Roy, 138 U.S. 656, 671, 11 S. Ct. 364, 34 L. Ed. 1096 (California cases involving Mexican grants along tide waters); New Orleans Land Co. v. Board of Levee Commissioners (a Louisiana Supreme Court case involving French and Spanish grants along Lake Pontchartrain), 171 La. 718, 132 So. 121, 122.

The American courts for Puerto Rico appear likewise to have regarded the Spanish definition as calling for the line of mean high water ("the highest *regular tide*"). People of Porto Rico v. Fortuna Estates, 1 Cir., 279 F. 500, 506, certiorari denied 259 U.S. 587, 42 S. Ct. 590, 66 L. Ed. 1077.

Theoretically, the rule of mean high tide is less favorable to the State in its capacity as a landowner than a rule based on a single instance of highest annual water or a mean of several such instances. But that is not a reason for our interpreting the law differently than we would if only private interests were involved. Moreover, we are far from sure that in actual practice the rule of mean high water is less favorable than a rule calling for a higher shore line that will always be vague and difficult of ascertainment until finally fixed on the ground after extended and complicated litigation. A result of the latter kind of rule may well be to give the abutting private landowner (and his mineral lessee) an advantage over the State in the inevitable litigation, because he has longer and better access to the kind of proof that will necessarily be involved in demonstrating whether on such and such an occasion in such and such a year or years one or more "highest waves" actually reached this or that irregular line on the ground. Another result may be to discourage the mineral leasing of tidal areas from the State by smaller operators who cannot run the risk of complicated boundary litigation in addition to the other risks of mineral exploration.

We sustain the contention of the petitioners-plaintiff that the applicable rule of the Mexican (Spanish) law is that of the average of highest daily water computed over or corrected to the regular tidal cycle of 18.6 years. This means in substance mean high tide.

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The judgment of the Court of Civil Appeals affirming that of the trial court is accordingly reversed and the cause remanded to the Court of Civil Appeals for further proceedings.

On Motion for Rehearing

Our original opinion has been criticized, and no doubt justly so, for some confusion as to whether the landward line of the shore as regards abutting Spanish or Mexican grants is that of mean high tide or mean higher high tide, since along the Texas coast there are generally two daily high tides and two daily low tides. While the difference, particularly in the Laguna Madre, is small, it conceivably could, in a given case, be substantial from the standpoint of acreage involved. It was our intention to hold, and we do hold, that the line under the Spanish (Mexican) law is that of mean higher high tide, as distinguished from the mean high tide of the Anglo-American law.

Certain *amici curiae* arguments on rehearing have urged that the shore at Surfside Beach in Brazoria County and various other Gulf beaches commonly used for public

recreation, will be much narrowed (from seaward to landward) and thus undesirably limited in usage, as the result of defining the shore line in terms of tide gauge readings. It is said that if we should base the shore line on the actual, day by day, reach of the highest water upon the beach, which can be observed, and the corresponding levels noted, about as easily as reading a local tide gauge, the altitude of an average line thus established will be very much higher than that of a line based on tide gauge readings and thus formed by the intersection with the land of a plane drawn through the level of mean higher high tide as determined by the tide gauge. In other words, it is said that the level of mean higher tide, as it exists on the beach itself, is one thing but, as determined by tide gauges is quite another. Presumably this would be no less true of the level of mean *high tide,* if that were the line involved.

The factual basis for this argument is allegedly reflected in a surveyor's report annexed to the corresponding brief on rehearing. The report in turn seems to rest on a single observation made at Surfside Beach on May 14, 1958, without comparison with a local tide gauge (the Galveston gauge some forty miles away being used), and its factual correctness is challenged by the respondents Luttes et al. Nor do we know of any decision concerning either the Spanish (Mexican) law shore line or the Anglo-American line of mean high tide, which rejects the use of tide gauges as the basis for fixing the line. As regards the line of mean high tide, Borax Consolidated v. City of Los Angeles, 296 U.S. 10, 56 S. Ct. 23, 80 L. Ed. 9, strongly suggests that the Court had tide gauge readings exclusively in mind; and if *that* line be thus properly defined in terms of tide gauge readings (and accordingly applied to the large portion of the Texas coast governed by the Anglo-American rule of mean high tide) it is hard to see how it should be otherwise with a line of mean higher high tide.

On the other hand, we are not bound by the Borax Consolidated case. And while Arts. 5415a (Sec. 3) and 7467, Vernon's Tex. Civ. Stats., use words such as "tide" and "high tide", the former also includes the phrase "lands covered by the waters of * * *." See City of Galveston v. Mann, 135 Tex. 319, 143 S.W. 2d 1028. Nor can we say for certain that the factual data supplied by *amici curiae* is wrong. Conceivably the winds or other physical forces do regularly cause the levels reached each day on the beach by the highest water to be far higher than the daily levels of highest water as shown by a tide gauge. Nor, however difficult it might now appear to us (or to the Surveyors Association of Texas, according to the report of its Boundary Commission of March 21, 1957, transmitted to the Commissioner of the General Land Office under date of April 1, 1957) to determine what the level of either mean higher high tide or mean high tide is in terms of the reach of water on the beach, can we be sure that is impossible, particularly having in mind such measuring techniques as science may hereafter afford.

Whatever may be the case as to that part of our shores governed by the Anglo-American rule of mean high tide, we do think it correct to say that the Spanish (Mexican) law concept of the shore is the area in which land is regularly covered and uncovered by the sea over a long period. If it be shown in a given case that the upper level of the shore, as actually covered and uncovered by the sea, is higher (or lower) than the level of mean higher high tide as determined by tide gauges, and if it also appears that an upper median line of the shore, as actually so regularly covered and uncovered, can be determined with reasonable accuracy otherwise than by exclusive resort to tide gauges, we do not by our opinion intend to foreclose such a case.

In the instant case, it is quite plain to us that the area in suit is not regularly covered and uncovered by the Laguna waters and has not been for a long time. To say that merely because there exists, at the western edge, a "bluff line" or a "vegetation line", marking where the waters at some undisclosed period in the past evidently did reach with regularity, the latter line is the line of mean higher high tide, would, in our opinion, be much less reasonable than to fix a line of mean higher high tide by exclusive resort to tide gauges. We have no doubt that the area in suit is fast land.

* * * * * * *

Subject to the modifications in our original opinion which are specified above, the motions for rehearing of both the petitioners and the respondent are overruled.

[Judge Smith dissented from the majority opinion on the ground that the determination of the shoreline by means of tidal observations was an artificial one and contended for the use of the vegetation line as better expressing the *Partidas* definition of seashore.]

APPENDIX E

Relation of the Tide to Property Boundaries

(This paper was prepared by the late Rear Admiral Raymond S. Patton, Director of the Coast and Geodetic Survey from 1929 to 1937, and was published in the December 1939 issue of the Field Engineers Bulletin of the Survey. It has been modified in a few instances to reflect present conditions and experiences, such amendments being shown as bracketed material or as footnotes.)

GENERAL

The grants, charters and conveyances which constitute the first links in the chains of title on which are based the present ownerships of lands along our seacoasts contain frequent reference to such boundaries as the high-water line, the high-tide line, the line of ordinary high water, etc., and similar reference to the opposite, or low stage of the tide. As a rule these references are indefinite to the point of ambiguity, primarily because of the inherently complex and variable character of the tidal phenomena, and secondarily because, at the time the early descriptions were written, either the significance of the first factor was not appreciated, or it was not considered of sufficient importance to require precise definitions of the phrases used.

The result is that our courts are called upon from time to time for precise and workable interpretations of these vague and ambiguous phrases. The frequency with which such interpretations are necessary is strikingly evident to the Coast and Geodetic Survey, which, as the agency of the Federal Government officially charged with the study and prediction of the tides, and the generally recognized authority in this country on that subject, is called upon many times each year for tabulations of tidal data applicable to this or that matter in litigation.

Statistical data, however, serve the ends of justice only to the extent that they are properly interpreted, and proper interpretation of tidal data is usually possible only when the tabulation is appraised against a background of pertinent scientific principles and physical facts pertaining to the situation under consideration.

Decisions which have come to the writer's attention sometimes contain imperfections which suggest that this background is not always made available to the court. For example, a decision which on more than one occasion has been submitted to the Coast and Geodetic Survey with a request for an opinion as to its meaning reads in part as follows:

> "The limit of the monthly spring tide is, in one sense, the usual high water mark, for, as often as those tides occur, to that limit the flow extends. But it is not the limit to which we refer when we speak of 'usual' or 'ordinary' high water mark. By that designation we mean the limit reached by the neap tides. That is, those tides which happen between the full and change of the moon twice in every twenty-four hours."

It is impossible from the language quoted, to be certain as to what the court had in mind. Strictly speaking, the neap tides are those which are caused by the moon and sun in quadrature. This happens once each fortnight, and the range of tide at that time, other factors being equal, differs by a considerable percentage of the total range from the average range for the entire period between the full and change of the moon.

The custom of regarding each decision rendered as a precedent to be taken into account by the courts when dealing with similar cases would seem to have a two-fold bearing upon the situation:

(1) It probably has some tendency to extend the application of imperfect decisions to subsequent cases in which the pertinent body of fact is closely similar.

(2) We could expect a similar tendency toward an *a priori* application of decisions, which were correct with respect to the underlying body of fact on which based, to matters which superficially seem identical, yet which a searching study of both cases would reveal as having important points of difference if only those concerned knew where to look for them.

The importance of our shore lands is rapidly increasing. Values in most of our coastal states have reached levels which demand accurate knowledge of the area involved in any conveyance. The riparian rights which accrue to the owner of the adjacent upland constitute an important factor in such values. There is a rapidly growing public interest in the proprietorship in the ripa which is inherent in the sovereignty of the people. On the Atlantic and Gulf coasts at least 10 states have formally created agencies to administer some or all aspects of this sovereignty. Six of these 10 agencies have been created or charged with this function within the past 4 or 5 years. As to the Pacific coast, the extent to which California is interesting herself in the subject is nationally known.

Everywhere there seems to be uncertainty and obscurity as to the specific application of the principles embodied in the law and the court decisions to the sites to which those principles must be applied. The need for a clarification of the whole subject is plainly indicated. That clarification can come only from a meeting of the legal and engineering minds.

Therefore, to the writer, as an engineer familiar with the true tide and the related phenomena which combine to produce those periodic fluctuations in the water's surface popularly known as the tide, it seems worth while to discuss, as briefly and with as little technical detail as possible, the physical factors which must serve as a background to any adequate consideration of this subject. The discussion will make no pretense of being a complete one. Rather, the thought is, by a hasty reconnaissance, to blaze a trail which may indicate the route to be followed by those who in due time may endeavor to go into the matter thoroughly. The writer would also emphasize that he has no knowledge of the law: if that fact becomes too strikingly apparent later he can only beg his readers' indulgence on the ground that he is merely trying to contribute his mite toward the needed achievement.

FACTORS WHICH PRODUCE THE TIDE

Four factors unite to produce the daily fluctuations in the elevation of the water surface which we call the tide. Each factor is complex, and three of the four are variable within themselves, and the great complexity and variability of the tide is due to the almost unlimited number of combinations into which these four factors can unite to produce

both differences at the same time at different points and differences at the same point at different times. These four factors are:

(1) The astronomic tide-producing forces.
(2) The unchanging configuration of the major ocean basins.
(3) The variable configuration of the minor tributary basins.
(4) Related terrestrial phenomena [essentially meteorological].

The Astronomic Tide-Producing Forces

The astronomic or true tide results from the force which we call gravitation. Newton's law is that the attractive force which one body will exert upon another varies directly as the mass of the attracting body and inversely as the square of the distance separating the two. The only two heavenly bodies which are close enough to the earth to have any tide-producing effect are the sun and the moon. The sun is many times larger than the moon, but the latter is so much closer to the earth that its tide-producing effect is a little more than double that of the sun.

Earth, moon and sun are in constant motion and in consequence their relationships to each other are constantly changing in both direction and distance. These changes are cyclical in character and in consequence of them the tides manifest certain directly related cycles of change.

It would take too long, and it is not pertinent, to describe how the sun and moon operate to produce the tides. It will be sufficient for our purpose to list the principal characteristics of the tide, and in connection therewith to state such facts as need to be taken into account.

1. During each period of slightly more than 24 hours we have [in most places] two high and two low waters. This rule, however, is not an invariable one either as to time or place. We may have only one high and one low water during that period, and sometimes one each and at others two each. We will revert to this subject when we consider our second major factor.

