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Engineer Intelligence Guide 15, Collection of Information on Coasts and Beaches, 1958

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ENGINEER INTELLIGENCE GUIDE

EIG 15

COLLECTION OF INFORMATION ON COASTS AND BEACHES

A TECHNICAL SERVICE INTELLIGENCE DOCUMENT

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COLLECTION OF INFORMATION ON COASTS AND BEACHES (U)

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This document was compiled by the Beach Erosion Board, Corps of Engineers, and has been approved by the Chief of Engineers for dissemination within the Corps of Engineers. This document has not been reviewed by the Office of the Assistant Chief of Staff for Intelligence, and therefore does not necessarily represent agreed Department of the Army guidance.

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PREFACE

Engineer Intelligence Guides (EIG's) are the media for the dissemination of intelligence collection, processing, production, and dissemination guidance by the Chief of Engineers to pertinent elements of the Corps of Engineers. EIG's are designed to provide orientation, direction, and instruction in the field of Engineer intelligence. Comments on this EIG and suggestions for additional EIG's are solicited from all recipients. Comments and suggestions should be addressed to:

Chief of Engineers
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Washington 25, D. C.
ATTN: Engineer Intelligence Division

COLLECTION OF INFORMATION ON COASTS AND BEACHES (U)

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SUMMARY

1. Chapter 1 states the purpose and scope of this guide for the collection of coast and beach intelligence information. It briefly describes the nature and employment of coast and beach intelligence, and it indicates responsibilities for intelligence production and collection.

2. Chapters 2 and 3 identify the subtopics which constitute coast and beach intelligence. Physical features and natural phenomena are discussed in terms of importance to amphibious operations, and the scope of beach and of coast intelligence reports is stated.

3. Chapter 4 concerns photography as an aid to field collection of information.

4. Chapter 5 contains techniques, aids, and instructions for the field collection and recording of intelligence data.

CHAPTER 1

INTRODUCTION

1. Purpose

a. The purpose of this publication is to furnish technical and nontechnical collectors with guidance for procurement of coast and beach information under the typical restrictions and difficulties normally existing in the field. The guide is designed to provide untrained or inexperienced collectors with sufficient instructions to permit easy recognition of significant information and its procurement in a form readily usable by intelligence-producing agencies.

b. Extensive experience in amphibious operations in many different environments during World War II and the Korean War firmly established the items of information which are necessary for landing troops and supplies by means of amphibious vessels and vehicles. Newly developed weapons, equipment, and techniques now require additional items of information and an increase in the area of intelligence interest on the coast. The guide also includes collection requirements for new forms of amphibious warfare to the extent that these requirements are known. Guidance is given for both personal observation and measurement of data and for procurement of existing published sources of required information.

2. Scope

The guide discusses those matters needed to understand collection for coast and beach intelligence. It covers areas of responsibility, the scope of coast and beach intelligence, pertinent coast and beach features and characteristics, environmental factors affecting the use of beaches, information needed to produce intelligence of coasts and beaches, photographic techniques to be used in coastal areas, procedures to follow, and forms to use. For those unfamiliar with special terms used, a glossary of terms has been added as Appendix 2 to the guide. Figures 18 and 19 are condensed intelligence collection guides and they are recommended for periodic review by field personnel. Figure 18 is a table of beach information requirements and Figure 19 provides an evaluated list of various sources of information.

3. Coast and Beach Intelligence

a. Intelligence of coasts and landing beaches is an important component of military terrain intelligence studies of world areas containing coasts, whether they be on the open sea or on inland waters. The shore is, in many places, the first line of resistance in the defense of a country and normally allows only limited maneuver space for the committed invading force. Complete and accurate intelligence of all pertinent features of coasts and beaches must be available in order that invading amphibious forces or defending forces may take advantage of every favorable marine and terrain feature and environmental condition. Coast and landing beach intelligence provides staff planners with such evaluated elements of information on the physical features, characteristics, and conditions of beaches and their adjacent waters and coastal areas as is necessary for the planning of offensive or defensive amphibious operations.

b. The scope of this type of intelligence is determined by those functions of physical movement in the sea and on the land areas necessary to accomplish the landing in accordance with established amphibious concepts and procedures. Under present concepts these movements involve transportation of men, equipment, and supplies from ship to shore; landing and debarkation on the beach; and movement from the beach into the hinterland. Recent concepts of operations under study and test envisage the movement of some men and supplies directly across the beaches to their ultimate destination without trans-shipment at the beaches. Beaches lie in the marginal area between sea and fast land, and the very nature of their formation and ever-changing physical characteristics causes them to merge with these adjacent physiographic areas in such a manner as to make clear delineations difficult. Insofar as amphibious operations are concerned, beaches provide a transition area of transport and movement, tactical employment, and command responsibility in which the nearshore zone of the sea approach, the beach proper, and the terrain immediately adjacent to the beach are merged into an area tied together by many common and related problems. Beach intelligence must adequately cover this zone and merge into oceanographic intelligence seaward and terrain intelligence landward. To insure adequate coverage the area of responsibility for beach intelligence must extend seaward at least as far as the 30-foot depth curve (anchorage depth boundary) and landward sufficiently to embrace the nearest significant change in topography or a main line of communication. Beach intelligence must include adequate descriptions of general coastal features, characteristics, and conditions of the coast in general because planners must be familiar with the physical environment of which the beach is a part, and must also be cognizant of coastal areas where beaches are nonexistent and landings, therefore, difficult or impossible.

c. The introduction of nuclear weapons into warfare is forcing changes in the conduct of amphibious operations. These operations, like others, must be widely dispersed. In order to give necessary striking power and adequate combat and logistic support to modern operations, extensive stretches of coasts may have to be exploited. The areas of responsibility for beach intelligence may extend seaward to include conditions of the sea approach from regular navigational waters and landward to approximately 15 or 20 miles. It is expected that small, battle-group size beaches will be the rule rather than the exception. Coastal areas where there are no suitable beaches may be made usable by special equipment and devices such as improved amphibians and aerial tramways. Airborne and helicopterborne operations may be combined with conventional amphibious landings to procure and hold unsuitable areas; therefore, the entire coastal area must be considered for utilization.

4. Production and Collection Responsibilities

a. It is the responsibility of the Army to produce such departmental intelligence as may be needed by the Army to perform its mission. The Chief of Engineers has been assigned the responsibility of producing coast and beach intelligence for Army use. This type of intelligence is essential to the complete fulfillment of the Engineer mission of providing the Army with adequate area and terrain intelligence. It is particularly essential to provide the Army with intelligence necessary for planning, training for, conducting, or participating in amphibious operations and for the developing of new concepts of amphibious warfare.

b. The Beach Erosion Board, Corps of Engineers, has the responsibility for producing the landing beach intelligence for the National Intelligence Survey program. This agency also produces, as directed by the Chief of Engineers, coast and landing beach intelligence needed for strategic and high-level operational planning within the Department of the Army. In view of these intelligence production responsibilities and the requirements of the Army Intelligence Collection Instructions, AR-381-25, it is necessary for Army representatives to collect coast and beach information.

CHAPTER 2

COAST AND BEACH FEATURES, CHARACTERISTICS, AND ENVIRONMENTAL CONDITIONS WHICH INFLUENCE AMPHIBIOUS OPERATIONS

Section I. THE BEACH

5. Materials

Beach materials vary greatly in their composition, size, sorting, and shape. Figures 2 and 3 classify typical materials. Characteristics are dependent upon the origin of materials and the water forces which move, sort, and shape the particles. A description of the characteristics of beach material gives a valuable clue to the slope or gradient of a beach when other information is lacking, as this gradient is determined chiefly by the size of material and the character of wave action. The depth of beach materials and the nature of subsurface materials is also a valuable indication of beach firmness.

6. Firmness and Trafficability

a. The firmness or trafficability of a beach, the ability to sustain traffic of troops and vehicles, varies greatly with many factors such as moisture content, slope, grain size, compaction, etc. It is an especially important characteristic when vehicles are to be landed, as is indicated in Figures 4, 5, 6, and 7. Some general rules on beach firmness follow; however, many factors influence firmness and changes in firmness may occur in short periods of time.

b. Sand beaches are more firm when damp. Beach backshores are frequently dry and therefore soft. Sorted pebbles and cobbles are firm as far as bearing capacity is concerned, but they are loose to traction of wheels and tracks of vehicles and provide poor trafficability. Clay is invariably soft when wet, but combinations of clay and sand content may be firm. A mixture of fine to coarse sand tends to be firm. Soft zones are common near the upper level of wave wash at high tide; these soft zones are due to the entrapment of air in pockets under the wet sand. Soft zones in the nature of buoyant sand are sometimes encountered in the troughs of low-tide terraces, particularly when water is in these troughs. Although most beaches are more firm when damp than when dry there is a notable exception. Where the inland terrain can become so inundated that water percolates through the ground behind the beach and up through the beach face, the beach becomes "quick" and has a spongy softness. Where streams having low discharge rates reach the sea and their mouths are blocked by sand, discharge water may percolate through the sand and reduce its supporting power in that vicinity. In general, sand beaches exposed to wave action are firmer than beaches of similar material in sheltered locations. Figure 10 shows a beach which has experienced compaction from surf action.

7. Cusps

Cusps as illustrated in Figure 9 are more or less evenly spaces ridges (horns) of beach material and intervening crescent-shaped troughs. The horns trend at right angles to the shoreline, and taper to their point seaward. Cusps are not always present on beaches, but when they are they should be noted. There are several characteristics of this beach feature that may be significant in amphibious landings. Along gravel beaches the cusps may develop very large proportions, rising several feet above adjacent troughs and becoming a serious hindrance to traffic. Spacing of cusps may exceed 75 feet. Cusps are soft, whereas the troughs are usually of the same firmness as the normal beach face.

8. Ridges

Beach ridges are another feature that may occur and when observed, should be reported. They are essentially continuous mounds or ridges of beach material along a beach which have been heaped up by wave action above the upper limit of normal-wave uprush. They may occur as single ridges or as a series of approximately parallel ridges extending some distance inland. The ridges commonly are 3 to 8 feet in height above mean high tide but have been known to attain a height of 30 feet on pebble beaches. High ridges are found only in exposed locations and are a sign of occasional severe storm-wave action. Ridges occur only when there is an abundant supply of material. At some locations beach ridge belts extend as much as 1 to 2 miles inland, with a vertical difference in elevation of only a few feet. Ridges may be of sand, pebbles, or gravel (shingle included). In the latter case they may be formidable barriers to movement off the beach. Gravel or shingle ridges are high and loose and are very difficult to traverse.

9. Scarps

A scarp is a near-vertical face cut into beach materials by a period of erosive wave action. Only those scarps which are cut into the backshore have appreciable permanence because normal wave action will soon eliminate those on or near the foreshore. Scarps present only temporary obstacles to movement and may range from a few inches to several feet in height. Scarps appear in Figures 10, 11, and 13.

10. Berms

A beach berm is a nearly horizontal formation of material deposited by wave action. It begins at the limit of normal-wave uprush and extends landward. No berm or one or more berms may exist. Several berms indicate several depositional wave regimes. Where more than one berm exist, they are separated by beach scarps in various stages of deterioration. The seaward margin of a berm is known as the berm crest. Berms are usually dry and soft, but when damp, as after a rain or high wave action, they may be firm for a short time. Figures 4, 10, and 11 illustrate berms.

11. Vegetation

Permanent vegetation normally is absent from beaches. Temporary grasses and herbaceous plants may become sparsely established in seasons of low waves, but eventually are destroyed. Vegetation on a beach is never of significance to military operations except for mangrove which is a woody tropical bush or tree, having aerial roots and a growth preference for salt water. Although mangrove normally occur in sheltered tidal areas having a soft, fine bottom material, they may exist on foreshores which do not experience heavy wave action. Their interlaced roots constitute a barrier to movement.

12. Structures

a. Groins are structures utilized in the stabilization of a beach. They are long, low, narrow structures extending seaward from the backshore and are intended to entrap water-suspended sand in motion along the shore. Groins are usually built as a system of structures spaced at regular intervals along the beach, therefore they are obstacles to the lateral movement of vehicles especially along the foreshore of a beach. Groins are sometimes erroneously called jetties. Several types of groins are seen in Figures 12, 14, 15, and 16.

b. Jetties are structures projecting seaward from the shoreline and through the normal surf zone. They are larger and more massive than groins and are used to improve and stabilize inlets and river mouths. They prevent deposition of sand in the channel, regulate the inflow and outflow of tides and river discharge, and protect vessels entering the inlet or river. In order to prevent the movement of sand into the channel and to protect vessels against wave action, jetties must be high enough to protect against expected storm waves. Figure 13 illustrates the unequal deposition of beach sands on opposite sides of a jetty-protected inlet as a result of interrupted littoral drift of sand.

c. Bulkheads and seawalls are used primarily to protect areas of the coast against heavy storm-wave action. They limit the shoreward movement of destructive waves, but under severe wave action they may cause the removal of sand from the beach by inducing scour at the base of the wall, and by reflected wave energy. During periods of normal wave action the sand may be returned to the beach, but the seawall or bulkhead has no function in this action. They are solely for the protection of land behind the bulkhead or seawall. Seawalls and bulkheads may be barriers to troop and vehicle movement from a beach to inland areas. They normally are strongly built being designed to protect against the highest storm wave which can be expected in the particular locality and therefore could be difficult to break through. Figure 16 shows a seawall in which steps have been placed to accommodate patrons of a resort beach.

d. Some information of value is indicated by structures. For example, if piles are used in their construction then bedrock must lie fairly deep below the surface. The direction of the prevailing littoral currents and the predominant direction of approach of wave action is shown by the alignment of the beaches between groins wherein the groins trap the moving sand, resulting in wider beaches next to the groin on the updrift side (See Figure 14).