2. The high and low waters of each day occur about 50 minutes later than the corresponding ones of the preceding day. This lag corresponds and is related to the daily retardation in the time of the moon's meridian passage.

3. The range of tide at any point changes from day to day, passing through fortnightly cycles. When the moon is in its first and third quarters the tide producing forces of sun and moon are opposed to each other, and, other factors being equal, the tidal range attains the minimum of its cycle. This minimum tide is called the neap tide. Thereafter there is a gradual increase in range until the time of new or full moon. At that time moon and sun are pulling together and, again other factors being equal, the tidal range attains its maximum for the cycle and is known as the spring range. The neap range is usually about 20 percent less than the mean range, and the spring range about 20 percent greater than the mean range. Spring and neap tides seldom occur at the exact times when the moon is in its equivalent phases. There is usually a lag of from one to two days which is known as the phase age of the tide.

4. The moon travels around the earth during a lunar month of 27½ days, moving in an elliptical orbit which has the earth at one focus. Therefore the distance between moon

and earth is constantly changing, and the tidal range changes in consonance. When the moon is nearest the earth, or in perigee, the tidal range, known as the perigean range, is about 20 percent greater than the average, and when the moon is in apogee, or most distant from the earth, the range is about 20 percent less than the average and is known as the apogean range. There is a lag in the occurrence of the perigean and apogean tides similar to that which we noted with respect to the spring and neap tides.

5. The moon's orbit lies in a plane which is inclined to that of the earth's equator. Twice each lunar month, therefore, the moon will be momentarily in the plane of the equator; at all other times during the month the moon will be varying distances north or south of that plane.

As the earth rotates on its axis, points everywhere on the earth's surface describe circles which are in or parallel to the plane of the equator. They are, in other words, circles of latitude.

Now consider the moon's relation to two points at the opposite ends of any diameter of any circle of latitude. At the two moments each month when the moon is in the plane of the equator its relation to these two points is identical and if all other factors were equal the tides there would be the same. At all other times during the month the moon's relation to the two points is not the same, and consequently the tides will differ from each other to an extent which will depend on the distance of the moon north or south of the equator. Because of the earth's rotation these two points may be said to change places every 12 hours. Point *A* rotates to the spot occupied 12 hours earlier by point *B*, and vice versa. Consequently, the two tides, 12 hours apart, at either point *A* or point *B* will differ from each other in the same way as, under the preceding assumption, the tide at *A* differed from that at *B*. In other words, when the moon is on the equator the two tides of each day at any point tend to be the same, and when the moon is north or south of the equator the two tides will be unequal.

This difference is called the diurnal inequality. It changes continuously with the moon's declination. When the moon is on the equator the diurnal inequality is least, and the tides are called equatorial tides, and when the moon is at its greatest north or south declination the tides are called tropic tides. The effect of the diurnal inequality can be described in a general way by stating that it is equivalent to increasing the range of one tide at the expense of the other.

6. Changes in the relative positions of earth and sun result in cyclical changes in the component of the tide resulting from the sun's attraction. These changes are similar in kind to those already described, but (1) their magnitude is less, and (2) their periods are longer, being semiannual instead of fortnightly.

7. The foregoing variables may combine in numerous different ways to produce variations in the tide. Thus a spring tide and a perigean tide occurring simultaneously will produce an actual tide of exceptionally great range, while a neap and an apogean tide would give a correspondingly reduced range. A spring and an apogean tide, or a neap and a perigean would combine to give a range not far from the average.

8. Besides the daily and semidaily tide-producing forces, we find groups having periods of half a month to a year. In addition there is a variation in the range of tide resulting from the westward motion of the moon's node of about 19° a year, or a periodicity of 18.6 years.

The Unchanging Configuration of the Major Ocean Basins

As pointed out previously, the astronomic tide results from the tide-producing forces of the sun and moon and the relative positions of these two bodies with that of the earth. These forces are distributed in a regular manner over the surface of the earth, varying with the latitude. It will be observed at once, however, that although the tidal ranges vary, the variations bear no relation to latitude, being largely local or regional. What is it, therefore, which from the same causes produces such different effects?

For many years scientists held that the "progressive wave" theory furnished the answer. This theory considers the tides of the world as due principally to the action of the tidal forces on the broad and deep waters of the Southern Ocean where it was assumed these forces raised two tidal waves, 180° apart in longitude, which traversed this belt of water from east to west, forced by the moon to keep step with its own motion. These waves, sweeping around the southern latitudes, were supposed to generate secondary waves in the Atlantic and Pacific oceans, which traveled northward across the equator and into the Northern Hemisphere, impressing minor waves into all the water areas in their paths. The various tidal ranges observed then were explained by the amount the energy in the waves was concentrated due to the shape of the regions through which they traveled.

As tidal observations increased in number throughout the world, however, they did not give data to accord with this progressive wave theory, and at the beginning of this century there was evolved the "stationary wave" theory. This newer theory does away with the conception of a single world phenomenon and substitutes regional oscillating areas as the origin of the principal tides of the various oceans.

We are all familiar with a stationary wave oscillating in a small tank when one end is raised and immediately lowered. The whole mass of water moves rhythmically first to one end of the tank and then to the other, so that it is low water over one-half the tank at the same instant that it is high water over the other half, with a line across the middle about which the water oscillates, with no change in elevation.

This surge is repeated again and again with a gradually decreasing magnitude until finally the waters resume their normal state of rest. In such a tank the extent of the rise and fall of the water at the two ends will depend on the magnitude of the generating force, but the period of each oscillation across the tank is independent of the generating force. It depends solely on the length of the tank and the depth of the water in it.

If, however, the tank end be raised and lowered repeatedly at regular intervals, the period in which the water oscillates becomes equal to that of the disturbing force, but in all other respects the character of the oscillation will depend on the relation which the natural period of the tank bears to the period of the disturbing force. Thus, if the end of the tank be lifted each time at the exact instant when the water at that end has reached its greatest elevation, the oscillations will rise higher and higher until the water spills out. Conversely, if the end of the tank be raised at the instant when the water there is at its lowest point, the tendency will be to reduce and even destroy the oscillation.

This simple example very crudely suggests the basis for the stationary wave theory of the tides. The actual characteristics of the tides, as observed on all coasts of the world, can best be explained on the assumption that the waters of the oceans naturally divide themselves into basins, within each of which the waters oscillate somewhat in the manner above suggested. Each basin has its own natural period of oscillation, and is acted upon in

regular periods by the forces imposed by the sun and moon. The resulting tide in the basin will depend on the relation between the natural and the imposed periods.

We have noted that, except when the moon is on the equator, we usually have two unequal tides during the day. In other words, the actual tide may be said to be composed of a semidaily and a daily component. Some of these basins will respond better to one of the periodic forces of the sun and moon than to another. We will then have regions where the semidiurnal tide is predominating, other localities the diurnal tide, or in other words, in each of the various locations the stationary waves best developed are those whose forced periods most nearly approximate the natural period of oscillation of the particular oceanic area in question. For example, we find not only areas in the Pacific Ocean and Indian Ocean of the proper dimensions to sustain stationary waves with a period of 12 hours, but also those which give rise to a well-developed daily tide and thus we find considerable diurnal inequality in this area. As it is explained that this condition arises from the combination of a daily tide with a semidaily tide, the greater the daily constituent the greater the inequality. In the Atlantic Ocean the daily tide is not well developed because the period of oscillation of this basin is near that of the semidaily tide. Therefore, there is little diurnal inequality along its shores. Finally, there are a few localities where the semidiurnal factor disappears and we have but one high and one low water a day.

From the above brief discussion of the modern concept of the tides, it will be seen that tidal ranges taken over long periods of time to average out meteorological effects will be as unchanging as the great open seas in which they are generated.

There are basins, although small compared with the oceanic areas, which may be regarded as similar to large vibrating areas, and partly by this view the large tides in the Bay of Fundy and Cook Inlet are explained. Taking the Bay of Fundy, we find that its natural period of oscillation is about 12 hours, which coincides very nicely with the period of the ocean tide. This brings about a stationary wave movement within the bay that is sustained by the tide of the ocean, and, as shown previously, in this kind of a wave the rise and fall of the tide increases with the distance from the axis about which it oscillates. The tidal range is further increased near the head of the bay by the converging shore line and gradually decreasing depth, which confines the energy of the moving mass of water into a gradually decreasing volume. The increase in range between Cape Sable and Minas Basin approximates 365 percent.

South San Francisco Bay presents a somewhat similar case, although with less increase of range at the head. The mean range of tide at Golden Gate is 3.9 [4.0] feet, with a mean value of 7.6 [7.2] feet at Alviso, or a percentage increase of 90 percent. The size and depth of the basin are such that the type of tide is partly stationary and partly progressive and this helps to explain the increase in the mean range of tide in the upper reaches of the bay.

The Variable Configuration of the Minor Tributary Basins

The two factors heretofore discussed determine the characteristics of the true ocean tide. Those characteristics, save for the fluctuations of the definitely known cycles, are fixed and unchanging. The effect which the astronomical forces will exert at any future moment can be computed with mathematical accuracy. Only an inconceivable cataclysm could alter the great ocean basins sufficiently to have any perceptible effect upon their tides. Therefore we can safely say that a hundred, or a thousand, years hence the tides at any point of

the ocean remote from the disturbing effect of local influence will be the same as they are at present, except for major geologic changes.

But when the basins become so localized as to be susceptible of modification by either natural or artificial agencies, important changes in their tidal regimes may be expected to accompany physical changes which occur from time to time.

Such changes are constantly in progress in many small basins indenting the coasts of the United States. Along a shore composed of sand or other readily erodable material, the inlets, by which the tidal waters of the ocean enter and leave these basins, are in a state of great instability. The waves and currents of the ocean, and particularly certain powerful components which operate in the immediate vicinity of the shore in times of storm, carry large quantities of sand to the inlets and there deposit it with a consequent tendency to reduce the cross section of the inlet, retard the flow of tidal currents into and out of the basin, and cause the inlet to close. On the other hand, the regular tidal currents through the inlet exert an unceasing effort to scour away these deposits and maintain channels adequate to accommodate their flow.

Thus at each such inlet we have a continuous conflict between two opposing sets of forces—the one group striving to close it, the other to maintain or increase its channel. The condition of the inlet at any time reflects the vicissitudes of this struggle. If the inlet currents dominate the situation the inlet will have a deep, well-defined and unobstructed channel leading from the ocean to the basin. If the alongshore forces are the stronger the inlet gorge proper may be deep and free from obstruction, but at one or both ends of the gorge, delta-like shoals will be formed containing one or more narrow, tortuous channels along the lines of maximum current flow.[1]

For a given range of ocean tide and size of basin the condition of the inlet at any time will be an important, and usually the principal, factor in determining the range of tide in the basin. The shoals already described act like dams to cut off the flow in the lower levels. The retarding effect of friction is everywhere increased. Bends, and irregularities in the widths and depths of the channels disturb the smooth, regular, streamline flow of the waters, deflect one portion of the current against another, and tend toward a condition of turbulence. The accumulative effect of all these factors is that each basin at any moment has its own characteristic tidal range, and that this range is usually less, and occasionally very much less than the range in the adjacent ocean. Similar retarding influences exist elsewhere within the basin, with the result that the tidal range frequently decreases gradually with increasing distance from the inlet.

The variations in tidal range resulting from the foregoing factors are well illustrated by tidal observations made some years ago in Barnegat Bay, N.J. At this spot the range of ocean tide is 4.0 feet. At a point near the inner end of the inlet and distant ¾ mile from the ocean the range was 2.0 feet. At a point on the west shore of the bay, directly opposite the inlet and 4½ miles distant therefrom, the range was 0.8 foot. At Bay Head, the northern extremity of the bay, 21 miles from the inlet, the range was 0.7 foot.

Such examples could be multiplied indefinitely. If, in addition to the conditions we are now considering, we will keep in mind the opposite conditions as exemplified in

1. When the alongshore forces are the predominant ones, inlet migration is also a common phenomenon. *See,* for example, fig. 91 in this volume showing the progressive southerly movement of Barnegat Inlet, N.J., between 1839 and 1936.

San Francisco Bay, where the tidal range increases with increasing distance from the entrance, a brief examination of the column of mean tidal ranges, in the official *Tide Tables* published by the Coast and Geodetic Survey, will afford convincing evidence of the high degree of individuality and variability of the ranges in the basins along our coasts.