13. Exits

a. Uninterrupted movement inland from a beach is necessary to provide direct, rapid support and supply of combat forces and to avoid the creation of lucrative targets of accumulated material and personnel on beaches. However, movement off a beach inland onto favorable terrain in many localities is one of the difficult aspects of a landing because of the prevalence of bluffs, dunes, swamp, or lagoons close behind beaches. Therefore, accurate and specific information of exits is important.

b. Existing exits are those which require little or no preparation. They may be man-made or natural, typical are roads, ramps, stairs, paths, gullies, dry stream beds, and gaps between dunes.

c. Prepared exits are those which require engineer effort in their preparation and must be resorted to in the absence of existing exits. The difficulty of preparation is dependent upon the terrain in which the exit will be and the distance to the nearest existing road. Constructed works such as seawalls and bulkheads can be breached or ramped over, but seawalls of heavy construction should be avoided if possible. Streams closely backing the beach can be either forded or bridged depending, or course, upon the width and depth of the stream as well as the bank conditions. Swampy or marshy ground close behind a beach is typical of some coasts and are an adverse factor especially if an exit must be built through such an area by the use of fill. Cultivated fields are usually easy to traverse unless attempted during an extremely wet season.

d. There are other characteristics of exits to be considered. In general, an exit should have a minimum width of 8 feet to permit the passage of vehicles. Most army vehicles can negotiate steep grades with little difficulty providing the surface is firm. A limited number of exits which would necessitate the convergence of traffic moving from the beach is undesirable.

Section II. TERRAIN IMMEDIATELY IN REAR OF THE BEACH

14. Dunes and Other Features

a. The terrain immediately to the rear of a beach takes on many varied forms. These variations may be in the form of a wind-created dune area, rock cliffs rising precipitously, or lagoons and marshland. Many types of structures in the rear of a beach are equally important. Terrain charactistics for several miles inland from the shore can seriously affect the desirability of a beach for landing. Many terrain features have a dual role of providing cover for a defending or assault force and of forming obstructions for the development of an area for a supply dump or for advancement inland.

b. Dunes are one of these terrain features and are formed of windblown sand carried inland from the beach and deposited in a variety of forms, usually as irregular hills or mounds. Dunes may be built upon pre-existing parallel beach ridges. Dunes may attain heights of 300 feet, but more commonly are well within 100 feet in height. Dunes are usually composed of fine to medium grains of sand. Where vegetation is sparse, the dune firmness is about the same as that of the beach berm, but steeper slopes increase the difficulty of movement. Dunes when damp provide better trafficability, but this condition is of short duration. Vegetation is commonly low and grassy or bushy and has the effect of slightly increasing the bearing strength of the sand. However, the vegetation cannot stand traffic and cannot be considered as appreciably improving the traversability of the area. Where dunes exist they may be coalesced into a semicontinuous belt parallel to the beach which constitutes a handicap to movement inland. Dunes appear in Figures 6 and 17.

c. Numerous other land forms, drainage systems, water areas, vegetation, and cultural features are of importance in a complete picture for the planning of movement, maneuver, tactical employment, and supply of landing forces. Descriptions of these features are essential requirements for terrain intelligence and will not be described in detail in this section. It is the purpose of this section to describe those special features and characteristics associated with beaches with which the collector may not be familiar. Those terrain features, however, are of importance to beach intelligence in that they provide either the means of or obstacles to movement from the beach proper into the coastal area and hinterland. Most collectors have had training in terrain intelligence and its military application. It does not differ in application in the coastal regions. It is important that the collector of beach information be especially cognizant of those features that form major obstacles to movement from the beach inland and describe them in detail as well as favorable exit routes from the beach.

Section III. NEARSHORE ZONE

15. Hydrography and Marine Features

a. Hydrographic conditions shoreward of 30-foot depth should be thoroughly investigated and surveyed if possible. Hydrographic surveys in the past have been designed for navigational purposes and in general have been incomplete shoreward of 30-foot depths. Shallower depths of the zone from zero- to 30-foot depths are of primary concern in amphibious operations because it is here that surf is encountered, craft may ground, and troops and vehicles may have to disembark in water. Normally investigations seaward of 10-foot depth should be made by conventional survey methods for most reliable results. In overt surveys the precision and comprehensiveness of the surveys should be adequate for accurate location of obstructions, determination of clear boat passages to the beach, location of points of grounding for all types of landing craft, determination of trafficability of bottom materials, selection of suitable beaching places for landing craft and amphibious vehicles, and determining maneuver areas for craft of all types. In covert operations as many of the above requirements as possible should be answered as accurately as circumstances allow.

b. Major obstructions in nearshore areas are now shown on hydrographic charts. However, available charts may be old. It is important to observe and check the location of these obstacles noting chart inadequacies. Those bars and shoals which are serious obstructions to landing craft normally lie relatively close inshore in shallow water and may never have been shown on charts. Their presence can be detected from vertical aerial photographs because they appear as bands or areas of lighter color than the surrounding water areas, and they lie more or less parallel to the shoreline. The ground observer can usually detect their presence by the breaking of waves and can investigate clear depths over the shoals by wading or swimming in the locality; sounding from small boats, waves or surf permitting; observing small craft coming in for a landing or through inquiries of local residents and fishermen. The depth of water shoreward of a shoal or bar should be obtained, if possible, to determine the feasibility of men wading ashore from craft grounded on them. All determinations of depths should be associated with the time of day or the stage of tide so that depths can be corrected to high and low tide.

16. Nearshore Structures

Breakwaters have two functions. The primary one is to provide shelter for vessels, and the other is to protect the shore from destructive wave action. Wave action behind an offshore breakwater may be reduced to such an extent that the rate of littoral transport is reduced or modified to the extent that sand transport along the shore stops and shoaling results in the sheltered area. Other nearshore structures which might affect amphibious operations include fish traps, mooring piles and navigation markers or signals.

17. Seas and Surf

a. Waves which affect amphibious landings may have their origin in local storms and are known as "seas" or may have traveled hundreds to several thousands of miles from a distant storm before arriving at the landing site and are known as "swells." Regardless of the type of waves from which they originate, breaking waves (breakers or surf) 4 feet in height normally are considered too high for amphibious assault operations or for logistic support to be made amphibiously. Surf at this height or higher causes across-the-beach tonnages to drop off sharply and is the limiting operational planning value for existing small landing craft, although skilled operators can land and retract small craft through higher surf. Statistical surf data on surf regimes is needed for such planning purposes as determining whether or not an operation can be adequately supported or for determining the most favorable time for amphibious operations.

b. Wave or surf observations for intelligence should cover at least 3 years and preferably more to permit determination of monthly or seasonal frequencies. Some areas of the world have organizations which collect suitable data. These may be oceanographic or hydrographic activities, lifesaving stations and lighthouses which usually maintain log records of surf and meteorological conditions, and port authorities. Single or few observations are of little value because they will not indicate typical characteristics.

c. Type of breaker indicates the type of nearshore bottom over which waves are approaching.

(1) Spilling breakers indicate a gentle sloping bottom, so gentle in fact that the waves lose energy gradually as they approach. Spilling breakers dissipate energy by breaking at the crest only, and it is common to see a number of such breakers existing simultaneously. Such a condition if waves are low, may indicate a nearshore bottom too flat for favorable use of landing craft. Several lines of spilling breakers are illustrated in Figure 13.

(2) Plunging breakers are waves which become totally unstable because of abrupt changes in the bottom over which they approach. These changes may be in the form of a longshore bar or degree of steepness at the shore. In either case the waves break in a rollover, plunging action as is illustrated in Figure 15.

(3) Surging breakers are the least common of all types of breakers. They occur only at very steep nearshore bottoms. This type of wave peaks up near the shoreline but instead of breaking or spilling actually surges up the face of the beach. Surging breakers are significant as indicators of steep nearshore gradient.

18. Currents

Currents in the nearshore zone which influence amphibious landing operations may be generally classified as wave-generated currents, tidal currents, and stream currents.

(1) The wave-generated currents, caused by the angular breaking of waves on the beach slope and the resultant backrush normal to the beach, result in a littoral current (alongshore current) in the nearshore zone, flowing generally parallel with the shoreline. It is found shoreward of the outermost edge of the breaker zone and varies in velocity or force with the force of the waves, their angle of impingement upon the shore, and the steepness of the foreshore. Littoral currents may be insignificant in terms of amphibious operations, or they may be strong enough to cause men to lose their footing, to make maneuvering of craft difficult, and to throw landing craft out of control and expose them to broadside attack by the surf. Littoral currents are particularly significant where depths shoreward of the breaker zone are such as to make wading hazardous. When the approach of breaking waves is fairly direct onshore or there is a convergence of littoral currents, there is a build-up of water within the breaker zone which eventually must find release. One means by which the stacked-up energy is returned seaward is by a rip current in which the water breaks out through the surf as an out-flowing current which may have great strength. It is possible to observe the seaward course of such a current from a high vantage point since the path of the rip current is manifested by the material in suspension discoloring the water. Rip currents are usually of short duration and may shift their locations from place to place along the shore. Unless they are a known persistent feature of a particular section of beach information of them is insignificant.

(2) Tidal currents are generally only significant in their effect on amphibious landings in the proximity of tidal inlets, estuaries, stream mouths, and similar restricted channels. With large tidal ranges these currents may make the maneuver or the landing of craft on beaches adjacent to the tidal inlet extremely hazardous.

(3) Currents which extend from rivers into the open sea are frequently of such strength as to affect the maneuver of landing craft near the mouth of such streams. As in the case of tidal currents, they are of significance insofar as amphibious landings are concerned only in the proximity of stream mouths.

19. Tides

a. Tides are the alternate rising and falling of the sea caused by the gravitational attraction of the moon and sun. Although the sun is much larger than the moon, the effect of the moon on the tides is more than twice as great because of the moon's close proximity to the earth. In any given locality the actual tidal range which occurs is the complicated product of various forces including local bottom configuration. The forces that control the tidal fluctuations are all present at any given time. The most important variations in these forces are those caused with respect to each other by the three bodies, earth, sun, and moon, orbiting together. The major movements of these bodies are as follows:

(1) The revolution of the moon in an elliptical orbit around the earth in a period of 29 1/2 days.

(2) The revolution of the earth in an elliptical orbit around the sun in a period of 365 1/4 days.

(3) The rotation of the earth on its axis once every 24 hours (one solar day). This results in an apparent rotation of the sun around the earth every 24 hours and the moon about the earth every 24 hours 50 minutes.

b. The size and configuration of oceanic basins may alter the height and time of the tides. This fact can be illustrated in very general terms by the comparison to the change in musical pitch with change in size and shape of a resonance chamber. The astronomical mechanics of the gravitational system are such that two high tides and two low tides should occur each day and this is the case in many of the tidal areas of the world. However, the shape of ocean basins in a few areas will induce a harmonic vibration which will result in only one apparent high and one apparent low tide each day or may cause extreme variations in the height of the two tides which occur each day. Inasmuch as the moon dominates the tide in most areas, high water each day comes 50 minues later than the preceding day. Where there are two high tides a day, it follows that the high tides occur at intervals of 12 hours 25 minutes.

c. Various relative positions of the earth, sun, and moon have a great influence on the tidal range from time to time at any given place. The movement of the moon from the southern hemisphere to the northern hemisphere and back again each 27 1/3 days causes a diurnal (daily) inequality in the tidal range. This diurnal inequality is particularly noticeable on our west coast and causes large tidal variations. The phase of the moon is even more important in influencing the range of the tides. At times of full and new moons the gravitational attraction of the moon is amplified by that of the sun giving higher tides called "spring tides." When the first and third quarters of the moon are present the gravitational attraction of the moon is reduced by that of the sun resulting in lower tides called "neap tides."

d. Tidal information for most places on the coasts of the world can be obtained from tide tables published by the Coast and Geodetic Survey of the U. S. Department of Commerce. This brief description is given because of the importance tidal phenomena have in amphibious operations and because collectors should be aware that the level of the sea is not constant. Therefore, beach widths, hazards, and depths must be related to a specified vertical datum or to the time of day observations were made in order to permit computation of the stage of the tide.

Section IV. CONCEPTS OF FUTURE AMPHIBIOUS OPERATIONS, EQUIPMENT, AND TECHNIQUES

20. Requirements for Additional Intelligence

The plentiful availability of nuclear weapons and the flexibility of their means of delivery have affected concepts of amphibious operations as well as of other military operations. The experience gained in World War II and the Korean War also caused changes to be made in previous concepts of such operations. As operational concepts change, so do intelligence requirements. New equipment also must be designed and procured. The use of new equipment in turn creates additional intelligence requirements by permitting greater flexibility of movement, maneuver, and application. Changes in amphibious equipment and concepts of probable operations have affected the type of intelligence required of coasts and landing beaches.

21. Trends in New Concepts for Amphibious Operations

a. Certain trends in development of amphibious concepts to meet new requirements are clearly established and can be used as guides for intelligence collection and production. These trends are in general as follows:

(1) Dispersion of all operations — Dispersian reduces the value of any target but increases the requirement for speed of movement and control, and greatly increases areas of operations. Numerous small beaches are obviously of more importance now.