The foregoing illustrates varying mean ranges at different points in a basin at the same period of time. We likewise have variations in the range at a single point at different periods.

Basin ranges are reduced by the growth of shoals at the inlets, by the closing of one or more of the inlets through which the tidal waters enter and leave the basin, by the building up of mud flats and the growth of marsh within the basin, etc. Basin ranges are increased by storms which erode the shoals at the seaward end of the inlet, by freshets which augment the scouring effect of the tidal flow and produce a better channel through the inlet shoals, by the opening of a new inlet through the barrier beach which separate ocean and basin, etc.

Such changes have been accomplished artificially. Men have filled up inlets and converted tidal basins into tideless lagoons. Conversely, engineers working in aid to navigation have improved inlet channels and thereby materially increased basin ranges. A case in point occurs at the Coquille River, Oreg. Here the range of ocean tide is 5.2 feet. In 1880, the bar at the entrance had a low-tide depth of 3 feet and the range of tide inside was 3.3 feet. By 1928, artificial improvement had increased the bar depth to 13.5 feet and the range inside to 5.1 feet.

Related Terrestrial [Meteorological] Phenomena

By reason of certain influences of non-tidal origin, additional to the minor effects of the long-period forces already mentioned, the imaginary plane of sea level, above and below which the tides oscillate daily by approximately equal amounts, is itself subject to variations in elevation. Some of these affect the range of tide and others do not, but all affect the position of the contours along the margin of the land marked out by the high or low waters at different times.

Typical of these terrestrial [meteorological] factors are wind and barometric pressure. A storm wind of some days duration blowing from off the land toward the ocean has been known to reduce the water level adjacent to the shore as much as 3 feet below normal. Conversely, a wind blowing in the opposite direction will temporarily elevate the water surface an equal amount above normal.[2]

Variations in barometric pressure likewise bring about fluctuations in sea level. Indeed, as a first approximation, any arm of the sea may be regarded as a huge inverted water barometer. When the barometric pressure over this arm rises the level of the water will be lowered, while a decrease in the barometric pressure raises the level of the water. Thus, at any point on the coast sea level varies from day to day, from month to month, and from year to year. From one day to the next sea level may vary by a foot or more, and within the same year two values of daily sea level may differ by 5 feet or more. Monthly sea level is subject to variations of both periodic and nonperiodic character, so that within a year sea level for two different months may differ by as much as a

2. It is not uncommon to have the normal level of the water elevated by more than 3 feet. The depression of the water is usually less than the elevation.

foot. Yearly values of sea level may show differences of a quarter of a foot or even more.

MEAN VALUES OF TIDAL PLANES

By reason of all the foregoing complex variations the most convenient method of dealing with the relationships between the various phases of the tide is in terms of average or mean values. Thus, we have mean lower low water, mean low water, mean sea level, mean tide level, mean high water, mean higher high water, etc. Each of these expressions designates a more or less accurately determined average value, of the phase designated, usually expressed in terms of its vertical relationship to one or more of the others, or to permanently marked points on shore.

Obviously, the accuracy of determination of these mean values will depend on the length of the series of observations from which they are derived. If we start with no known relationships, a series several years in length is the minimum which gives an accuracy sufficient for present engineering purposes, and a series of 19 years will be even better, as it takes full account of the longest-period forces.

Series of such length, however, are necessary at only a few widely separated points so selected as to be indicative both of the various basin tides and of regional meteorological conditions. These furnish primary stations from which the relationships at secondary stations in their vicinity can be derived by comparisons based on much shorter periods of observations. A considerable number of these primary stations is already available in this country, so that it is today a relatively simple matter to obtain accurate knowledge of the tidal planes at most of the points where it may be needed.[3]

TIDAL CONTOURS AS PROPERTY BOUNDARIES

All the foregoing indicates the background of fact which must be taken into account in any adequate solution of this problem. We are now ready to deal with the problem itself.

It is no part of the writer's purpose to advocate any particular tidal contour, as, in theory, the proper one to separate the proprietorship of the state from that of the individual. While that question is very much in evidence at present, it is in principle one for determination by the jurist rather than the engineer. Therefore, solely for the purpose of definiteness and simplicity of discussion, mean high water will be assumed to have been adopted. The factors to be considered would be equally applicable to any other contour selected.

The problem then becomes one of so formulating the law or the court decision that it shall be so definite and specific that the engineer using standard engineering methods in applying it on the ground, can arrive at only one result. Our boundary is the line or contour along which the substantially horizontal plane of mean high water intersects the sloping surface of the land. We must recall that we are dealing here with two different relationships—vertical and horizontal.

Each mean plane is ascertained and perpetuated in terms of its vertical distance above or below permanently marked points called bench marks. The Federal Government has

3. Present-day terminology refers to these as "control tide stations." The number of such stations at which continuous tide observations are now available has been increased since 1937. There are now 70 such stations in conterminous United States as compared with 45 in 1937.

established this relationship at thousands of points along our coasts. Each determination makes possible the location, on adjacent parts of the shore, of the position of the contour of intersection. If for any reason the elevation of the plane be changed, the contour of intersection will be shifted along the sloping surface of the land.

Even though the elevation of the tidal plane remains unchanged, usually, from time to time, there will be appreciable horizontal changes in the position of the line along which the plane intersects the surface of the land. These changes result from the action of waves and currents in producing erosions from and accretions to the land. They are in progress all the time, and physiographically speaking, at a very rapid rate. In fact, this zone where land and water meet is, generally speaking, the scene of the most rapid and radical natural changes which occur anywhere on the earth's surface.

It is the writer's understanding that this variability in position of this line of intersection is generally recognized in the law; that erosions and accretions are regarded as acts of God, and that as the proprietor has no recourse from the loss suffered from the first, so he is entitled to the gain from the second—at least in those cases where the changes are so imperceptible that they cannot be noted from day to day. The following discussion assumes the correctness of that understanding.

On the Outer Coast

On the outer coast, the following considerations make the problem a simple one from the engineer's viewpoint.

For all practical purposes the elevations of the various mean tidal planes are fixed and unchanging, and their relation to adjacent bench marks is a constant one.[4] A possible exception to this rule occurs in the very infrequent case where an elevation or subsidence of the coast may be in progress. This exception, however, is not a serious one. In the first place, these geologic changes are usually so slow that generations are required for them to attain to appreciable amounts. In the second place, the coastal bench marks either are now or soon will be connected to the federal precise level net of the United States, so that any change in the relation between tidal plane and bench mark can be detected by leveling carried beyond the zone of earth movement.

The range of tide, and hence the elevation of the mean high-water line, varies from point to point along the coasts. The rate of change, however, is a very gradual one. Therefore, assuming a reasonable spacing of bench marks, it usually will be sufficiently accurate for the engineer who must indicate on the ground the momentary position of the mean high-water line, to start at the nearest bench mark, carry spirit levels to the pre-determined elevation of the line and then by the same method stake out along the beach the contour having that elevation throughout.

In the rare cases when the high-water plane has a more pronounced slope it would be a simple matter for the engineer to interpolate elevations between two adjacent bench marks (whose elevations with respect to each other can be derived from the federal precise level net) and to run his contour to conform thereto. We should recall, however, that a line

4. Studies made in recent years based on long-series observations indicate slow, secular changes in the relation of land and sea. For example, investigations indicate that in the last 40 years the relative rise of sea level along the Atlantic and Gulf coasts has been 0.011 foot per year; while along the Pacific coast, it has been 0.005 foot per year. For a discussion of this phenomenon, *see* Part 1 of this volume at 2311 A.

so marked would have no permanent value, as erosions and accretions eventually would make it inapplicable.

Along the outer coast, therefore, it should not be difficult for the legislature or the court to formulate a precise and unambiguous definition of any tidal contour adopted as a boundary, by stating it in terms of its elevation with respect to a series of bench marks along the coast, and possibly, as a further precaution, by stating the elevations of the bench marks in terms of the federal precise level net.

Application of the method is facilitated by the fact that for many sections of the coast all necessary data already exist in the archives of the Federal Government.

In the Basins

In the basins, the situation is much more complicated. Possibly it will be found that the method suggested for the outer coast can be applied here also, but certainly its application will be a proper one only if it takes careful account of the actual tidal regime of the basin.

I doubt whether there exists on any part of our coasts a natural basin—that is, one unimproved by man—where a contour derived from the elevation of mean high tide in the adjacent ocean and carried at that elevation around the basin by spirit levels would not depart more or less from the position of the true mean high-tide line of the basin. In short, in the basins the plane of mean high water is usually a tilted or warped surface, or a combination of both.

As an extreme case, consider Barnegat Bay, for which tidal data have already been given. That bay is bordered, particularly along parts of its western shore, by extensive areas of low, flat marsh or meadow, and the area which would be included between the true and the instrumental mean high-tide line could appropriately be measured in square miles rather than acres. At the opposite extreme we have San Francisco Bay as an example, where the mean high-tide line derived from the ocean would lie far out in the waters in some of the southern parts of the bay.

The writer would not imply that such discrepancies would survive in any litigation. He merely cites them as extreme examples, which differ only in degree and not in principle from cases which have come to his attention. The situation, while complicated, is not inherently difficult. Exact knowledge of the tidal regime of the basin will afford the solution.

Such knowledge in most cases is not available at the present time. While the tides in all or nearly all the basins on our coasts have been measured the work was done for other purposes and would require supplementing for this one. The additional work could be quickly and cheaply performed. A relatively short period of simultaneous observations at a number of points about the basin would afford data which, by comparison with those at a primary station, could be reduced to accurate mean values. Between the points thus determined interpolations would furnish intermediate values of adequate accuracy, and the method suggested for the outer coast could be applied. The value of the result would depend on the adequacy in number and location of the points at which the observations were made, and this matter should receive careful consideration by an experienced agency.

The foregoing relates to a sound engineering method of defining the present mean high-water line for future use. Sometimes it is necessary to ascertain the most probable position of that line as of some date in the remote past. The difficulties attending such

an effort afford the most conclusive argument for obviating similar future uncertainties regarding present conditions.

Usually after all obtainable data have been assembled it will be found that any determination which may be made is subject to considerable uncertainties. Surveys and maps must be used whose accuracy is problematical. Interpolations must be made between showings of conditions as of two more or less widely separated dates, which depend not only on the correctness of the showings as of the two dates, but also on an assumption of continuity in rate and character of change during the intervening period which may or may not have existed. Local testimony envelops the situation in a fog of uncertainty and contradiction.

In the last analysis, the difficulties are those of relative values. A century or more ago when the foundations for some of our present difficulties were laid, the methods and processes used, and the precautions taken, were such as were considered appropriate to the then existing values. No thought, or too little thought, was given to the future. Since that period values have increased tremendously; in many cases land is worth more per square foot today than it was per acre then. And so, in some regions, our court calendars are crowded with cases seeking authoritative determinations of questions for which the methods originally used would have afforded no adequate basis for determination even if they had not been further obscured by the lapse of time.

It does not seem to the writer that we are profiting as we should from these experiences. Nothing is more certain than that values will continue to increase, and that if we continue to act only in terms of present-day values our actions will be as inadequate for our successors a century in the future as those of our predecessors a century ago are now proving to us.

Especially in matters pertaining to this tidal boundary, on one side of which proprietorship is vested in the state, it would seem that we should hope for constructive, forward-looking vision adequate to meet the situation.

ARTIFICIAL CHANGES IN BASIN REGIMES

This is a subject of some importance at present, and which will become increasingly so in the future. Important cases within this category, involving property of considerable value, have been decided on bases which, insofar as the writer is informed, took no account of the human instrumentality involved; if so, presumably because that aspect of the matter was not brought to the attention of the court.

It has already been stated that artificial works of improvement at a basin can materially change its tidal regime, and here the question of responsibility, including the possibility of demonstrating that the same exists, becomes an interesting one. The first is a legal question, the latter essentially an engineering one.

To give concreteness to the picture let us again revert to Barnegat Bay. For many years the range of tide toward the northern end of the bay has been only a few inches and the physiography of the region has adjusted itself to that range. Now suppose that during some severe storm an inlet broke through the beach which separates bay from ocean. The range of tide in the bay would immediately be increased, probably to an extent which overflowed the low, flat meadowlands in the vicinity. This would be an act of God, for which no court would entertain a plea for relief from any damaged landowner.