(2) Increased speed of movement — Speed is being stressed from troop transport ships to individual soldiers. Speed necessitates that information be more detailed and accurate.

(3) Direct logistic support from transport to user — This requires amphibious aircraft, vessels, and vehicles having operational capabilities in sea, surf, and on terrain formerly considered unsuited for such equipment. Accurate forecasts of weather, sea, and surf conditions are also more essential.

(4) Employment of the helicopter vertical envelopment maneuver — The general concept of vertical envelopment envisages the use of helicopter assault forces in the ship-to-shore movement to gain deep initial penetration. The speed and flexibility of the helicopter are exploited so a beachhead can be secured and protected while reinforcements and supplies are flown in or follow in a normal amphibious operation. In ultimate development less and less emphasis will be placed on a beach for tactical use. The success of such attacks, however, are dependent upon maximum surprise, complete air superiority, nullification of ground forces in a beachhead area (especially of small-arms fire), and superiority over enemy forces seeking to counter attack. Also there must follow the development of lighter, smaller, more efficient weapons and equipment; the creation of self-sufficient, independent small units; and improved intelligence, reconnaissance, and communications. Such an ideal set of circumstances will not be attained immediately and in certain regions may never be all possible.

b. At present and for some time to come beach areas will be needed for logistical and reinforcement purposes. With the use of nuclear weapons, it is expected that beaches in dispersed groups will be utilized instead of a port for resupply inasmuch as ports are too congested and therefore vulnerable to attack. If new improvements in tactics and transport are utilized, the present ports may also be inadequate for full logistical support. The beaches will then be relied upon to supplement such ports. Coast and beach intelligence will not be displaced by future developments, but will require wider coverage and more thorough information.

CHAPTER 3

INFORMATION REQUIREMENTS

Section I. BASIC REQUIREMENTS COASTS AND BEACHES

22. General

a. Information collected in the field by the attachés and other similar collectors is used primarily to produce intelligence for strategic planning purposes. Occasions arise when the information also is used to produce operational intelligence studies. These studies are of necessity more detaile and must be of greater accuracy. The following general statements indicate areas and subjects on which information is collected:

(1) Localities or areas where it is possible to land men, vehicles, equipment, and supplies and move them into the hinterland.

(2) Physical conditions of sea approaches, characteristics of beaches, and nature of the adjacent terrain in areas where such landings are possible.

(3) Landing sites that are best suited for amphibious landings.

(4) Coastal sections which are less desirable for landings or which are unsuitable for landings.

(5) Characteristics and seasonal changes of conditions influencing amphibious landings, such as winds, storms, surf, tides, currents, ice, fog, and special local phenomena such as tidal bores.

(6) Detailed physical conditions of individual beaches, their nearshore approaches, and the terrain immediately adjacent to the beach rear and flanks.

(7) Areas suitable for vertical envelopment operations.

b. For each specific landing beach area the topics described in this chapter are normally essential for complete coverage. The accuracy and detail of information of these topics and to some extent their number will depend upon the level of planning for which the intelligence is produced. For the higher echelons, generalized and summarized intelligence will suffice; for the lower levels the intelligence must be complete in scope, accurate in detail, and currently maintained. Figure 18 is a table summarizing in convenient form the information requirements for beach intelligence. Figure 19 is a table which lists and evaluates the principal sources of coast and beach information Figures 16 and 17 illustrate many typical features of importance in beach intelligence. Figures 16 and 17 illustrate many typical features of importance in beach intelligence.

Section II. REQUIREMENTS FOR COASTAL INTELLIGENCE

23. Topics

The following topics are those considered essential for adequate description of coastal conditions. The extend of knowledge required and the accuracy and detail needed depend upon the level for which the intelligence is produced. For many areas much of information can be obtained from charts, maps, and publications and need not be collected by reconnaissance.

a. Extent of Study Area

Intelligence of coasts normally covers large segments such as an entire coast of a country.

b. Terrain Characteristics

(1) The approximate length, general location, and alignment of coastline are stated, and major water bodies bordering on the coast are named. Aspects of coastal geography which affect military operations are summarized on a regional basis. Mountains, plains, lowlands, swamps, marshes, lagoons, streams, and drainage, waterways, vegetation, concealment, cover, land use, type of cultivation, existing road and railroad nets, airfields, communication centers, populated areas, and ports as significant are noted.

(2) Similarly the characteristics and distribution of coastal features such as headlands, cliffs, bluffs, bars, spits, barrier islands, reefs, deltas, and beaches are reported in terms of the coast as a whole.

c. Coastal Oceanography

(1) Hydrography — Characteristics of water depths are given very generally seaward of 30-foot depths stressing major obstructions and more detailed shoreward of 30-foot depths giving distance of isobaths off the shoreline; the general approach conditions; and the presence of shoals, bars, and island groups.

(2) Tides — Peculiarities, inequalities, or unusual phenomena such as wind setup, height increases due to coastal configuration, bores, or other unusual local conditions should be recorded as well as information of type and ranges of tide. It should be noted that normal range of tide for most regions of the world can be obtained readily from tables of the U. S. Coast and Geodetic Survey.

(3) Winds and storms — Characteristics, including periods of occurrence are needed.

(4) Swells, seas, and surf — General characteristics needed are heights, periods, seasonal characteristics, and directions of deep water swells approaching the coast; the nature of seas approaching the coast and

resulting surf conditions such as the location and heights of breakers, and the widths of surf zones. Those stretches of coast where energy concentration causes breakers higher than average, or where energy dispersion causes lower breakers should be noted.

(5) Currents — Only currents in the nearshore area that could affect amphibious landings are significant.

(6) Bottom sediments — The prevalent types of bottom sediments along a coast and their suitability for anchoring are stated.

d. Climatic Factors

Other weather phenomena which could affect amphibious landing operations are summarized. Frequently important are visibility, temperatures, shore ice, or precipitation.

Section III. REQUIREMENTS FOR BEACH INTELLIGENCE

24. Location

The location of the ends of long beaches and the centers of the short beaches should be stated in terms of map coordinates. A location to the nearest minute is practical and sufficient if the coordinates differentiate the beach from neighboring beaches. Location by grid coordinates may be specified if the grid system is identified. Location should also be given by distance and direction to prominent physiographic features or other landmarks. The beach should be given number or name and should be accurately plotted and annotated on a large-scale map, chart, or photograph and appropriate cross-references made between graphic plot and descriptive notes.

25. Length of Beach

The total length of the beach and the <u>usable</u> length (gross length minus portions rendered unsuitable for landing by features such as rock outcroppings) must be given. The unsuitable sections of the beach should also be described and plotted. Beach features which might affect movement along the beach should be described and located.

26. Width of Beach

It is important to know the widths of beaches that would be available at different stages of the tide particularly the width at low-water stage, maximum width and at high-water stage, minimum width. When beach widths are quoted, the stage of the tide should be given. Where beach widths vary throughout the length of the beach, the location of major changes in width should be given.

27. Beach Gradients

The gradient of the foreshore may be so steep as to prohibit the landing of vehicles from beached craft without use of matting, or it may so flat as to cause personnel and vehicles to move great distances over exposed areas from boats to cover. The gradient of the high-water zone of the foreshore may be much steeper than the foreshore. If so, the condition is recorded. Information of season changes in gradient, if available, also should be recorded. If backshores are not level, their slope is also necessary. Gradient is normally given as one unit of vertical rise in relation to horizontal distance such as 1 (vertical) on 20 (horizontal). Gradient may also be given in percent of slope or degrees if clearly indicated.

28. Beach

Information of approaches seaward of the 30-foot depth are beyond the scope of most information collections, however, information of the nearshore approaches shoreward of the 30-foot depth should be as complete as possible. This information indicates the possibility of hazards to landing craft and how far they could ground off shore. The horizontal distances out to specified depths or a profile of the bottom gradient should be given. Irregularities of the bottom and the type of bottom material are needed as well as the location and the depth at specified stages of the tide over natural and manmade obstacles. Where ice is an obstacle or hazard, its characteristics and the period during which it is present should be given.

29. Waves and Surf

The occurrence and nature of surf on a beach should be stated if obtained from many observations. The directions of approach; the percent of time breakers approach from those directions; and the height, length, and period should be stated. Sheltered portions of the beach should be located. The location, breaker type (surging, spilling, or plunging), width of the surf zone, and any persistent gaps in breaker lines should be given.

30. Currents

Give directions and velocities of tidal currents, currents set up by stream discharge, and littoral currents caused by wave action provided the currents have a velocity of 1 knot or more.

31. Tides

Existing tide tables are satisfactory for most tide data used in intelligence. The field observer should confine his effort to the collection of data on unusual phenomena such as wind setup (wind tides), increase in tide heights due to coastal configuration, bores, and other items too local to be covered in tide tables or sailing directions.

32. Beach Material and Firmness

The type and size of particles composing a beach affect its firmness. Field observers should report beach materials using descriptive terms such as silt, clay, fine sand, medium sand, coarse sand, fine gravel, coarse gravel, cobbles or boulders or mixtures of these materials. Figures 2 and 3 give sizes of the different categories. Significant changes in size along the length or width of the beach should be noted. Patches of boulders or rock outcroppings should also be noted and located. The trafficability of wheeled and tracked military-type vehicles should be given when possible, estimating the number of passes before immobilization. The depth to which a man or vehicle sinks in the sand while passing over the beach should be stated. The relative firmness of different parts of the beach, such as foreshore and backshore, or portions of each should be given for dry and for wet conditions. Photographs of actual tracks, as in Figures 4 through 7, are good records of beach firmness. For procedures of recording material composition graphically see Chapter 5 and Figures 39 and 40.

The purposes for which a beach is used by local inhabitants may provide valuable information as to beach characteristics. Such uses as extensive bathing, a source of commercial sand or gravel, a landing place for lighters, or as a highway or raceway for automobiles, should be noted.

33. Terrain Adjacent to Beach

A description of coastal terrain including landforms, drainage systems, water areas, vegetation, exits, and cultural development is necessary for the planning of maneuver, tactical employment, and supply of landing forces. Special features that the collector must be alert for are dunes, lagoons, ponds, lakes, streams, marshes, swamps, bogs, cliffs, bluffs, escarpments, seawalls, etc. that would restrict or preclude movement directly inland, and firm ground, roads, railroads, streets, etc., connecting with road systems that would provide easy passage directly inland and to the interior. The presence of commanding or high ground to the rear and on the flanks of the beach should be reported. Major facilities such as airfields, railheads, communication networks, industrial areas, harbors, and population centers adjacent to the beach should be located. When they exist, beach defenses should be fully described.

34. Exits and Communications Inland

Exits from a landing beach area are important. The location and nature of all possible exits for vehicles, equipment, and troops should be described. The width and type of surface should be specified for trails, roads, and other prepared routes; and their approximate gradients should be determined. Connections of beach exits with road nets leading to towns and cities or into the interior, as well as connections with railroads, should be noted. Information on the seasonal differences in the use of the exits or cross-country movement is particularly important for flat, poorly drained lowlands.

Section IV. NEW AND FUTURE INTELLIGENCE REQUIREMENTS

35. Dispersal

The dispersal of operations to meet the threat of nuclear attack has changed considerations of beach size and beach distribution considered practical for use. Present concepts are rather fluid, the maximum practical size depending on many factors chief of which are enemy capabilities and terrain and weather factors. The current thinking is that a landing force at any one beach area will not exceed the equivalent of a reinforced battle group. The dispersal between beach areas will of course be determined by the same factors with terrain factors and coastline configuration playing a major part in the selection of landing sites. On open, fully exposed coasts a minimum distance of 4,000 yards between beach sites is the present guide. These guides are subject to constant revision. However, it is evident that operations will be distributed over a much greater coastal area than previously considered; that all of the usable area of long beaches cannot be used; and that smaller beaches than previously considered will have to be used to their maximum capacities. This reasoning holds true for logistical support as well as for assault. Therefore the collector must report information of an entire coastal area, and describe all possible landing sites in terms of present doctrine and available craft, vehicles, and organization, and also in terms of new equipment and organization as they become known. An example of requirements under the latter conditions is the location of helicopter landing sites for assault and logistical operations.

CHAPTER 4

BEACH PHOTOGRAPHY

Section I. PHOTOGRAPHY AND EQUIPMENT

36. Purpose

It is the purpose of this chapter to provide the collector with an explanation of the problems, equipment, and techniques for taking simple beach photographs together with suggestions on the handling of certain subject matter.

37. General

The beach together with the many light-reflecting variations of the adjoining water surface provides a unique photographic environment with many special problems. It is a surrounding in which the light contrasts are high for one type of picture, and where contrasts must be increased through the use of filters for another; where the time of day the pictures are to be made assumes particular importance; where a heavy overcast may so diffuse the light that one type of picture is difficult, yet for another for which soft light is required this condition may be ideal. These are the circumstances of environment encountered by those who take pictures on beaches.

Military personnel are concerned primarily with black and white rather than with color photographs. Sharp, well exposed pictures of significant features are required, and this chapter deals with the factors which must be considered in order to obtain them.