But suppose that, without giving due thought to the consequences, men dug the same inlet, as has been attempted in more than one locality. Then it would seem to the layman

that the damaged property owner would have in theory a just cause for seeking damages, and to the engineer that the relation between cause and effect was so direct and obvious that the ground for an award of damages could readily be shown.

In other actual cases, however, this relationship between cause and effect is not so clear. In engineering work it is sometimes economical to resort to indirect means to accomplish a desired purpose, as when engineers, instead of resorting to a large amount of expensive dredging to remove a shoal or improve a channel, build a relatively inexpensive training wall which so deflects the current as to cause it to do the work for them. In such cases the change may be brought about so gradually, extending over such a period of years, that the relation between cause and effect becomes obscured and difficult of proof.

As this is written there is pending in a certain state a case involving the ownership of an island in the heart of one of our important seaports, in which the city is seeking to wrest title from a corporation now in possession. This case is one of a number of similar ones; the total values involved probably run well into the millions of dollars.

The case hinges on the question whether the island was covered by the tide at ordinary high water as of a certain date almost a century ago. The city can produce presumably reliable evidence to show that it was so covered some two decades ago. On the other hand, there is other evidence of a much earlier date, presumably of equal reliability and including official federal surveys, which indicate that the tract in question was then bare at high tide.

In the writer's opinion no actual contradiction is involved in these two seemingly conflicting groups of evidence. Between the two periods, to which the respective groups apply, extensive artificial improvements of the basin and its entrance were made which could scarcely have failed to result in a material increase in the tidal range, and as a result of this increase the island, which was of the typical marsh formation and therefore low and flat, could well have been bare at high tide at the earlier period and covered at the later one.

This case is typical of those in which the relation between cause and effect is difficult of proof. Tidal data taken in the basin prior to the beginning of the improvement would give a direct and conclusive answer to the problem. But if tidal observations were ever made they can no longer be found, and presumably the case will be decided on a basis of probabilities as indicated by other indirect and less conclusive evidence.

If this case were unique it would not merit the space which has been given it here. But it is not unique; it is a sign-post to point out the way to avoid countless similar controversies in the future. The development of our coastal basins is in its infancy. The next century will see progress of which we scarcely dream today. That progress will be brought about in large part by the states or their political subdivisions or agencies which also have a function of guarding the rights of their citizens. Factors in that guardianship pertinent to our subject are on the one hand to protect the individual from uncompensated damage and on the other hand to protect the citizens as a whole against excessive damage claims by individuals. To that protection an exact knowledge of physical conditions prior to improvement is an essential prerequisite, of which exact knowledge of the tidal boundary constitutes an important part.

APPENDIX F

Nautical Chart Symbols and Abbreviations

(Promulgated by the U.S. Coast and Geodetic Survey, the U.S. Naval Oceanographic Office, and the U.S. Lake Survey)

GENERAL REMARKS

Chart No. 1 contains the standard symbols and abbreviations which have been approved for use on nautical charts published by the United States of America.

Symbols and abbreviations shown on Chart No. 1 apply to the regular nautical charts and may differ from those shown on certain reproductions and special charts.

Terms, symbols and abbreviations are numbered in accordance with a standard form approved by a Resolution of the Sixth International Hydrographic Conference, 1952.

Vertical figures indicate those items where the symbol and abbreviation are in accordance with the Resolutions of the International Hydrographic Conferences.

Slanting figures indicate those items where the symbol and/or abbreviation differ from the Resolutions of the Conferences, or for which Resolutions do not yet exist.

(Those items which differ from the Resolutions are underlined.)

Slanting letters in parentheses indicate that the items are in addition to those shown on the approved standard form.

Colors are optional for characterizing various features and areas on the charts.

Lettering styles and capitalization as used on Chart No. 1 are not always rigidly adhered to on the charts.

Longitudes are referred to the Meridian of Greenwich.

Scales are computed on the middle latitude of each chart, or on the middle latitude of a series of charts.

Buildings - A conspicuous feature on a building may be shown by a landmark symbol with descriptive note (See L-63 & I-n). Prominent buildings that are of assistance to the mariner are crosshatched (See I-3a,5,47 & 66).

Shoreline is the line of Mean High Water, except in marsh or mangrove areas, where the outer edge of vegetation (berm line) is used. A heavy line (A-9) is used to represent a firm shoreline. A light line (A-7) represents a berm line.

Heights of land and conspicuous objects are given in feet above Mean High Water, unless otherwise stated in the title of the chart.

Depth Contours and Soundings may be shown in meters on charts of foreign waters.

Visibility of a light is in nautical miles for an observer's eye 15 feet above water level.

Buoys and Beacons - On entering a channel from seaward, buoys on starboard side are red with even numbers, on port side black with odd numbers. Lights on buoys on starboard side of channel are red or white, on port side white or green. Mid-channel buoys have black-and-white vertical stripes. Junction or obstruction buoys, which may be passed on either side, have red-and-black horizontal bands. This system does not always apply to foreign waters. The dot of the buoy symbol, the small circle of the light vessel and mooring buoy symbols, and the center of the beacon symbol indicate their positions.

Improved channels are shown by limiting dashed lines, the depth, month, and the year of latest examination being placed adjacent to the channel, except when tabulated.

U. S. Coast Pilots, Sailing Directions, Light Lists, Radio Aids, and related publications furnish information required by the navigator that cannot be shown conveniently on the nautical chart.

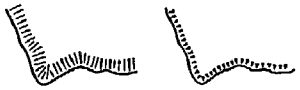
U. S. Nautical Chart Catalogs and Indexes list nautical charts, auxiliary maps, and related publications, and include general information (marginal notes, etc.) relative to the charts.

A glossary of foreign terms and abbreviations is generally given on the charts on which they are used, as well as in the Sailing Directions.

Charts already on issue will be brought into conformity as soon as opportunity affords.

A. The Coastline (Nature of the Coast)

1 *Shoreline unsurveyed*



2 *Steep coast (Bluff)*

2a *Flat coast*

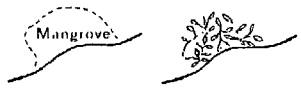
3 *Cliffy coast*

3a *Rocky coast*

4 *Sandhills; Dunes*

5 *Stony or Shingly shore*

6 *Sandy shore*



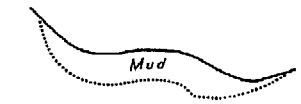
7 *Mangrove*

8 *Surveyed coastline*

9 *High water line*

10 *Low water line*

11 **Foreshore** *(Strand in general)*



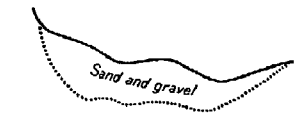
11a *Mud*

11b *Sand*

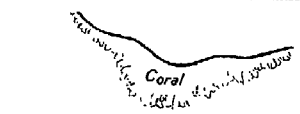
11c *Stones; Shingle; or Gravel*

11d *Rock, uncovers at sounding datum (See A-11g)*

11e *Sand and mud*

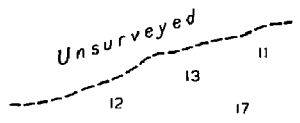


11f *Sand and gravel*

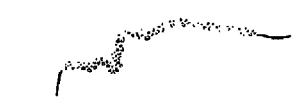


11g *Coral, uncovers at sounding datum (See O-10)*

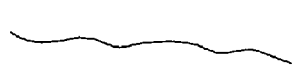
12 *Breakers along a shore (See O-25)*



14 *Limit of unsurveyed areas*



(Aa) *Rubble*

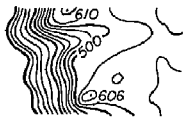


(Ab) *Shoreline from older surveys or small-scale charts*

B. Coast Features

1	**G**	Gulf
2	**B**	Bay
(Ba)	**B**	Bayou
3	**Fd**	Fjord
4	**L**	Loch; Lough; Lake
5	**Cr**	Creek
5a	**C**	Cove
6	**In**	Inlet
7	**Str**	Strait
8	**Sd**	Sound
9	**Pass**	Passage; Pass
	Thoro	Thorofare
10	**Chan**	Channel
10a		Narrows
11	**Entr**	Entrance
12	**Est**	Estuary
12a		Delta
13	**Mth**	Mouth
14	**Rd**	Road; Roadstead
15	**Anch**	Anchorage
16	**Hbr**	Harbor
16a	**Hn**	Haven
17	**P**	Port
(Bb)	**P**	Pond
18	**I**	Island
19	**It**	Islet
20	**Arch**	Archipelago
21	**Pen**	Peninsula
22	**C**	Cape
23	**Prom**	Promontory
24	**Hd**	Head; Headland
25	**Pt**	Point
26	**Mt**	Mountain; Mount
27	**Rge**	Range
27a		Valley
28		Summit
29	**Pk**	Peak
30	**Vol**	Volcano
31		Hill
32	**Bld**	Boulder
33	**Ldg**	Landing
34		Table-land (Plateau)
35	**Rk**	Rock
36		Isolated rock
(Bc)	**Str**	Stream
(Bd)	**R**	River
(Be)	**Slu**	Slough
(Bf)	**Lag**	Lagoon
(Bg)	**Apprs**	Approaches
(Bh)	Rky	Rocky

C. The Land (Natural Features)



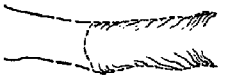
1 *Contour lines (Contours)*

1a *Contour lines, approximate (Contours)*

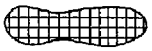
2 *Hachures*

2a *Form lines, no definite interval*

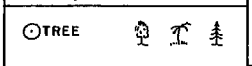
2b *Shading*



3 *Glacier*



4 *Saltpans*



5 *Isolated trees*

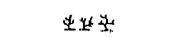
5a *Deciduous or of unknown or unspecified type*

5b *Coniferous*

5c *Palm tree*

5d *Nipa palm*

5e *Filao*



5f *Casuarina*

6 *Cultivated fields*

6a *Grass fields*

7 *Paddy (rice) fields*

7a *Park; Garden*

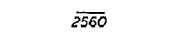
8 *Bushes*

8a *Tree plantation in general*

9 *Deciduous woodland*

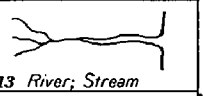
10 *Coniferous woodland*

10a *Woods in general*



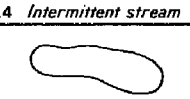
11 *Tree top elevation (above height datum)*

12 *Lava flow*



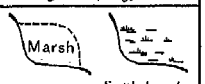
13 *River; Stream*

14 *Intermittent stream*



15 *Lake; Pond*

16 *Lagoon (Lag)*



17 *Marsh; Swamp*

18 *Slough (Slu.)*

19 *Rapids*

20 *Waterfalls*

21 *Spring*

D. Control Points

1	△		*Triangulation point (station)*
2	⊙		*Fixed point (landmark) (See L-63)*
3	· 256		*Summit of height (Peak) (when not a landmark)*
(Da)	◎ 256		*Peak, accentuated by contours*
(Db)	✳ 256		*Peak, accentuated by hachures*
(Dc)	✳		*Peak, elevation not determined*
(Dd)	⊙ 256		*Peak, when a landmark*
4	⊕	Obs Spot	*Observation spot*
5		BM	*Bench mark*
6	∘	See View	*View point*
7			*Datum point for grid of a plan*
8			*Graphical triangulation point*
9		Astro	*Astronomical*
10		Tri	*Triangulation*
(De)		C of E	*Corps of Engineers*
12			*Great trigonometrical survey station*
13			*Traverse station*
14		Bdy. Mon	*Boundary monument*
(Df)	◈		*International boundary monument*

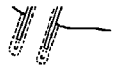
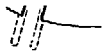
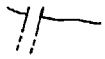
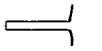
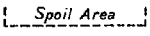
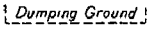
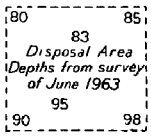
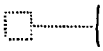
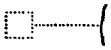
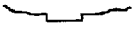
E. Units