38. Basic Principles

There are a number of basic rules which should govern the taking of beach photographs. Some of these are:

a. Expose at a shutter speed sufficiently fast that the picture will not be blurred. Generally a shutter speed of 1/50th of a second or faster is required for a hand-held camera, however with great care 1/25th can be used if poor light necessitates.

b. Hold the camera still -- Use of a tripod is desirable. If the camera is moved during exposure, even at a reasonable fast shutter speeds, blurring will show up, especially in enlargements of miniature and sub-miniature photography.

c. Focus to get the best definition of the object of primary interest and attempt to get maximum depth-of-field for the beach.

d. Study your subject -- Get the picture that will best serve the purpose by selecting the angle from which the exposure is made and the lighting on the subject.

e. Use an exposure meter — The light on beaches can be very deceptive, particularly when the sky is overcast. Take light readings where the light reflected off the beach most nearly corresponds with that of the subject to be photographed or where the light is an average of the brightest and least light reading.

f. When photographing a beach during the middle portion of the day, use contrast filters to give a variation in the tone of sky, water, and beach.

g. When photographs are taken early or late in the day and the rising or setting sun appears red, open the aperture a full f-stop more than called for by the exposure meter.

h. When loading or unloading a camera, use care to keep the film from becoming light-struck at the edges. Wrap exposed film to prevent any light from leaking in while awaiting development.

39. Types of Photographs

Color or Polaroid photographs may be made of beach features, but on most occasions the number of copies required make black and white photography the most practical for intelligence purposes.

40. Cameras

Any camera of fair quality that has an adjustable aperture, a reasonable range of shutter speeds, and can be fitted with filters is suitable for beach photography. The 35 mm. although good for color photographs is not ideal for black and white work because of the susceptibility of the negatives to emulsion scratches, lint particles, blemishes, and graininess. Of course, considerations such as compactness, number of exposures per roll of film, and the control of records by having the exposures numbered on the film often overshadow the limitations.

41. Exposure Meters

An exposure meter should be used if possible. When light is extremely dull or abnormally bright estimation of quantity of light without a meter is especially difficult even for the professional photographer. Careful use of an exposure meter will result in better photographs under any light condition.

42. Filters

Before attempting to use filters for beach photography, the photographer should be proficient in obtaining sharp, well-exposed, black and white negatives. He can then use filters to improve the tones of the water, sand, and sky or to penetrate haze. Filters will improve the quality of the picture in most cases; however, at times of heavy overcast or in the early morning or late afternoon when the amount of blue light in the sky is reduced, filters may be ineffective in bringing out the desired contrasts. Filters may also be used to prevent overexposure when light is extremely intense and exceeds the ability of the film and camera to reproduce it corrently. A polarizing screen for controlling light is very useful in beach photography. It serves as an all-purpose contrast filter, can be used with both black and white and color film, and controls glare better than other filters. If the polarizing screen is not used, the yellow (K2, Wratten Scale), or the deep yellow (G, Wratten Scale), are the most useful filters for beach work. Besides controlling color contrast, these will penetrate haze slightly. If greater haze penetration is desired, the red filter, (A, Wratten Scale) may be used.

43. Reflected Light on Beaches

The light level of beach sands may differ considerably from place to place along a coast, the amount depending upon the materials that compose the sands. The volcanic or carboniferous sands of some areas absorb so much light that the sand appears dark gray in color. In other places the coral, shell, or crystalline sands reflect light to the extent that the beach appears almost white. Between these extremes there is an infinite variation in the amount of light reflected and absorbed and consequently, in the variations of the tones of gray recorded in photographs. There is a substantial difference in the amount of light reflected from different parts of a beach. The loose sand of the backshore and dune may appear almost white, but the damp portion of the beach exposed as the tide ebbs will appear much darker. The part of the foreshore wetted by the wave uprush will give a lower light reading than other parts of the beach except in the direction of the light source.

Section II. PHOTOGRAPHIC TECHNIQUES

44. Use of Exposure Meter on Beaches

The manufacturer's instructions on the use of exposure meters should be followed with the following special considerations. When taking a photograph on a beach it is necessary to expose for one of two basic types of pictures. These are:

a. The beach — Frequently a combination of white sand, blue sky, and light-reflecting water, all of which photograph in white tones of gray. The exposure meter reading is taken as shown in Figure 20.

b. Subjects on the beach — Here the picture interest is an object requiring 2 to 4 times more light to be admitted to the film than for the area in which the subject is sited. To further illustrate the two types of beach photographs, when a photograph is made at an exposure setting for the beach, objects on the beach will appear silhouetted as shown in Figure 21. When an object on the beach is photographed, the light reflected from the object only measured should be as in Figure 22, and the exposure made on that basis. In this case, photoelectric cell should be directed parallel to the beach and care taken to exclude the light reflected from the beach sand. The type of photograph which results when this method is followed is shown in Figure 23, in which it will be noted that while the figure shows up well, the sand, water, and sky have lost reproducible differences in tone. Experience has shown that a good average light level for all-purpose photographs can be read from the moist parts of the beach as is done in Figure 24.

45. Filters

In black and white photography the loss of identity of sand, water, and sky due to lack of difference in the tones of gray can be controlled by the use of color filters as shown in Figures 25 and 26. Yellow filters, the ones most commonly used, as well as orange and red, control blue light but are not effective in the low-angle light of early morning or late evening. Filters require more light to be admitted to the camera; the amount of increase being indicated by the filter factors. For example, the K2 yellow filter has a factor of 2; therefore the amount of light must be doubled. If the factor is 8, then 8 times the light must be admitted. The filter factor of any particular filter is furnished by the manufacturer. The polarizing screen can be used to darken a sky in either black and white or color photography and to control glare under most conditions. Experience has shown that when taking beach photographs the pictures will be improved in almost all instances when a polarizing screen is used. The degree of improvement may vary due to the differences in the polarization of light in the direction of the exposure, but an improvement will be present. Hazy skies reduce the effect of polarizing screens.

46. Stereo Photographs

The subjects of most interest along the coast in which three-dimensional views are desired for study of detail are harbor structures, groins, jetties, bridges, etc. These can be photographed in stereo with a hand-held, single-lense camera with little difficulty, merely by taking one exposure with the view finder at the right eye and another directed at exactly the same point with the viewfinder at the left eye. For all practical purposes this provides photos spaced approximately at normal 2 1/2-inch interocular distance although there is a minor technical difference. However, it is far more important to get sharpness of detail in both stereo pictures than to worry about the spacing of the two photos as long as spacing is provided. Figure 27 shows stereo pairs made with the camera rested on a steel sheet-pile channel wall with pictures spacings of 4 inches and 5 feet. Third-dimensional viewing is provided at either spacing.

47. Panorama Exposures

Panorama pictures are excellent for showing structures or broad vistas that are too long to show up when photographed in a single picture since that would require the camera to be at a much greater distance from the structure or subject. Panoramas can be taken by anyone without previous experience as long as the consecutive pictures are taken from the same spot with the camera swung in the same general horizontal plane and a small overlap provided to permit matching the images. Figures 28 through 31 illustrate use of panoramas to record types of information. Figures 32 through 37 are other photographs containing information of value for coast and beach intelligence.

Section III. AREAS OF PHOTOGRAPHIC COVERAGE

48. Beach Areas

Use single or panorama views to give the overall appearance of the beach and to indicate its shape, extent, and features. Included would be the expanse of beach at low-water level, the high-water line, gradients of the foreshore, extend of storm-wave uprush zone, pertinent beach features such as scarps, berms, cusps, runnels, structures, trafficability, and interruptions and separations. For photos showing material composition or detail in features, use closeups.

49. Beach Flanks or Terminations

Use panorama or distant views if necessary to locate the beach flanks in relation to landmarks.

50. Offshore Areas

Include in beach exposures any features in the nearshore approaches that will give indications of nearshore gradients, hazards, and obstructions. Use closeups to identify features and structures. Small craft and waders off the beach are an aid in the estimation of bottom gradients. Always note the stage of the tide or date and time of day the shot was taken to permit calculation of tide height.

51. Exits and Communications

Take at least one view looking inland at each road or exit point. Closeups can be used to show the surface material, and a general view will show its relationship to other features. Road or cross-country routes of egress linking the beach with the road network should be covered also by general views to show the route, its relation to the area, and the location of its more important features. Medium views and closeups will amplify detail of the general view.

52. Terrain Behind the Beach

Panorama or general views from high points show various coastal elements and their relation one to the other. Such photography may include dunes, ridges, escarpments, bluffs, cliffs, seawalls, or bulkheads, marshes, lagoons, vegetation and conditions for cross-country movement. Closeups show detail.

53. Structures and Installations

Photograph important coastal structures and installations to show the type, size, and condition. Use closeups for structural detail.

CHAPTER 5

SUGGESTED FIELD PROCEDURES AND FORMS

Section I. GENERAL

54. Recording Procedures

Methods of obtaining and recording field observations will vary with the individual collector, the requirement which he satisfies, and the circumstances under which he works. This guide does not specify one standard procedure for collection and recording. Information can be presented textually, graphically with annotations or as a combination of the two methods. The last method in many instances will be preferable. Examination of the various check lists, forms, and illustrations in Appendix 1 will indicate to a collector the best procedure to follow, what information to obtain, and how to present it. All forms do not have to be utilized for a collection project. For instance, Figures 40 and 41 illustrate two different graphic methods of recording information of gradients, materials, widths, etc. at one place on a beach. The same information might also be presented as entries in a form such as is illustrated in Figure 43; or for a simple beach, the information might be presented adequately by descriptive text. A collector should bear in mind that characteristics may not be consistent throughout a beach. Information of widths, gradients, materials, and other conditions should therefore reflect significant differences in these characteristics.

55. Beach Lengths

Overall and usable beach lengths are both given in beach information reports; however neither of these lengths need to be measured in the field provided terminations can be located and described in the report. This information will then permit beach lengths to be computed from the graphic plot.

56. Beach Widths

Total width of a beach is the width of the backshore measured from the coastline (landward limit of a beach) to the landward limit of normal-wave uprush (berm crest) plus the width of the foreshore measured from the berm crest to the line of low tide in tidal areas or to the line of still water in tideless areas. Measurement of foreshore width in many places is complicated by tidal fluctuations which cause the low-water line to be covered much of the time. This results in an apparent foreshore width which is narrower than the actual foreshore as in the situation illustrated in Figure 1a. Obviously this difficulty does not exist in tideless areas except under unusual circumstances such as a period of strong onshore winds which might "pile" water up against a coast. The problem of obtaining widths of tidal foreshores can be overcome by several methods. Preferably the times of low tide should be obtained from tide tables or local inhabitants and measurements made at those times. When a collector will be near a beach for only a limited time, the width can be subsequently computed from his observations of foreshore gradient, position of waterline at the time of observation, the precise time of observation and its time zone, and tide tables which will give the time of high and low tides as well as the amount of vertical fluctuation for the place of observation.

57. Gradients

Gradients can normally be shown best by a profile diagram; but if none is used, gradient should be included in a written report or a beach information form. Gradient is simply a ratio of vertical rise to a given horizontal distance and is easily figured or estimated in the field. Some graphic presentations **of gradient are discussed below.**

a. Figure 38a diagrams a method of measuring the gradient of the foreshore beach face. To determine the gradient, establish a point at or near the waterline and sight along a level line ("b") toward the high-water line and normal to the shoreline. Mark this point "A" with a stake, rock, or some suitable object. Know the height from the beach underfoot to eye level or instrument height. Pace off or measure the distance from waterline "B" to object "A." The gradient precisely equals a/b, but for practical purposes a/c is close enough. In this method of measurement the point at the back of the foreshore ("A") may be established first and then the observer can walk down toward the waterline, normal to the shoreline, until he reaches a point ("B") where a level line of sight strikes the established point "A."

b. Figure 38b diagrams another method of determining the foreshore beach face by using a sitting or kneeling person or an elevated instrument at point "A" to sight a level line to a stadia rod or an object of known height at point "B." The height "h" of the sitting or kneeling person's eye level or the height of instrument must be subtracted from the observed height "a" to determine the true gradient. In this case the gradient is equal to (a-h)/b; since "c" and "b" will not differ appreciably on any but very steep beaches.

c. Figure 38c diagrams a method for determining the gradient of the nearshore bottom. To determine such a gradient, establish a point "A" at the waterline and measure off the distance "c" to an established depth "a" at point "B" on a line normal to the shoreline. This can be done by wading out with a calibrated line or tape or by estimating or pacing off the distance while wading. The depth can either be measured or estimated by knowing the vertical distance to various parts of the body. The gradient than equals a/b or for practical purposes a/c. Gradients may be obtained in many other simple ways and may also be expressed in other units such as degrees of slope of percent of slope. However in amphibious operations it is more common to use the ratio expression of vertical rise over horizontal distance, i.e. 1 on 30, 1/30 or 1:30.

58. Materials

Beach materials are classified according to particle sizes, shapes, and position on a beach. Figure 3 shows the recommended field classification terms and categories which are an adaptation for amphibious intelligence from the U. S. Army Corps of Engineers Soil Classification shown in Figure 2 . Report beach material of the nearshore, the low- to high-water zone, the high-water zone, and the backshore. If possible dig down to about 2 feet at each test point to ascertain the composition below the surface. If this is not possible, at least kick away a little of the surface material to make sure it is not a veneer over another type of material. Notes on trafficability of each area can be made at the time of observation of material composition. For samples of photographs of materials and trafficability see Figures 4 through 8. Material composition can be recorded on a beach profile diagram as indicated in Figures 39, 40, and 41 or in a beach information form such as Figure 43.