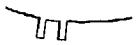
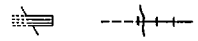
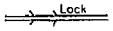
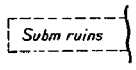
1	hr	*Hour*	12b	cd	*Candela (new candle)*
2	m. min	*Minute (of time)*	13	lat	*Latitude*
3	sec	*Second (of time)*	14	long	*Longitude*
4	m	*Meter*	15	pub	*Publication*
4a	dm	*Decimeter*	16	Ed	*Edition*
4b	cm	*Centimeter*	17	corr	*Correction*
4c	mm	*Millimeter*	18	alt	*Altitude*
4d	m^2	*Square meter*	19	ht; elev	*Height; Elevation*
4e	m^3	*Cubic meter*	20	°	*Degree*
5	km	*Kilometer*	21	′	*Minute (of arc)*
6	in	*Inch*	22	″	*Second (of arc)*
7	ft	*Foot*	23	No	*Number*
8	yd	*Yard*			
9	fm	*Fathom*			
10	cbl	*Cable length*			
11	M	*Nautical mile*	*(Ea)*	St. M	*Statute mile*
12	kn	*Knot*	*(Eb)*	Msec	*Microsecond*
12a	t	*Ton*			

F. Adjectives, Adverbs and other abbreviations

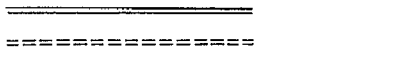
1	gt	*Great*
2	lit	*Little*
3	lrg	*Large*
4	sml	*Small*
5		*Outer*
6		*Inner*
7	mid	*Middle*
8		*Old*
9	anc	*Ancient*
10		*New*
11	St	*Saint*
12	conspic	*Conspicuous*
13		*Remarkable*
14	D., Destr	*Destroyed*
15		*Projected*
16	dist	*Distant*
17	abt	*About*
18		*See chart*
18a		*See plan*
19		*Lighted; Luminous*
20	sub	*Submarine*
21		*Eventual*
22	AERO	*Aeronautical*
23		*Higher*
24	exper	*Experimental*
25	discontd	*Discontinued*
26	prohib	*Prohibited*
27	explos	*Explosive*
28	estab	*Established*
29	elec	*Electric*
30	priv	*Private, Privately*
31	prom	*Prominent*
32	std	*Standard*
33	subm	*Submerged*
34	approx	*Approximate*
(Fa)	unverd	*Unverified*
(Fb)	AUTH	*Authorized*
(Fc)	CL	*Clearance*
(Fd)	maintd	*Maintained*
(Fe)	aband	*Abandoned*
(Ff)	cor	*Corner*
(Fg)	concr	*Concrete*
(Fh)	fl	*Flood*
(Fi)	extr	*Extreme*
(Fj)	mod	*Moderate*
(Fk)	bet	*Between*
(Fl)	1st	*First*
(Fm)	2nd	*Second*
(Fn)	3rd	*Third*
(Fo)	4th	*Fourth*

G. Ports and Harbors

1		Anch	*Anchorage (large vessels)*
2		Anch	*Anchorage (small vessels)*
3		Hbr	*Harbor*
4		Hn	*Haven*
5		P	*Port*
6		Bkw	*Breakwater*
6a			*Dike*
7			*Mole*
8			*Jetty (partly below MHW)*
8a			*Submerged jetty*
(Ga)			*Jetty (small scale)*
9		Pier	*Pier*
10			*Spit*
11			*Groin (partly below MHW)*
12		ANCH PROHIB	*Anchorage prohibited (See P-25)*
13			*Spoil ground*
(Gb)			*Dumping ground*
(Gc)			*Disposal area*
14		Fsh stks	*Fisheries; Fishing stakes*
14a			*Fish trap; Fish weirs (actual shape charted)*
14b			*Duck blind*
15			*Tunny nets (See G-14a)*
15a		Oys	*Oyster bed*
16		Ldg	*Landing place*
17			*Watering place*
18		Whf	*Wharf*
19			*Quay*

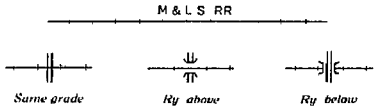
20			*Berth*
20a			*Anchoring berth*
20b	3		*Berth number*
21		Dol.	*Dolphin*
22			*Bollard*
23			*Mooring ring*
24			*Crane*
25			*Landing stage*
25a			*Landing stairs*
26		Quar	*Quarantine*
27			*Lazaret*
28		Harbor Master	*Harbor master's office*
29		Cus. Ho.	*Customhouse*
30			*Fishing harbor*
31			*Winter harbor*
32			*Refuge harbor*
33		B. Hbr.	*Boat harbor*
34			*Stranding harbor (uncovers at LW)*
35			*Dock*
36			*Dry dock (actual shape on large-scale charts)*
37			*Floating dock (actual shape on large-scale charts)*
38			*Gridiron; Careening grid*
39			*Patent slip; Slipway; Marine railway*
39a		Ramp	*Ramp*
40			*Lock (point upstream) (See H-13)*
41			*Wet dock*
42			*Shipyard*
43			*Lumber yard*
44		Health Office	*Health officer's office*
45		Hk	*Hulk (actual shape on lrg. scale charts) (See O-11)*
46		PROHIB AREA	*Prohibited area*
47			*Anchorage for seaplanes*
48			*Seaplane landing area*
49			*Work in progress*
50			*Under construction*
(Gd)			*Submerged ruins*

H. Topography (Artificial Features)



1 *Road* (Rd) *or Highway* (Hy)

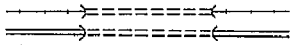
2 *Track, Footpath, or Trail*



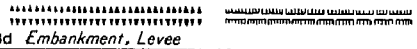
3 *Railway* (Ry) *(single or double track); Railroad* (RR)

3a Tramway

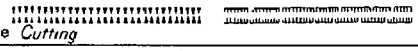
3b *Railway station*



3c *Tunnel (railroad or road)*

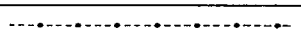


3d *Embankment, Levee*



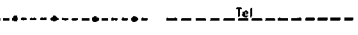
3e *Cutting*

4 *Overhead power cable* (OVHD PWR CAB)



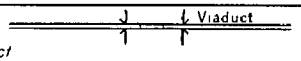
5 *Power transmission line*

5a Power transmission mast

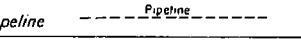


6 *Prominent telegraph or telephone line*

7 Aqueduct; Water pipe



8 *Viaduct*

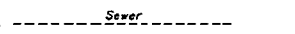


8a Oil pipeline

9 Pile; Piling; Post (above MHW) (See L-59, 0-30)

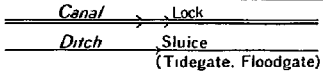
9a Mast

10 *Highway (See H-1)*

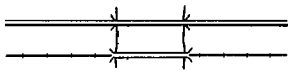


11 Sewer

12 Culvert



13 Canal; Ditch, Lock, Sluice (point upstream)



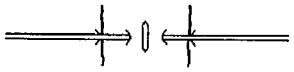
14 *Bridge* (BR) *in general*

14a Stone, concrete bridge (Same as H-14)

14b Wooden bridge (Same as H-14)

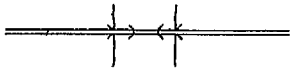
14c Iron bridge (Same as H-14)

14d Suspension bridge (Same as H-14)

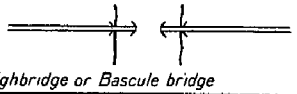


15 *Drawbridge (in general)*

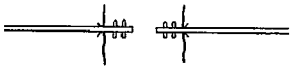
16 *Swing bridge (Same as H-15)*



16a Lift bridge



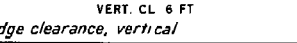
16b Weighbridge or Bascule bridge



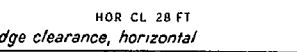
17 *Pontoon bridge*

17a Footbridge

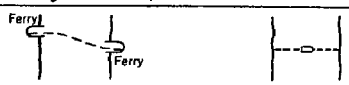
18 Transporter bridge (Same as H-14)



18a *Bridge clearance, vertical*



18b *Bridge clearance, horizontal*



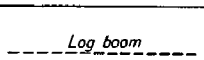
19 *Ferry* (Fy)

20 Ford

21 *Dam*

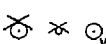
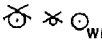
22 Fence

23 Training wall



(Ha) Log boom

I. Buildings and Structures (see General Remarks)

1			*City or Town (large scale)*
(1a)			*City or Town (small scale)*
2			*Suburb*
3		Vil	*Village*
3a			*Buildings in general*
4		Cas	*Castle*
5			*House*
6			*Villa*
7			*Farm*
8		Ch	*Church*
8a		Cath	*Cathedral*
8b		Spire	*Spire; Steeple*
8c			*Christian Shrine*
9			*Roman Catholic Church*
10			*Temple*
11			*Chapel*
12			*Mosque; Minaret*
(1b)			*Moslem Shrine*
13			*Marabout*
14		Pag	*Pagoda*
15			*Buddhist Temple; Joss-House*
15a			*Shinto Shrine*
16			*Monastery; Convent*
17			*Calvary; Cross*
17a			*Cemetery, Non-Christian*
18			*Cemetery, Christian*
18a			*Tomb*
19			*Fort (actual shape charted)*
20			*Battery (Same as 1-19)*
21			*Barracks*
22			*Powder magazine*
23			*Airplane landing field*
24			*Airport, large scale (See P-13)*
(1c)			*Airport, military (small scale)*
(1d)			*Airport, civil (small scale)*
25			*Mooring mast*
26		St	*Street*
26a		Ave	*Avenue*
(1e)		Blvd	*Boulevard*
27		Tel	*Telegraph*
28		Tel.Off	*Telegraph office*
29		P O	*Post office*
30		Govt. Ho	*Government house*
31			*Town hall*
32		Hosp	*Hospital*
33			*Slaughterhouse*
34		Magz	*Magazine*
34a			*Warehouse; Storehouse*
35			*Monument*
36			*Cupola*
37			*Elevator; Lift*
(1f)		Elev	*Elevation; Elevated*
38			*Shed*
39			*Zinc roof*
40			*Ruins*
41			*Tower*
42			*Windmill*
43			*Watermill*
43a			*Windmotor*
44			*Chimney; Stack*
45			*Water tower; Standpipe*
46			*Oil tank*
47			*Factory*
48			*Saw mill*
49			*Brick kiln*
50			*Mine; Quarry*
51			*Well*
52			*Cistern*
53			*Tank*
54			*Noria*
55			*Fountain*

I. Buildings and Structures (continued)

61		Inst	*Institute*
62			*Establishment*
63			*Bathing establishment*
64		Ct Ho	*Courthouse*
65		Sch	*School*
(Ig)		H. S	*High school*
(Ih)		Univ	*University*
66	▪ ▨ ▫	Bldg	*Building*
67		Pav	*Pavilion*
68			*Hut*
69			*Stadium*
70		T	*Telephone*
71	⊕ •		*Gas tank; Gasometer*
72	⊙GAB	°Gab	*Gable*
73			*Wall*
(Ii)		Ltd	*Limited*
(Ij)		Apt	*Apartment*
(Ik)		Cap	*Capitol*
(Il)		Co	*Company*
(Im)		Corp	*Corporation*
(In)	⊙		*Landmark (conspicuous object)*
(Io)	○		*Landmark (position approx.)*

J. Miscellaneous Stations

1		Sta	*Any kind of station*
2		Sta	*Station*
3	C.G		*Coast Guard station (Similar to LS. S.)*
(Ja)	⊙C.G WALLIS SANDS		*Coast Guard station (when landmark)*
4	⊙LOOK.TR		*Lookout station; Watch tower*
5			*Lifeboat station*
6	LS. S		*Lifesaving station (See J-3)*
7		Rkt. Sta	*Rocket station*
8	⊙PIL. STA		*Pilot station*
9		Sig Sta	*Signal station*
10		Sem	*Semaphore*
11		S Sig Sta	*Storm signal station*
12			*Weather signal station*
(Jb)	⊙W.B. SIG. STA		*Weather Bureau signal station*
13			*Tide signal station*
14			*Stream signal station*
15			*Ice signal station*
16			*Time signal station*
17			*Time ball*
18			*Signal mast*
19	⊙FS ⊙FP °FS °FP		*Flagstaff; Flagpole*
(Jc)	⊙F. TR	°F.Tr	*Flag tower*
20			*Signal*
21		Obsy	*Observatory*
22		Off	*Office*
(Jd)	°BELL		*Bell (on land)*
(Je)	°HECP		*Harbor entrance control post*

K. Lights

1		*Position of light*	29	F Fl	*Fixed and flashing light*
2	Lt	*Light*	30	F Gp Fl	*Fixed and group flashing light*
(Ka)		*Riprap surrounding light*	31	Rot	*Revolving or Rotating light*
3	Lt Ho	*Lighthouse*	(Kbb)	Mo	*Morse code*
4	AERO	*Aeronautical light (See F-22)*	41		*Period*
4a		*Marine and air navigation light*	42		*Every*
5	Bn	*Light beacon*	43		*With*
6		*Light vessel, Lightship*	44		*Visible (range)*
8		*Lantern*	(Kc)	M	*Nautical mile (See E-11)*
9		*Street lamp*	(Kd)	m. min	*Minutes (See E-2)*
10	REF	*Reflector*	(Ke)	sec	*Seconds (See E-3)*
11	Ldg Lt	*Leading light*	45	Fl	*Flash*
12	RED	*Sector light*	46	Occ	*Occultation*
13	RED GREEN	*Directional light*	46a		*Eclipse*
			47	Gp	*Group*
14		*Harbor light*	48	Occ	*Intermittent light*
15		*Fishing light*	49	SEC	*Sector*
16		*Tidal light*	50		*Color of sector*
17	Priv maintd	*Private light (maintained by private interests; to be used with caution)*	51	Aux	*Auxiliary light*
			52		*Varied*
21	F	*Fixed light*			
22	Occ	*Occulting light*			
23	Fl	*Flashing light*	61	Vi	*Violet*
24	Qk Fl	*Quick flashing (scintillating) light*	62		*Purple*
24a	I Qk Fl Int Qk Fl	*Interrupted quick flashing light*	63	Bu	*Blue*
(Kb)	E Int	*Equal interval (isophase) light*	64	G	*Green*
25a	S Fl	*Short flashing light*	65	Or	*Orange*
26	Alt	*Alternating light*	66	R	*Red*
27	Gp Occ	*Group occulting light*	67	W	*White*
28	Gp Fl	*Group flashing light*	67a	Am	*Amber*
28a	S-L Fl	*Short-long flashing light*	68	OBSC	*Obscured light*
28b		*Group short flashing light*	(Kf)	Fog Det Lt	*Fog detector light (See Nb)*

K. Lights (continued)

69		*Unwatched light*	*79*		*Front light*
70	Occas	*Occasional light*	*80*	Vert	*Vertical lights*
71	Irreg	*Irregular light*	*81*	Hor	*Horizontal lights*
72	Prov	*Provisional light*	*(Kh)*	VB	*Vertical beam*
73	Temp	*Temporary light*	*(Ki)*	RGE	*Range*
(Kg)	D Destr	*Destroyed*	*(Kj)*	Exper	*Experimental light*
74	Exting	*Extinguished light*	*(Kk)*	TRLB	*Temporarily replaced by lighted buoy showing the same characteristics*
75		*Faint light*			
76		*Upper light*	*(Kl)*	TRUB	*Temporarily replaced by unlighted buoy*
77		*Lower light*	*(Km)*	TLB	*Temporary lighted buoy*
78		*Rear light*	*(Kn)*	TUB	*Temporary unlighted buoy*

L. Buoys and Beacons (see General Remarks)

1		*Position of buoy*	16	"1"	*Port-hand buoy (entering from seaward)*
2		*Light buoy*	17	RB RB	*Bifurcation buoy (RBHB)*
3	BELL	*Bell buoy*	18	RB RB	*Junction buoy (RBHB)*
3a	GONG	*Gong buoy*	19	RB RB	*Isolated danger buoy (RBHB)*
4	WHIS	*Whistle buoy*	20	RB G	*Wreck buoy (RBHB or G)*
5	C	*Can or Cylindrical buoy*	20a	RB G	*Obstruction buoy (RBHB or G)*
6	N	*Nun or Conical buoy*	21	Tel	*Telegraph-cable buoy*
7	SP	*Spherical buoy*	22		*Mooring buoy (colors of mooring buoys never carried)*
8	S	*Spar buoy*	22a		*Mooring*
8a	P	*Pillar buoy*	22b	Tel	*Mooring buoy with telegraphic communications*
9		*Buoy with topmark (ball) (See L-70)*	22c	T	*Mooring buoy with telephonic communications*
10		*Barrel or Ton buoy*	23		*Warping buoy*
			24	Y	*Quarantine buoy*
(La)		*Color unknown*	25	Explos Anch	*Explosive anchorage buoy*
(Lb)	FLOAT	*Float*	25a	AERO	*Aeronautical anchorage buoy*
12	FLOAT	*Lightfloat*	26	Deviation	*Compass adjustment buoy*
13		*Outer or Landfall buoy*	27	BW	*Fish trap buoy (BWHB)*
14	BW	*Fairway buoy (BWVS)*	27a		*Spoil ground buoy*
14a	BW	*Mid-channel buoy (BWVS)*	28		*Anchorage buoy (marks limits)*
15	R "2"	*Starboard-hand buoy (entering from seaward)*	29	Priv maintd	*Private buoy (maintained by private interests, use with caution)*

L. Buoys and Beacons (continued)

30			Temporary buoy (See Kk, l, m, n)
30a			Winter buoy
31		HB	Horizontal stripes or bands
32		VS	Vertical stripes
33		Chec	Checkered
(Lc)		Diag	Diagonal buoy
41		W	White
42		B	Black
43		R	Red
44		Y	Yellow
45		G	Green
46		Br	Brown
47		Gy	Gray
48		Bu	Blue
(Ld)		Am	Amber
(Le)		Or	Orange
51			Floating beacon
52	△RW Bn △W Bn ▲R Bn		Fixed beacon (unlighted or daybeacon)
	▲ Bn		Black beacon
	△ Bn		Color unknown
(Lf)	⊙MARKER		Private aid to navigation
53		Bn	Beacon, in general (See L-52)
54			Tower beacon

55			Cardinal marking system
56	△ Deviation Bn		Compass adjustment beacon
57			Topmarks (See L-9, 70)
58			Telegraph-cable (landing) beacon
59	° Piles		Piles (See O-30, H-9)
	⊥⊥		Stakes
	° Stumps		Stumps (See O-30)
	⊥⊥		Perches
61	⊙CAIRN	° Cairn	Cairn
62			Painted patches
63	⊙		Landmark (conspicuous object) (See D-2)
(Lg)	o		Landmark (position approximate)
64		REF	Reflector
65	⊙MARKER		Range targets, markers
(Lh)	W Or	W Or	Special-purpose buoys
70	Note: TOPMARKS on buoys and beacons may be shown on charts of foreign waters. The abbreviation for black is not shown adjacent to buoys or beacons.		
(Li)		Ra Ref	Radar reflector (See M-13)

M. Radio and Radar Stations

1	°R. Sta	*Radio telegraph station*
2	°R. T	*Radio telephone station*
3	⊙ R. Bn	*Radiobeacon*
4	⊙ R. Bn	*Circular radiobeacon*
5	⊙ R.D	*Directional radiobeacon; Radio range*
6		*Rotating loop radiobeacon*
7	⊙ R.D.F	*Radio direction finding station*
(Ma)	⊙ TELEM ANT	*Telemetry antenna*
9	⊙ R. MAST ⊙ R. TR	*Radio mast* *Radio tower*
(Mb)	⊙ TV TR	*Television tower*
10	⊙ R. TR. (WBAL) 1090 Kc	*Radio broadcasting station (commercial)*
10a	°R. Sta	*Q.T.G Radio station*
11	⊙ Ra	*Radar station*
12	⊙ Racon	*Radar responder beacon*
13	Ra Ref	*Radar reflector (See Lj)*
14	Ra (conspic)	*Radar conspicuous object*
14a		*Ramark*
15	D.F.S	*Distance finding station (synchronized signals)*
(Mc)	⊙ AERO R. Bn 302	*Aeronautical radiobeacon*
(Md)	⊙ AERO R. Rge 342	*Aeronautical radio range*
(Me)	⊙ Ra Ref Calibration Bn	*Radar calibration beacon*
(Mf)	⊙ CONSOL Bn 190 Kc MMF	*Consol (Consolan) station*
(Mg)	○ Loran Sta Venice	*Loran station (name)*
(Mh)	⊙ LORAN TR SPRING ISLAND	*Loran tower (name)*
(Mi)	10	*Radio calling-in point for traffic control*

N. Fog Signals

1	Fog Sig	*Fog-signal station*
2		*Radio fog-signal station*
3	GUN	*Explosive fog signal*
4		*Submarine fog signal*
5	SUB-BELL	*Submarine fog bell (action of waves)*
6	SUB-BELL	*Submarine fog bell (mechanical)*
7	SUB-OSC	*Submarine oscillator*
8	NAUTO	*Nautophone*
9	DIA	*Diaphone*
10	GUN	*Fog gun*
11	SIREN	*Fog siren*
12	HORN	*Fog trumpet*
13	HORN	*Fog horn*
14	BELL	*Fog bell*
15	WHIS	*Fog whistle*
16	HORN	*Reed horn*
17	GONG	*Fog gong*
18		*Submarine sound signal not connected to the shore (See N-5, 6, 7)*
18a		*Submarine sound signal connected to the shore (See N-5, 6, 7)*
(Na)	HORN	*Typhon*
(Nb)	Fog Det Lt	*Fog detector light (See Kf)*

O. Dangers

(25)

1 *Rock which does not cover (elevation above MHW)*

*Uncov 2 ft Uncov 2 ft

*(2) (2)

2 *Rock which covers and uncovers, with height in feet above chart (sounding) datum*

3 *Rock awash at the level of chart (sounding) datum*

When rock of O-2 or O-3 is considered a danger to navigation

4 *Sunken rock with less than 6 feet of water over it (Same as O-26)*

5 *Sunken rock with between 6 and 33 ft. of water over it (Same as O-26)*

(5) Rk

5a *Shoal sounding on isolated rock (replaces symbol)*

6 *Sunken rock with more than 66 feet of water over it (Same as O-26)*

(21) Rk (21) Wk (21) Obstr

6a *Sunken danger with depth cleared by wire drag (in feet or fathoms)*

Reef

7 *Reef of unknown extent*

Sub Vol

8 *Submarine volcano*

Discol Water

9 *Discolored water*

Coral Co Co Co

10 *Coral reef, detached (uncovers at sounding datum)*

Co 3 Reef Line

Coral or Rocky reef, covered at sounding datum (See A-IId, IIg)

11

Wreck showing any portion of hull or superstructure above sounding datum

Masts

12 *Wreck with only masts visible above sounding datum*

13. *Old symbols for wrecks*

13a *Wreck always partially submerged*

14

Sunken wreck which may be dangerous to surface navigation (See O-6a)

(5) Wk

15 *Wreck over which depth is known*

16 *Sunken wreck, not dangerous to surface navigation*

Foul

17 *Foul ground*

Tide Rips

18 *Overfalls or Tide rips*

Symbol used only in small areas

Eddies

19 *Eddies*

Symbol used only in small areas

Kelp

20 *Kelp, Seaweed*

Symbol used only in small areas

21 Bk Bank
22 Shl Shoal
23 Rf Reef (See A-IId,IIg;O-10)
23a Ridge
24 Le Ledge

25 *Breakers (See A-12)*

\+

26 *Sunken rock (depth unknown)*

When rock is considered a danger to navigation

(5) Obstr

27 *Obstruction*

28 *Wreck (See O-11 to 16)*

Wreckage Wks

29 *Wreckage*

29a *Wreck remains (dangerous only for anchoring)*

Subm piles

30 *Submerged piling (See H-9, L-59)*

Snags Stumps

30a *Snags, Submerged stumps (See L-59)*

31 *Lesser depth, possible*

32 Uncov *Dries (See A-10; O-2, 10)*
33 Cov *Covers (See O-2, 10)*
34 Uncov *Uncovers (See A-10; O-2, 10)*

(3) Rep (1958)

Reported (with date)

Eagle Rk (rep 1958)

35 *Reported (with name and date)*

36 Discol *Discolored (See O-9)*
37 *Isolated danger*

38 *Limiting danger line*

rky

39 *Limit of rocky area*

41 P A Position approximate
42 P D Position doubtful
43 E D Existence doubtful
44 P Pos Position
45 D Doubtful

Subm Crib Crib (above water)