Section II. CONSTRUCTION AND USE OF FIELD AIDS

59. Beach Profile Diagrams

Profile diagrams give a clear, concise picture of widths and gradients of the particular section of beach or nearshore for which they are representative. In addition classification of the beach material and estimates of trafficability can be recorded in an orderly manner on a profile graph. The profile can be constructed by determining and plotting the elevation above and below a particular datum and the horizontal position of several points along a straight line crossing a beach normal to the shoreline. These plotted points of the graph are then connected with a line to complete the profile. The procedure for constructing a profile diagram follows:

a. Set up the profile on a piece of graph paper by first designating the line formed by intersection of still-water line (i.e. the waterline as it would exist if the surface of the water were perfectly calm) and the beach face as zero for vertical and horizontal distances. Mark the vertical scale off in feet and the horizontal off in the smallest unit of measurement which permits inclusion on the graph of the entire horizontal distance to be represented. Usually the vertical scale must be exaggerated over the horizontal.

b. Select a beach profile line which is typical of conditions in the particular section of beach to be represented.

c. Lay out the profile line on the beach by placing markers at the coastline, and the high-water mark, the still-water line, and other points for which vertical elevations should be precise.

d. From the still-water line, measure the differences in elevation (vertical distance) and the horizontal distance of the profile-line markers.

e. Plot each point on the graph. Connect the points on the graph with a solid line estimating minor relief between the plotted points.

f. Classify beach materials according to particle size and shape categories of Figure 3. Figures 39, 40, and 41 illustrate application of material distribution diagrams or notes to constructed profiles.

g. Notations pertaining to estimates of trafficability conditions; location, dimensions, and effects of beach features; notes on estimated required engineer effort for beach stabilization or improvement; and other pertinent details should be noted above the profile line. These notes should be keyed to the area to which they pertain as in Figures 40 or 41.

h. The following information should be recorded in the bottom margin of the profile sheet:

(1) Beach location.

(2) Profile location on the beach.

(3) Date and time (with time zone) or profile survey.

(4) Method of survey.

(5) Approximate distance to either side of the profile for which it is representative of existing conditions.

60. Examples of Field Aids

The use of check lists in the field may help an inexperienced collector by assuring the coverage of all necessary subjects. Figure 42 is a recommended check list of subjects to be observed. Figure 44 is a check list of subjects which might be photographed. Figure 43 is a form which can be filled in on a beach as observations are made; the headings in the form suggest subjects to be covered and in effect are a check list.

Figure 1a

GENERAL BEACH PROFILE DIAGRAM

(TIDAL SEA)

BEACH EROSION BOARD — CORPS OF ENGINEERS

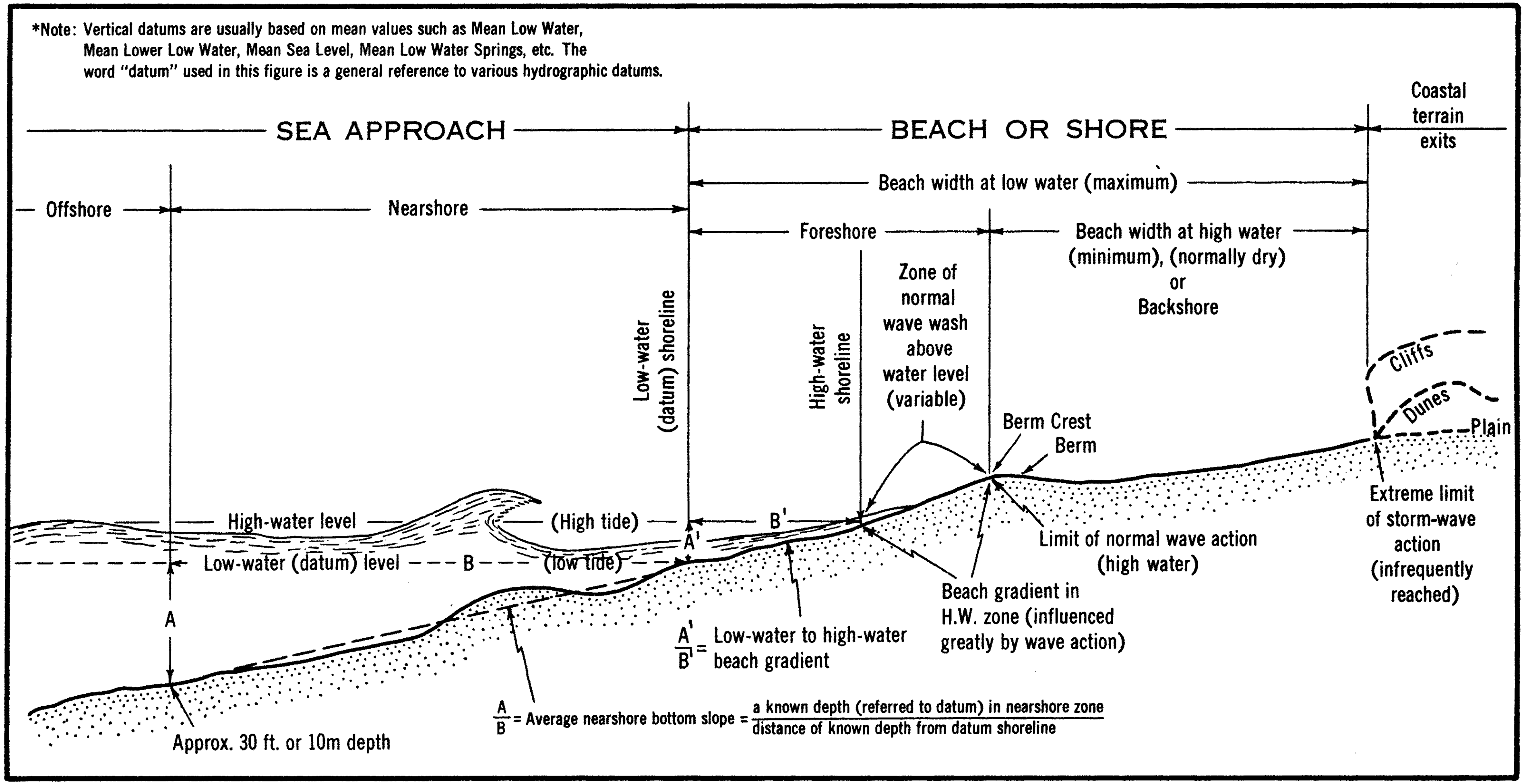


Figure 1b

GENERAL BEACH PROFILE DIAGRAM

(NON-TIDAL SEA)

BEACH EROSION BOARD

CORPS OF ENGINEERS

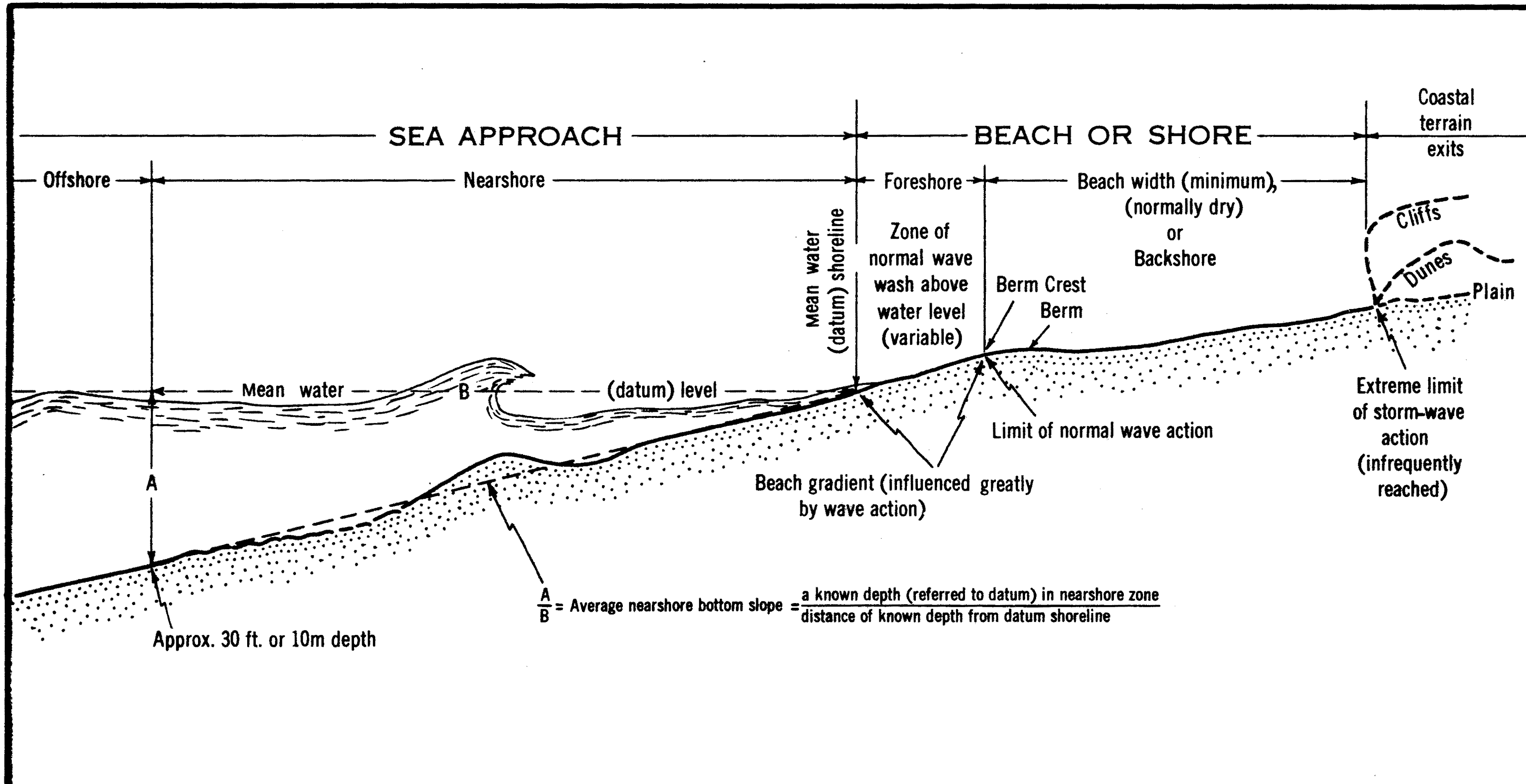


FIGURE 2

U.S. Army Corps of Engineers' SOIL CLASSIFICATION

Grade Limits	US Standard Sieve Size	Name
Above 76mm.	Above 3"	*Cobbles
76mm. - 19mm.	3" to 3/4"	Coarse Gravel
19mm. - 4.76mm.	3/4" to No. 4	Fine gravel
4.76mm. - 2.00mm.	No. 4 to No. 10	Coarse sand
2.00mm. - 0.42mm.	No. 10 to No. 40	Medium sand
0.42mm. - 0.074mm.	No. 40 to No. 200	Fine sand
Below 0.074mm.	Below No. 200	Silt or clay

*Boulders as used in text is a subdivision of Cobbles and consists of those particles above 10" in diameter.

Figure 3

SUGGESTED FIELD CLASSIFICATION FOR BEACH MATERIALS

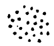
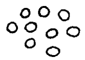
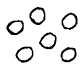
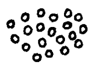
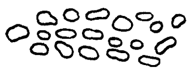
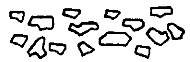
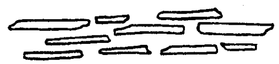
	CLASS. TERM	APPEARANCE	DIAMETER RANGE	DESCRIPTION
SIZE CLASSES	Clay and silt	Micro-grained particles	Less than 3/1000 inch	Individual grains not visable to unaided eye; has slippery or silky feel; clays are cohesive when wet.
	Fine Sand	 to 	3/1000 in. or more but less than 1/60 inch.	Smaller grains appear as specks; larger grains comparable to table salt; has gritty feel.
	Medium Sand	 to 	1/60 in. or more but less than 1/10 inch.	Larger of these grains comparable to BB shot.
	Coarse Sand	 	1/10 in. or more but less than 1/5 inch.	Large enough to be easily measured, larger particles the size of small peas.
	Large Particles (Fine gravel, coarse gravel, cobbles, boulders)		1/5 in. or more. (For further breakdown see U.S.C. of E. classification table.	Describe size by reporting diameters of particles in inches or fractions of inches.
SORTING	CLASS. TERM	APPEARANCE		DESCRIPTION
	Well-sorted			All particles approximately the same diameter..
	Poorly sorted			Particles fall within more than one size class or there is a wide range of diameters within a single size class.
SHAPE	CLASS. TERM	APPEARANCE		DESCRIPTION
	Rounded			Nearly all surface area rounded;no sharp edges.
	Angular			Generally flat sides; many sharp edges.
	Flattened (shingle)			Flattened particles.

Figure 4.

Trafficability photograph, note softness of backshore berm and relative firmness of wetted foreshore. Type of vehicle and tire pressures should be given if possible. These tracks made by amphibious DUKW, 8-pounds tire pressure.