(Oa) *Crib*

■ Platform (lighted) HORN

(Ob) *Offshore platform (unnamed)*

■ Hazel (lighted) HORN

(Oc) *Offshore platform (named)*

P. Various Limits, etc.

1		*Leading line; Range line*
2		*Transit*
3		*In line with*
4		*Limit of sector*
5		*Channel, Course, Track recommended (marked by buoys or beacons)(See P-21)*
(Pa)		*Alternate course*
6		*Leader cable*
7		*Submarine cable (power, telegraph, telephone, etc.)*
7a	Cable Area	*Submarine cable area*
8	Pipeline	*Submarine pipeline*
8a	Pipeline Area	*Submarine pipeline area*
9		*Maritime limit in general*
9a	RESTRICTED AREA	*Limit of restricted area*
10		*Limit of fishing zone (fish trap areas)*
11		*Limit of dumping ground, spoil ground (See P-9, G-13)*
12		*Anchorage limit*
13		*Limit of airport (See I-23, 24)*
14		*Limit of sovereignty (Territorial waters)*
15		*Customs boundary*
16		*International boundary (also State boundary)*
17		*Stream limit*
18		*Ice limit*
19		*Limit of tide*
20		*Limit of navigation*
21		*Course recommended (not marked by buoys or beacons)(See P-5)*
22		*District or province limit*
23		*Reservation line*
24	COURSE 053°00' TRUE; MARKERS; MARKERS	*Measured distance*
25	PROHIBITED AREA	*Prohibited area (See G-12)*

Q. Soundings

1	SD	*Doubtful sounding*
2	65	*No bottom found*
3		*Out of position*
4		*Least depth in narrow channel*
5	30 FEET APR 1958	*Dredged channel (with controlling depth indicated)*
6	24 FEET MAY 1958	*Dredged area*
7		*Swept channel (See Q-9)*
8	6	*Drying or uncovering height in feet above chart (sounding) datum*
9	17; 119	*Swept area, not adequately sounded (shown by green tint)*
9a	29; 23; 3; 22; 8; 30; 18; 21; 7	*Swept area adequately sounded (swept by wire drag to depth indicated)*
10		*Hair-line depths*
10a	8_2 19	*Figures for ordinary soundings*
11	8_2 19	*Soundings taken from foreign charts*
12	8_2 19	*Soundings taken from older surveys or smaller scale charts*
13	8_2 19	*Soundings taken by echo*
14	8_2 19	*Sloping figures (See Q-12)*
15	8_2 19	*Upright figures (See Q-10a)*
16	(25); (2)	*Bracketed figures (See O-1, 2)*
17	6	*Underlined sounding figures (See Q-8)*
18	3_2 6_1	*Soundings expressed in fathoms and feet*
(Qa)	6 5 2ft	*Stream*

R. Depth Contours and Tints (see General Remarks)

Feet	Fathoms
0	0
6	1
12	2
18	3
24	4
30	5
36	6
60	10
120	20
180	30
240	40

Feet	Fathoms
300	50
600	100
1,200	200
1,800	300
2,400	400
3,000	500
6,000	1,000
12,000	2,000
18,000	3,000

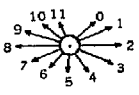
Or continuous lines, with values

5 (blue or black) 100

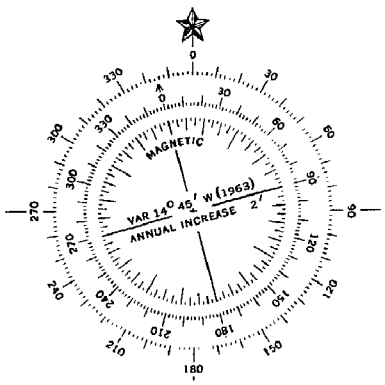
S. Quality of the Bottom

1		Ground	25	Ms	Mussels	50	spk	Speckled
2	S	Sand	26	Spg	Sponge	51	gty	Gritty
3	M	Mud; Muddy	27		Kelp	52		Decayed
4	Oz	Ooze	28	Wd	Seaweed	53	fly	Flinty
5	Ml	Marl		Grs	Grass	54	glac	Glacial
6	Cl	Clay	29		Seatangle	55		Tenacious
7	G	Gravel				56	wh	White
8	Sn	Shingle	31		Spicules	57	bk	Black
9	P	Pebbles	32	Fr	Foraminifera	58	vi	Violet
10	St	Stones	33	Gl	Globigerina	59	bu	Blue
11	Rk; rky	Rock; Rocky	34	Di	Diatoms	60	gn	Green
11a	Blds	Boulders	35	Rd	Radiolaria	61	yl	Yellow
12	Ck	Chalk	36	Pt	Pteropods	62	or	Orange
12a	Ca	Calcareous	37	Po	Polyzoa	63	rd	Red
13	Qz	Quartz	38		Cirripeda	64	br	Brown
13a		Schist	38a		Fucus	65	ch	Chocolate
14	Co	Coral	38b		Mattes	66	gy	Gray
(Sa)	Co Hd	Coral head	39	fne	Fine	67	lt	Light
15	Mds	Madrepores	40	crs	Coarse	68	dk	Dark
16	Vol	Volcanic	41	sft	Soft			
(Sb)	Vol Ash	Volcanic ash	42	hrd	Hard	70		Varied
17	La	Lava	43	stf	Stiff	7		Uneven
18	Pm	Pumice	44	sml	Small			
19	T	Tufa	45	lrg	Large			
20	Sc	Scoriae	46	stk	Sticky			
21	Cn	Cinders	47	brk	Broken			
22	Mn	Manganese	47a	grd	Ground	76		Fresh water springs in sea-bed
23	Sh	Shells	48		Rotten			
24	Oys	Oysters	49		Streaky			

T. Tides and Currents

1	HW	High water
1a	HHW	Higher high water
2	LW	Low water
(Ta)	LWD	Low water datum
2a	LLW	Lower low water
3	MTL	Mean tide level
4	MSL	Mean sea level
4a		Elevation of mean sea level above chart (sounding) datum
5		Chart datum (datum for sounding reduction)
6	Sp	Spring tide
7	Np	Neap tide
8	MHWS	Mean high water springs
8a	MHWN	Mean high water neaps
8b	MHHW	Mean higher high water
(Tb)	MHW	Mean high water
9	MLWS	Mean low water springs
9a	MLWN	Mean low water neaps
9b	MLLW	Mean lower low water
(Tc)	MLW	Mean low water
10	ISLW	Indian spring low water
11		High water full and change (vulgar establishment of the port)
12		Low water full and change
13		Mean establishment of the port
13a		Establishment of the port
14		Unit of height
15		Equinoctial
16		Quarter; Quadrature
17	Str.	Stream
18	2 kn	Current, general, with rate
19	2 kn	Flood stream (current) with rate
20	2 kn	Ebb stream (current) with rate
21	Tide gauge	Tide gauge; Tidepole, Automatic tide gauge
23	vel	Velocity; Rate
24	kn.	Knots
25	ht.	Height
26		Tide
27		New moon
28		Full moon
29		Ordinary
30		Syzygy
31	fl	Flood
32		Ebb
33		Tidal stream diagram
34	A B	Place for which tabulated tidal stream data are given
35		Range (of tide)
36		Phase lag
(Td)		Current diagram, with explanatory note

U. Compass



Compass Rose

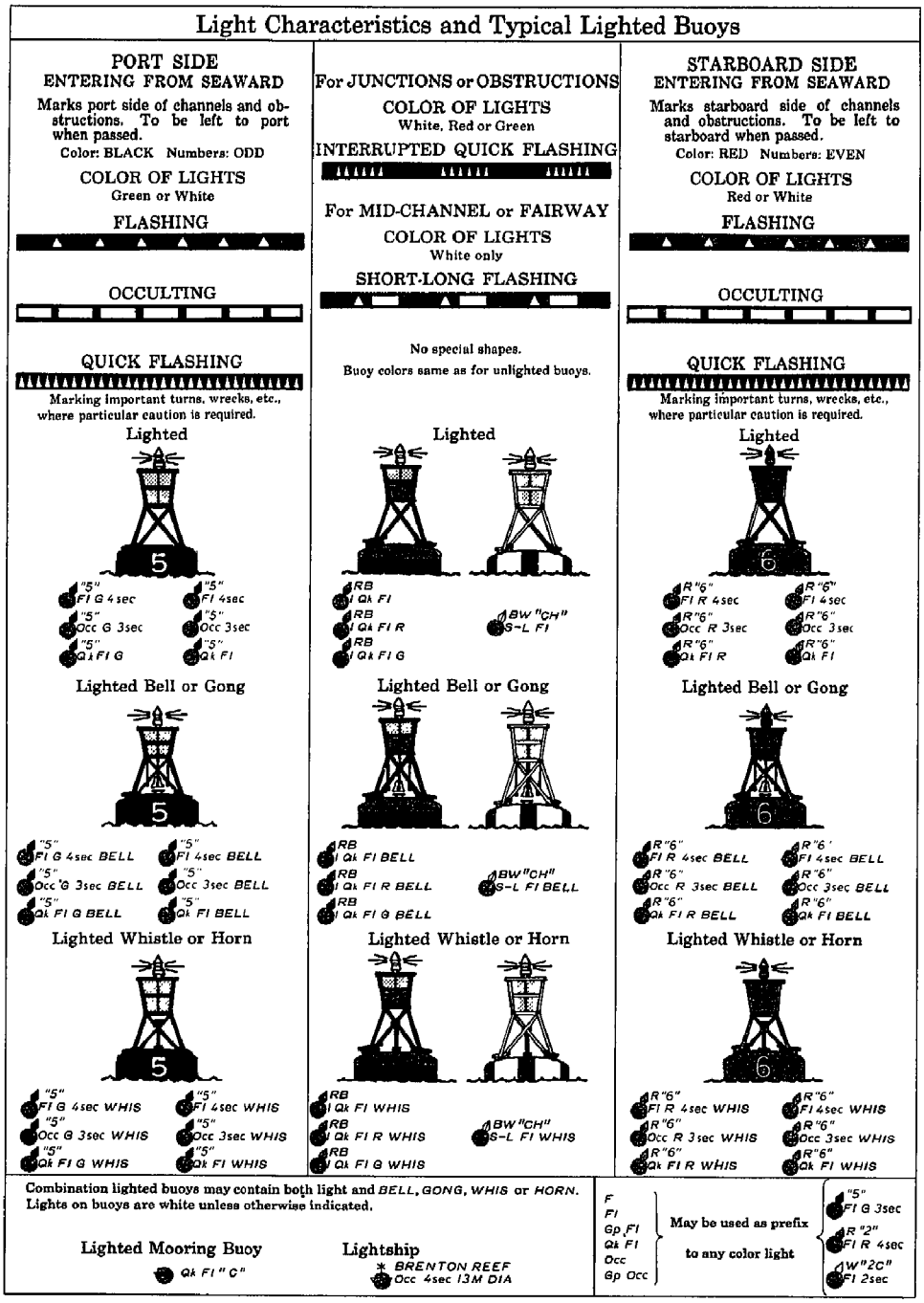
The outer circle is in degrees with zero at true north. The inner circles are in points and degrees with the arrow indicating magnetic north.

1	N	North
2	E	East
3	S	South
4	W	West
5	NE	Northeast
6	SE	Southeast
7	SW	Southwest
8	NW	Northwest
9	N	Northern
10	E	Eastern
11	S	Southern
12	W	Western
21	brg	Bearing
22		True
23	mag	Magnetic
24	var	Variation
25		Annual change
25a		Annual change nil
26		Abnormal variation; Magnetic attraction
27	deg	Degrees (See E-20)
28	de	Deviation

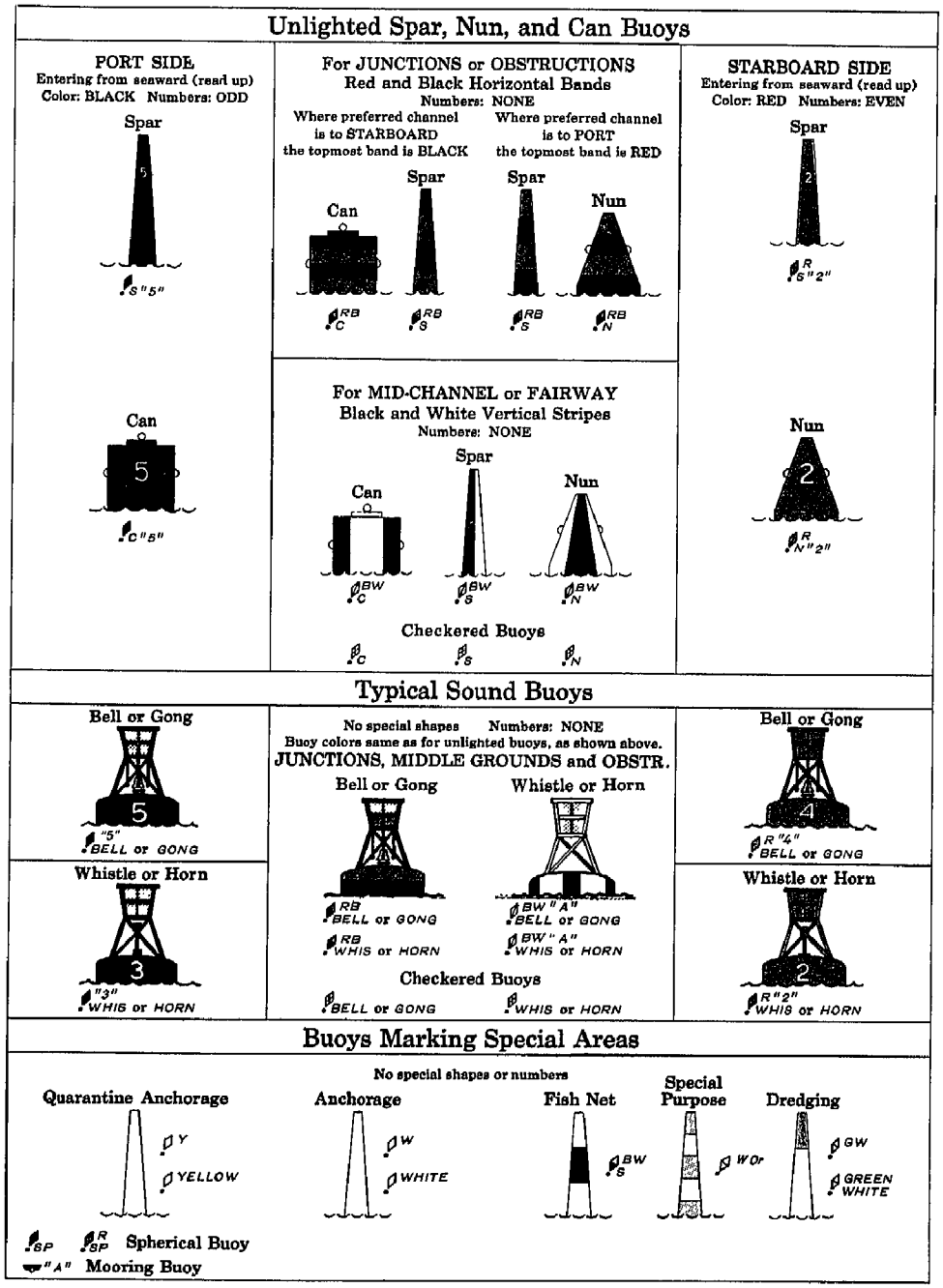
NAVIGATIONAL AIDS

IN

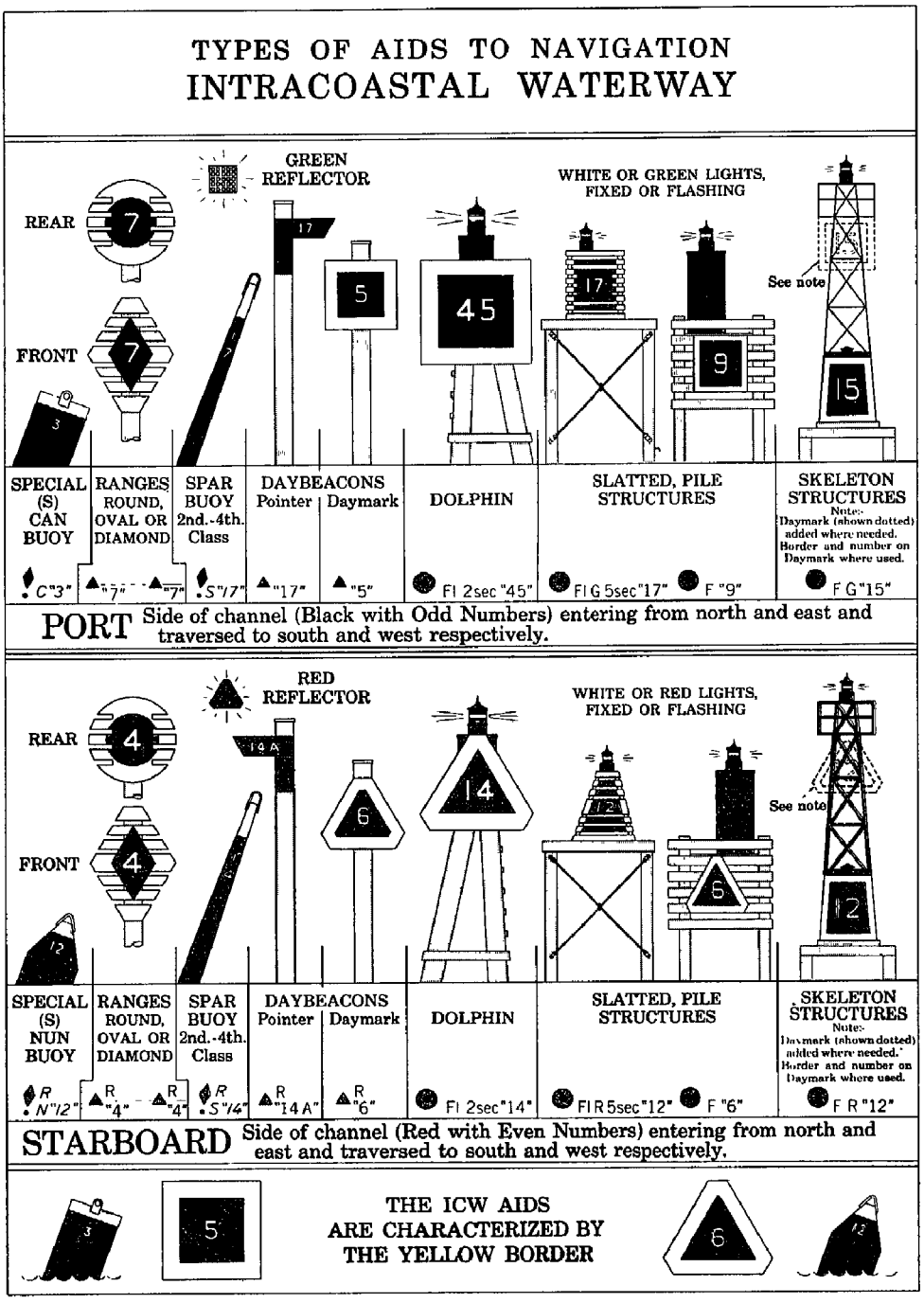
UNITED STATES WATERS



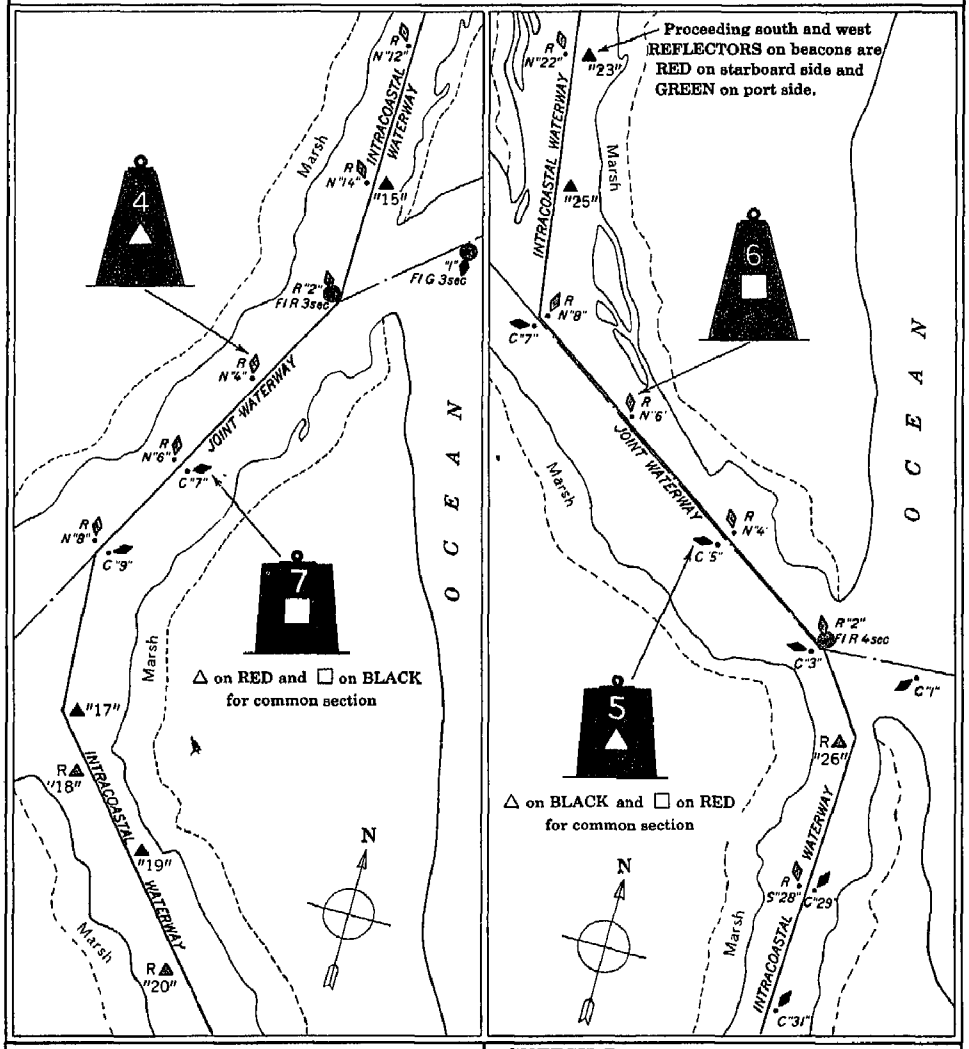
Lighted buoyage of the United States with explanation of their standard chart symbols and abbreviations. Light characteristics do not apply to Mississippi River System.



Unlighted buoyage of the United States with explanation of their standard chart symbols and abbreviations.


TYPES OF AIDS TO NAVIGATION
INTRACOASTAL WATERWAY
GREEN REFLECTOR
WHITE OR GREEN LIGHTS, FIXED OR FLASHING
REAR
FRONT
See note
SPECIAL (S) CAN BUOY
RANGES ROUND, OVAL OR DIAMOND
SPAR BUOY 2nd.-4th. Class
DAYBEACONS Pointer | Daymark
DOLPHIN
SLATTED, PILE STRUCTURES
SKELETON STRUCTURES
Note:- Daymark (shown dotted) added where needed. Border and number on Daymark where used.
C"3"
"7"
"7"
S"17"
"17"
"5"
Fl 2sec "45"
FlG 5sec"17"
F "9"
F G"15"
PORT Side of channel (Black with Odd Numbers) entering from north and east and traversed to south and west respectively.
RED REFLECTOR
WHITE OR RED LIGHTS, FIXED OR FLASHING
REAR
FRONT
See note
SPECIAL (S) NUN BUOY
RANGES ROUND, OVAL OR DIAMOND
SPAR BUOY 2nd.-4th. Class
DAYBEACONS Pointer | Daymark
DOLPHIN
SLATTED, PILE STRUCTURES
SKELETON STRUCTURES
Note:- Daymark (shown dotted) added where needed. Border and number on Daymark where used.
R N"12"
R "4"
R "4"
R S"14"
R "14 A"
R "6"
Fl 2sec"14"
FlR 5sec"12"
F "6"
F R "12"
STARBOARD Side of channel (Red with Even Numbers) entering from north and east and traversed to south and west respectively.
THE ICW AIDS ARE CHARACTERIZED BY THE YELLOW BORDER

ILLUSTRATING THE SYSTEM OF DUAL-PURPOSE MARKING WHERE THE ICW AND OTHER WATERWAYS COINCIDE



SKETCH A:

ICW joins another waterway,.which is numbered from seaward, at buoy No. 2 and is common with it to buoy No. 9. ICW numbers and yellow borders are omitted in this section but the △ or □ is used on the regular aids to designate the ICW.

SKETCH B:

ICW joins another waterway at buoy No. 8 and is common with it to buoy No. 3. This section is numbered in the opposite direction to that of the ICW. The ICW numbers and yellow borders are omitted from the regular aids but a △ or □ is shown to designate the ICW.

APPENDIX G

Table of Cases Cited

(References are to pages)