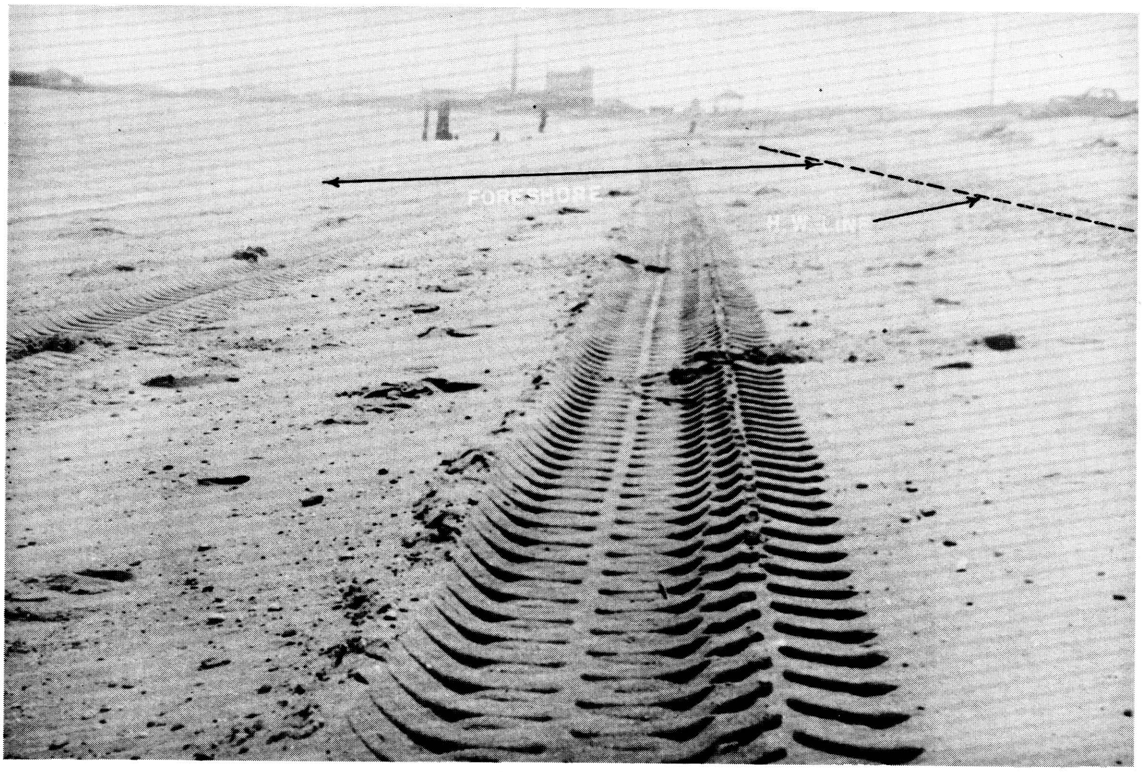


Figure 5.

View showing trafficability of foreshore (soft). Tracks made by amphibious DUKW, 8-pounds tire pressure. Also note footprints.

Figure 6.

View showing tire impressions HW zone. Wide, waffle-pattern prints made by amphibious BARC. Note escarpment at back of beach fronting foot of high, grassy dune area.

Figure 7.

View showing civilian "jeepster" tire impressions and footprints in mid-tide zone.

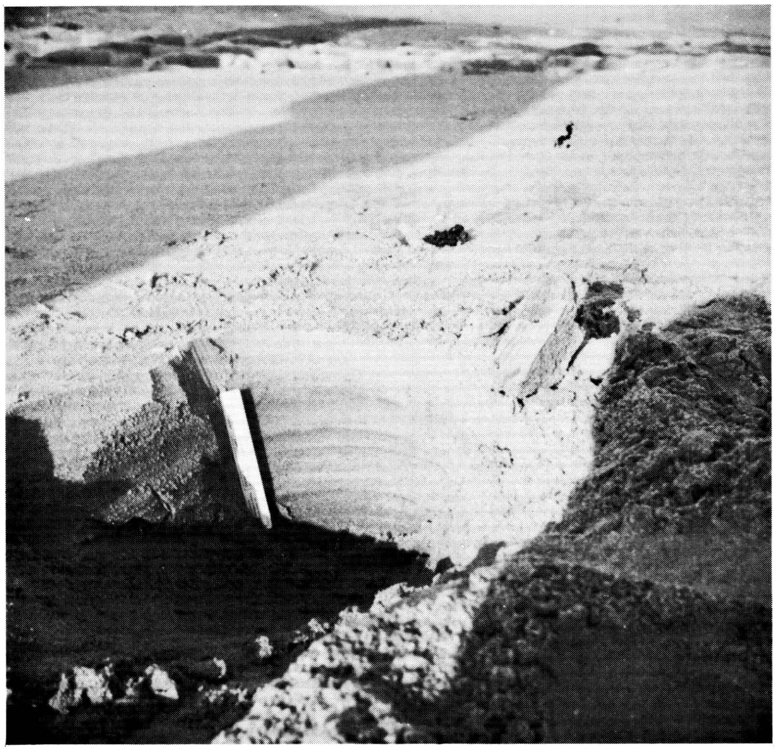


Figure 8.

Ground shot showing sand stratification in mid-tide zone. A six-inch ruler shown in left center.

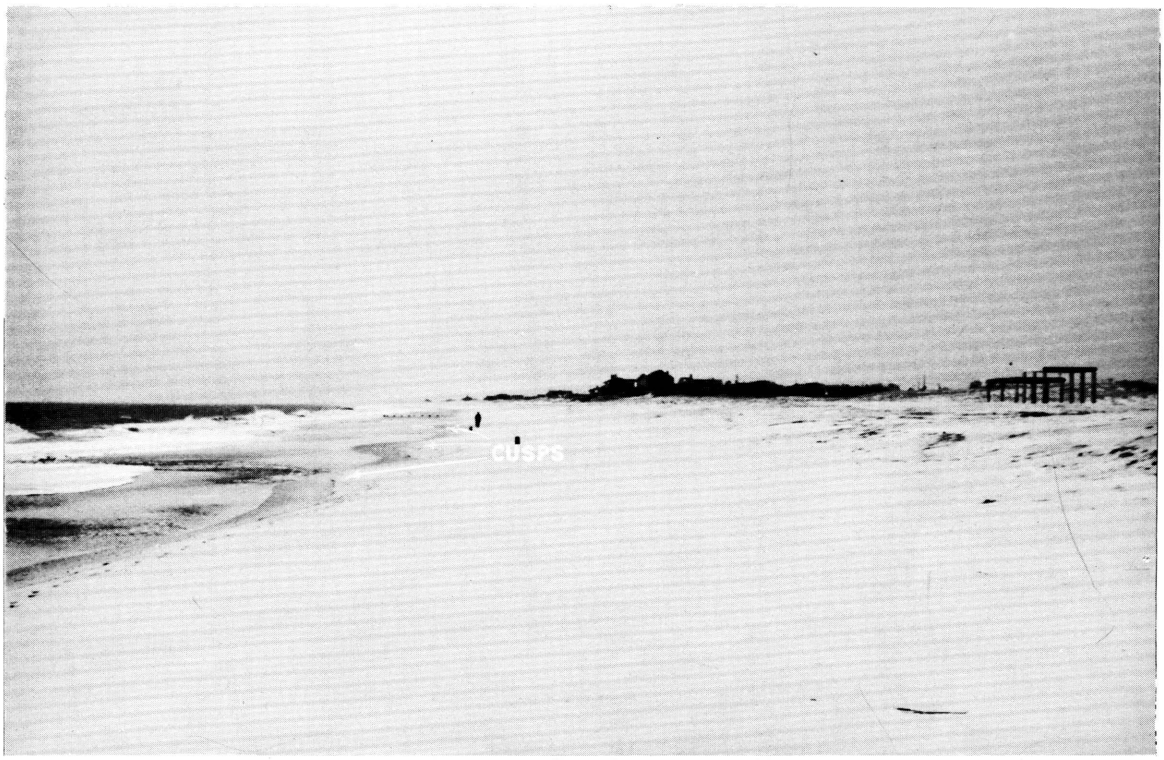


Figure 9.

View showing small beach cusps being formed by wave action.

Figure 10.

View showing beach scarp (6-inch rule in left center of photo), beach berm, material and trafficability (footprints in foreground).

Figure 11.

View showing small beach scarp being cut into beach berm by wave action (wave uprush). The presence of the DUKW gives an indication of the trafficability of the berm.

Figure 12.

View showing obstructions to lateral movement formed by protective structures (groins); also shows ponds in low-water terrace; a fair idea of beach gradient can be computed.

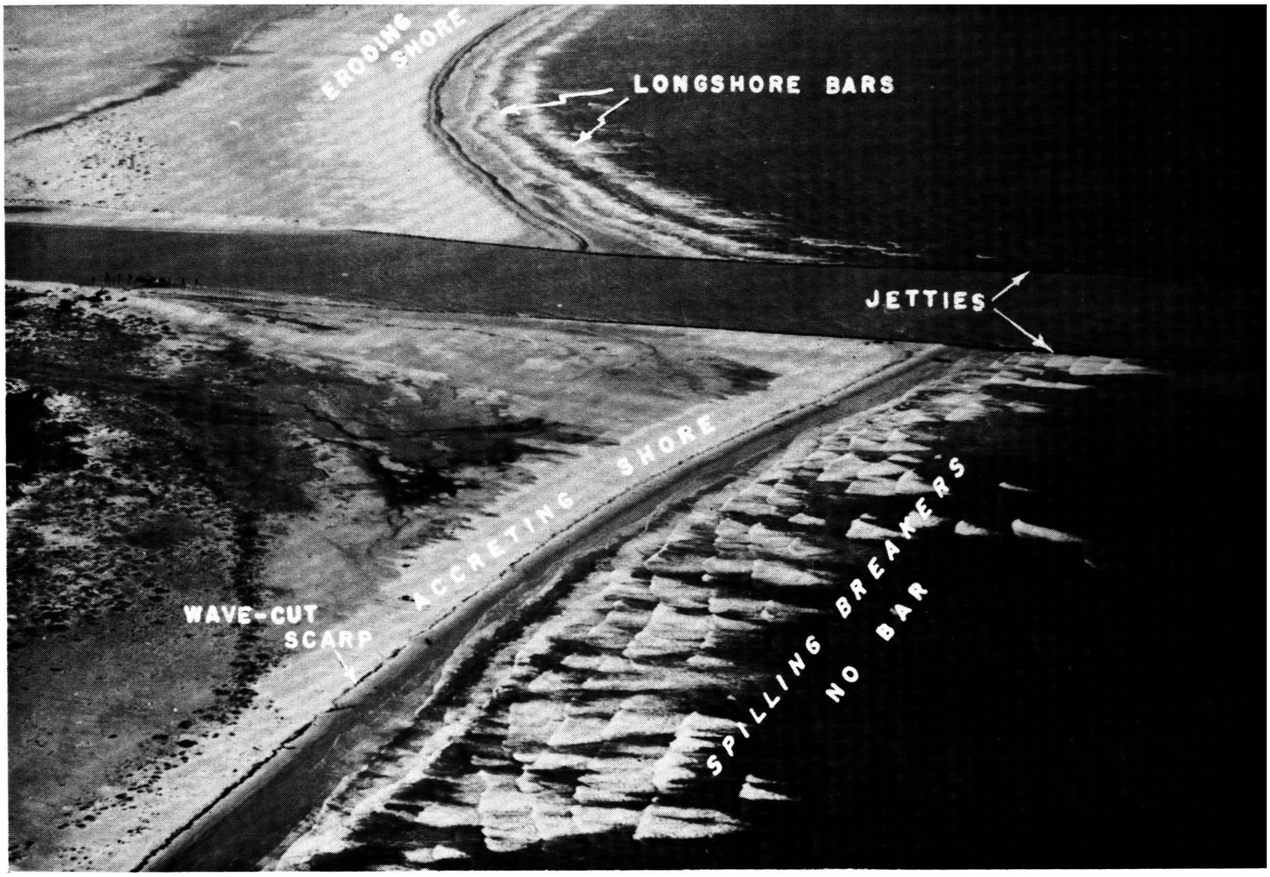


Figure 13.

Stabilization of an entrance channel by jetties. Note difference in position of shoreline at each side of the channel. Several lines of spilling breakers on the near side of the channel indicates a generally uniform bottom slope with no longshore bars. Breakers on the far side indicate the presence of two longshore bars.

Figure 14.

View of groin which has been flanked by erosion at its landward end (foreground). Note difference in elevation of beach (approximately 10 feet) on either side of groin due to accretion on updrift side. Such structures are formidable obstacles to lateral movement along a beach. Approximate measurements of the structure should be made, and its condition estimated.

Figure 15.

View showing plunging breaker at seaward end of groin. Note backrush of water (in foreground) from preceding wave.

Figure 16.

A low oblique illustrating many beach and coastal features. See also Fig. 4 .

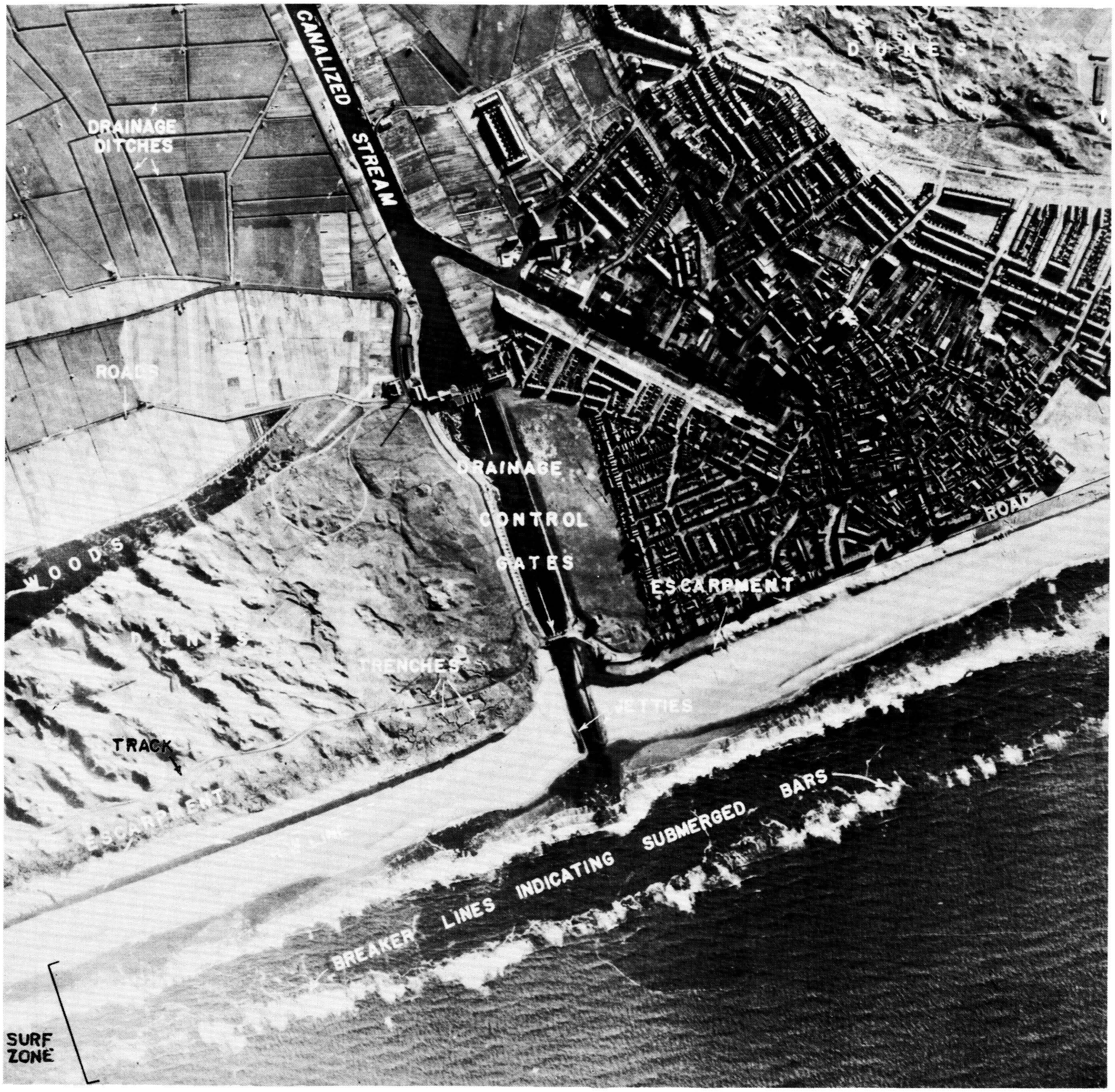


Figure 17.

Aerial vertical showing many features pertinent to beach intelligence.

See also Fig. 5

Figure 18.
Table of Information Requirements
for Beach Intelligence Reports

Beach No. or Identification; Location; Map, Chart, or Photograph Reference	1. Distance and direction from prominent landmarks, capes, towns, harbors, lights, rivers, etc. 2. Geographical or UTM grid coordinates to center of short beaches or to ends of long beaches. 3. Beach number or name keyed to map, chart or photographic references.
Length and Usable Length	1. Total length of beach area in yards or statute miles. 2. Length, location and description of unusable portions. 3. Length and location of portion most favorable for landing. 4. Obstacles that would interrupt lateral movement along beach (usually surmountable without additional aids; small streams, piers, etc.) 5. Obstacles that separate beach such as large streams, harbor areas, rocky outcrops, etc. 6. Obstacles at ends of beach such as rocky shores, cliffs, streams, etc.
Width at L.W. and H.W.	1. Width of beach available during high water periods (minimum width). 2. Width of beach available during low water periods (maximum width).
Beach Gradients L.W. to H.W.; H.W. Zone	1. Gradient (ratio of vertical rise to horizontal distance or degrees) of beach from low water line to high water line (portion exposed to tidal variations). Note presence of drying mud and sand flats; coral reefs, etc. 2. Gradient of beach in high water zone (portion in zone of high water levels where waves may cast up ridge of material or erode beach berm). 3. In case of non-tidal sea, give gradient in high water zone only.
Approach	1. Nearshore bottom slopes or gradients, preferably shoreward of 14-ft. depth, otherwise shoreward of 30-ft. depth. 2. Distances offshore of certain depths, such as 12-, 18-, 30-ft. depth curves. 3. Condition of nearshore area, location of submerged and exposed obstructions to landing craft, clear depths over obstructions referred to a certain datum. 4. Location and description of offshore obstructions to navigation which would influence sea approach to beaches. 5. Nature of bottom topography and bottom materials. 6. Location and nature of anchorage and holding ground. 7. Ice conditions influencing landing operations. 8. Wind and other weather conditions influencing landing conditions.
Surf, Currents, and Tidal Range	1. Wave conditions fronting beach; wind conditions influencing wave action; protection from wave action; types of breakers, occurrence and number of lines of breakers and distance offshore; heights of breakers. 2. Surf action fronting beach; widths of surf zones. 3. Presence of tidal currents and rips, littoral currents, with velocities. 4. Types of tides (diurnal or semi-diurnal); ranges of spring and neap tides; other peculiarities of water level fluctuations (wind tides).
Beach Material and Firmness	1. Composition of beach, type and size of material, such as fine or coarse sand, gravel, pebbles, cobbles, boulders, mud, and combinations thereof. 2. Distribution of materials along beach. 3. Trafficability of different materials (wet and dry) for men and vehicles.
Terrain Immediately Behind Beach	1. Description of coastal terrain from back of beach proper to first major topographic terrain feature (such as mountain range, large river, etc.) but not more than 5 miles inland, and nature of flanking terrain, listing and locating data influencing movement of men and vehicles, such as (a) lagoons, marshes, swamps, sloughs, ponds, lakes, etc.; (b) dunes, hills, cliffs, bluffs, mountains, valleys, etc., with vegetation and cover; (c) plains with type of cultivation and culture; (d) villages, cities, ports, harbors, airfields, and other developed areas.
Exits and Communications Inland	1. Means of exit from beach proper to established communications nets and interior, such as: (a) overland or cross-country movement, noting most favorable routes, with distance to existing roads and railroads; (b) footpaths, trails, wagon tracks, dirt, improved or paved roads, railroads, village or city streets, etc. 2. Note whether movement can be made directly inland or whether lateral movement is necessary before proceeding inland. Describe barriers. 3. List major cities or towns, with distance and direction, reached by roads and railroads.

Figure 19.

Table of Sources for Information Requirements for Coast and Beach Intelligence

NOTE: This Table provides a ready reference for the collector to guide his efforts and conserve his time in selecting sources of information to augment and confirm observations. It is to be considered as a guide only, as coverage and value listed are only the normal or average provided. Each document must be evaluated on its own merits. The categories of relative normal value are:
E: Excellent; G: Good; F: Fair.

	SOURCES	Location	Length	Type and Shape	Separations of Beach	Interruptions to Lateral Movement	Beach Widths	Beach Gradients	Nature of Drying Zone	Beach Features	Offshore Approach	Nearshore Approach	Nearshore Bottom Profiles	Bottom Configuration & Composition	Anchorage	Protective Structures	Ice Conditions	Wind, Precipitation, Temperature	Surf Conditions	Sea and Swell Data	Tidal Ranges	General Currents	Tidal Currents	Littoral Currents	Beach Material	Beach Trafficability	Terrain Description	Drainage	Vegetation	Towns and Villages	Water Supply	Electric Power Supply	Storage Areas	Military Installations	Roads	Railroads	Navigable Waterways	Aircraft Facilities	Radio Facilities	Telephone and Telegraph Facilities	Pipelines	Cross-country Movement	Water Bases	
	MAP AND GROUND SURVEYS																																											
1.	Topographic Maps	E	E	E	E	G	F			G	F	F				F											E	E	G	E	G	F	F	G	E	E	F	G	F	F	G	G	F	1.
2.	Topographic Surveys	E	E	E	E	G	F			G						F											E	E	G	E	G	F	F		E	E	F	G			G	G	G	2.
3.	Terrain Diagrams			E	E	F	F			G																	E	E		F					F	F	F	F				G	F	3.
4.	Vegetation Maps																										F	F	E													F		4.
5.	Vegetation Surveys																										F	F	E													F		5.
6.	Geologic Maps	G	G	G	G				F					F											F		G	G														F		6.
7.	Geologic Surveys	G	G	G	G				F					F											F		G	G														F		7.
8.	Geologic Sections													G											F		F	F			G													8.
9.	Geologic Structure Contour Maps													F											F			F			G													9.
10.	Geologic Subsurface Maps													F											F			F			G													10.
11.	Geologic Block Diagrams			G	G								G	G													E	E														G		11.
12.	Columnar Sections													F											F			F			F													12.
13.	Soil Maps																										F	G	F													E		13.
14.	Trafficability Maps																									E	F		G						E	E						E		14.
15.	Agricultural Products Maps																										F	F	G		F													15.
16.	Agricultural Surveys																										F	F	G		F													16.
17.	Drainage Maps				G																						G	E			E											G	F	17.
18.	Drainage Surveys				G																						G	E			E											G		18.
19.	Ground Water Surveys																											E			E													19.
20.	Inland Waterway Maps	F																												F							E						E	20.
21.	Road and Railroad Maps	F																												G					E	E								21.
22.	Tele-Communication Maps																													G									E	E				22.
23.	World Aeronautical Charts	G	F	F	F						F	F				F											F	G		G					F	G	F	E				F		23.
24.	Approach Charts	G	G	G	G	F					F	F				F											F	G		G					G	G	F	E				F		24.
	HYDROGRAPHIC DATA																																											
25.	Hydrographic Charts	E	E	E	E	E	E		E	G	E	E	E	E	E	E					E	E	E	E			F	F	F	F					F	F	E				F		E	25.
26.	Hydrographic Surveys	E			G	F	E	G	E	G	E	E	E	E	E	E					E	E	E	E	G		F		F								E						E	26.
27.	Coastal Pilots	F								F	E	E		F	E	G	G	G	G	G	E	E	E	E	F		F			F	F						E		F	F			E	27.
28.	Sailing Directions	F								F	E	E		F	E	G	G	G	G	G	E	E	E	E	G		F			F	F						E		F	F				28.
29.	Notices to Mariners										E	E		F	E	G	G		G	G																	E							29.
30.	Reports of Activity which Result in Change in Hydrographic Conditions										G	G		F	E	G	F																				E						G	30.
31.	Boat Survey Sheets						G	G	E	E	E	E	E	E	E	E																					E						E	31.
32.	Tide and Current Tables																			E	E	E	E																					32.
33.	Tidal Current Charts																					E																						33.
34.	Port Studies										E	F		G	E	E	G		G	G	E	E	E	E						F	F	G	G			G	E						E	34.
	PHOTOGRAPHS																																											
35.	Ground, Selective Stills			F	F	G	F	E		E		F				E									E	F	E	F	E	G	F	G	G	E	E	F	G	E	E	G		E		35.
36.	Ground, Panoramas			F	G	E	F	F		G		F				G											E	F	E	G	F	F	F	E	G	F	F	F				E		36.
37.	Aerial Verticals: Singles	E	E	E	E	E	E			G	F	F				G									F		E	G	G	G	F	F	F	E	E	E	G	E	F	F		G	G	37.
38.	Aerial Verticals: Stereographic Pairs	E	E	E	E	E	E			E	G	G				E									F		E	G	G	G	F	F	F	E	E	E	G	E	F	F		E	G	38.
39.	Aerial Obliques: Singles			E	E	E	F	F		E	F	F				G									F		E	G	G	G	F	F	F	E	E	E	G	E	F	F		E	G	39.
40.	Aerial Obliques: Stereographic Pairs			E	E	E	F	F		E	G	G				E									F		E	G	G	G	F	F	F	E	E	E	G	E	F	F		E	G	40.
41.	Aerials: Separate Prints		E	E	E	E	E	F		G						G									F		E	G	G	G	F	F	F	E	E	E	G	E	F	F		G	G	41.
42.	Aerials: Mosaics	E	E	E	E	E	E			G	F	F				G									F		E	G	G	G	F	F	F	E	E	E	G	E	F	F		G	G	42.
43.	Trimetrogon	E	E	E	E	E	E	F		G	F	F				G									F		E	G	G	G	F	F	F	E	E	E	G	E	F	F		G	G	43.
44.	Nine- lens	E	E	E	E	E	E			G	F	F				G									F		E	G	G	G	F	F	F	E	E	E	G	E	F	F		G	G	44.
	WEATHER																																											
45.	Climatic Atlas																	E													G													45.
46.	Weather Reviews																	E													G													46.
47.	Climatic Handbooks																	E													G													47.
48.	Agricultural Publications																	E											G		G													48.
49.	Sea and Swell Atlas																		G	E																								49.
50.	Ice Atlas																E																											50.
	OTHER SOURCES																																											
51.	Documents	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	G	G	G	G	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	51.
52.	Travel and Tourist Literature, Newspaper Accounts	F	F	F	F		F	F	F	F	F	F			F	F	F	F	F	F	G				F	F	G	F	G	G	F	F	F	F	G	G	G	G	G	G	F	F	F	52.
53.	Technical Publications					G	F	F	F	F	G	G	F	G	G	G	G	E	E	E	E	E	E	E	G	G	G	E	E	E	E	E	E	E	E	E	E	E	E	E	E	G	G	53.
54.	Interviews and Interrogations	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	54.
55.	Personal Reconnaissance	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	F	F	F	F	F	F	F	F	F	G	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	55.

Figure 20.

Light reading off dry sand of the backshore.

Figure 21.

An exposure based on the light reading in Figure 20 usually results in silhouetted subjects.

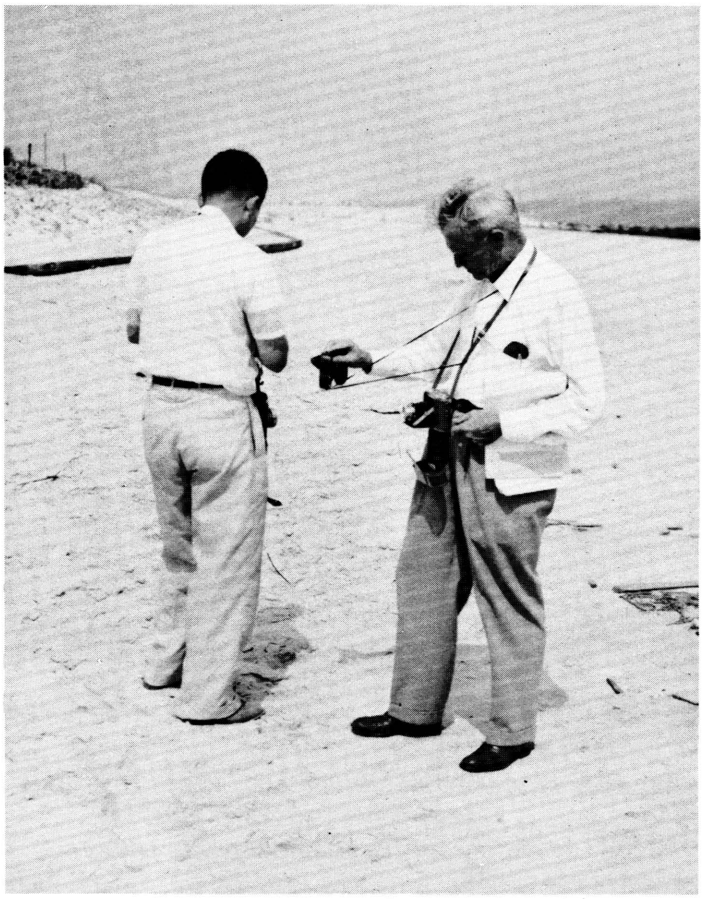


Figure 22.

Light reflected from the clothing, facial features, or a structure, should be measured when subject detail is required.

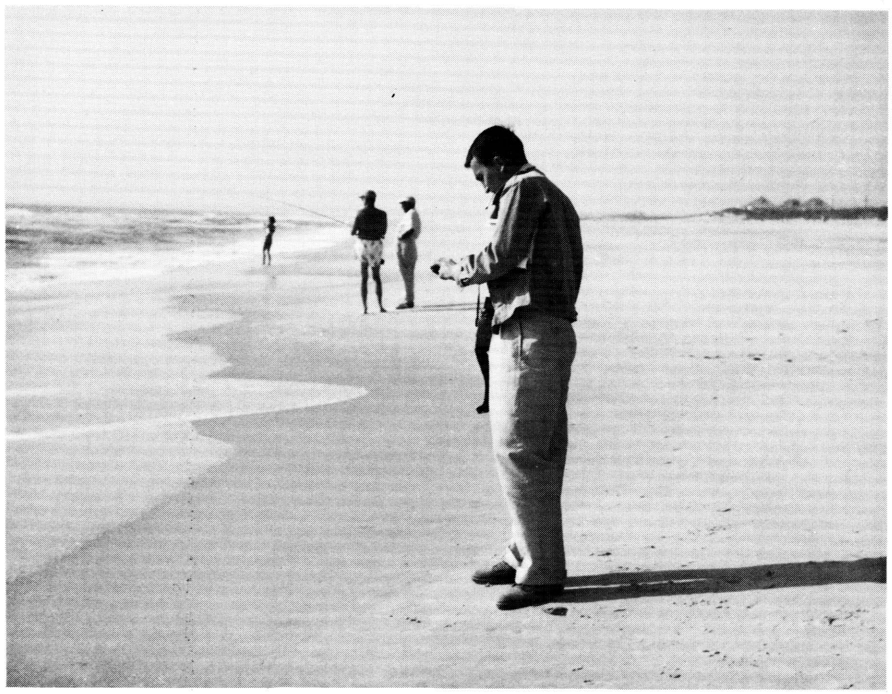


Figure 23.

On bright days the sand, water, and sky have almost the same tone when exposure is made for subject detail (man in foreground). Contrast can be increased by use of filters.

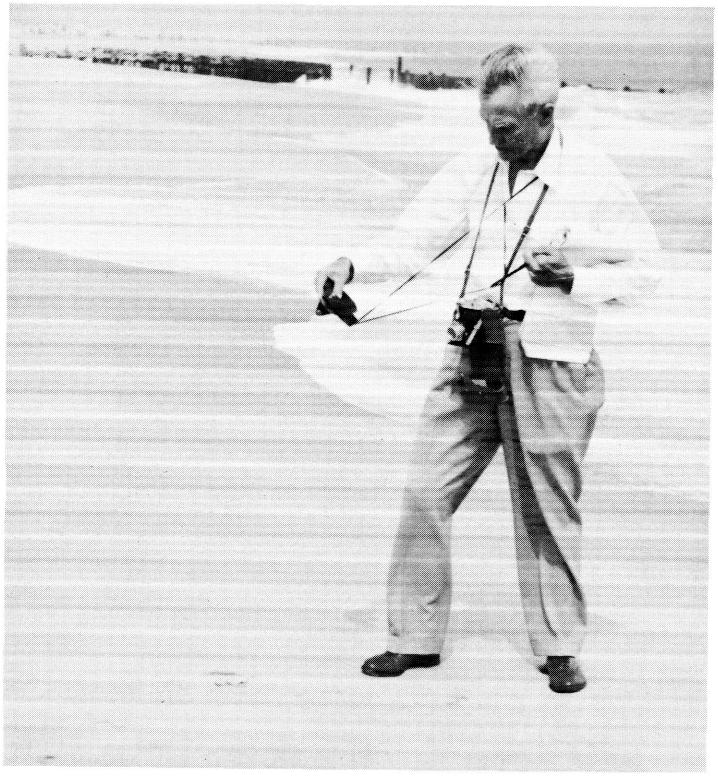


Figure 24.

The best average exposure readings for all-purpose beach photographs will be obtained from the moist, not wet, part of the beach.

Figure 25.

Contrast of sand, water, and sky as obtained through the use of a yellow filter.

Figure 26.

Filters provide contrast for the high-angle light of mid-day.

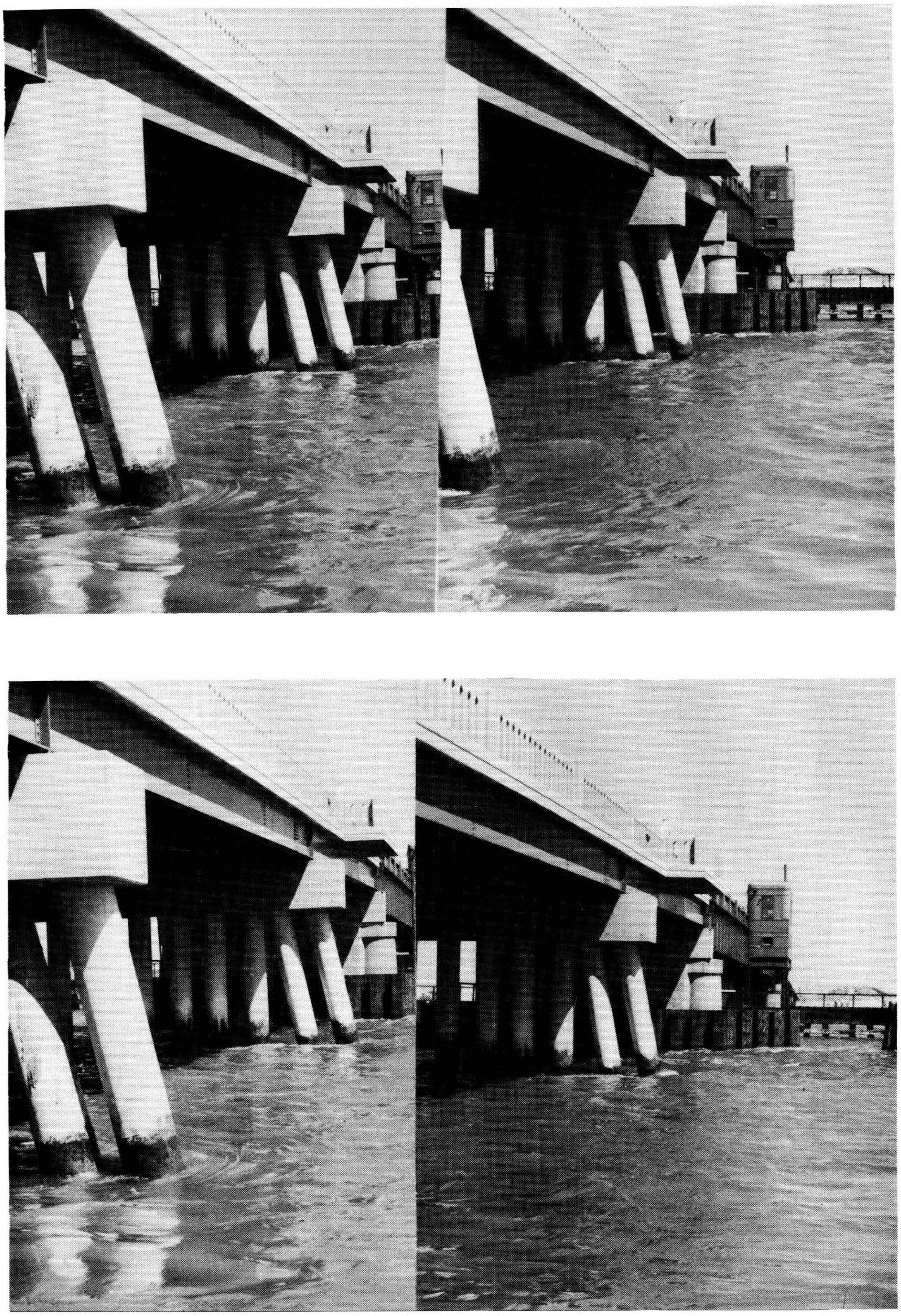


Figure 27.

Stereo pair at top was made with camera moved 4 inches. The lens spacing of the lower pair is 5 feet.

Figure 28.

Use of panorama to show a strategically important lengthy structure.

Figure 29.

Two-exposure panorama showing the conditions seaward and landward of the crest of a dune. The dune is not natural, but was made of material from the excavation shown in the photo on the right. The dune is stabilized by closely planted dune grass.

Figure 30.

Panorama used to show the foreground width of a beach. The width is deceptive without a line shown normal to the waterline and parallel to the horizon.

Figure 31.

Three-exposure panorama of a steel-timber groin.

Figure 32.

Comparative photos down the axis of a groin to show construction details. The photo on the right was made with the focus at infinity; on left, at 30 feet.

Figure 33.

Tire tracks of an amphibious truck with a 1-ton load at 15-pound tire pressure.

Figure 34.

Beach cusps, otherwise difficult to photograph, may be treated as shown here. The surf fisherman on the right is standing on one of the cusps and the other nearly so. The cusps are 95 feet apart.

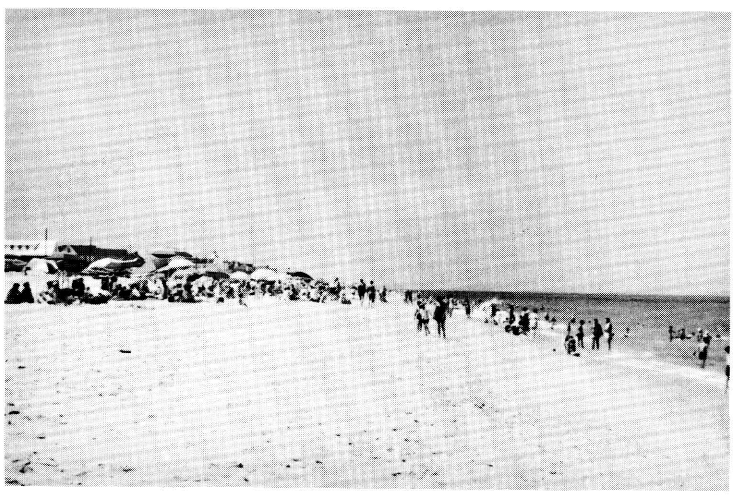


Figure 35.

The use of a beach for recreational purposes has certain significance. Photos such as this permit estimates to be made of nearshore depths, beach slopes, beach material and its supporting power, availability of potable water, shelter, supplies, power, etc.

Figure 36.

Photograph vegetation to show density and type.

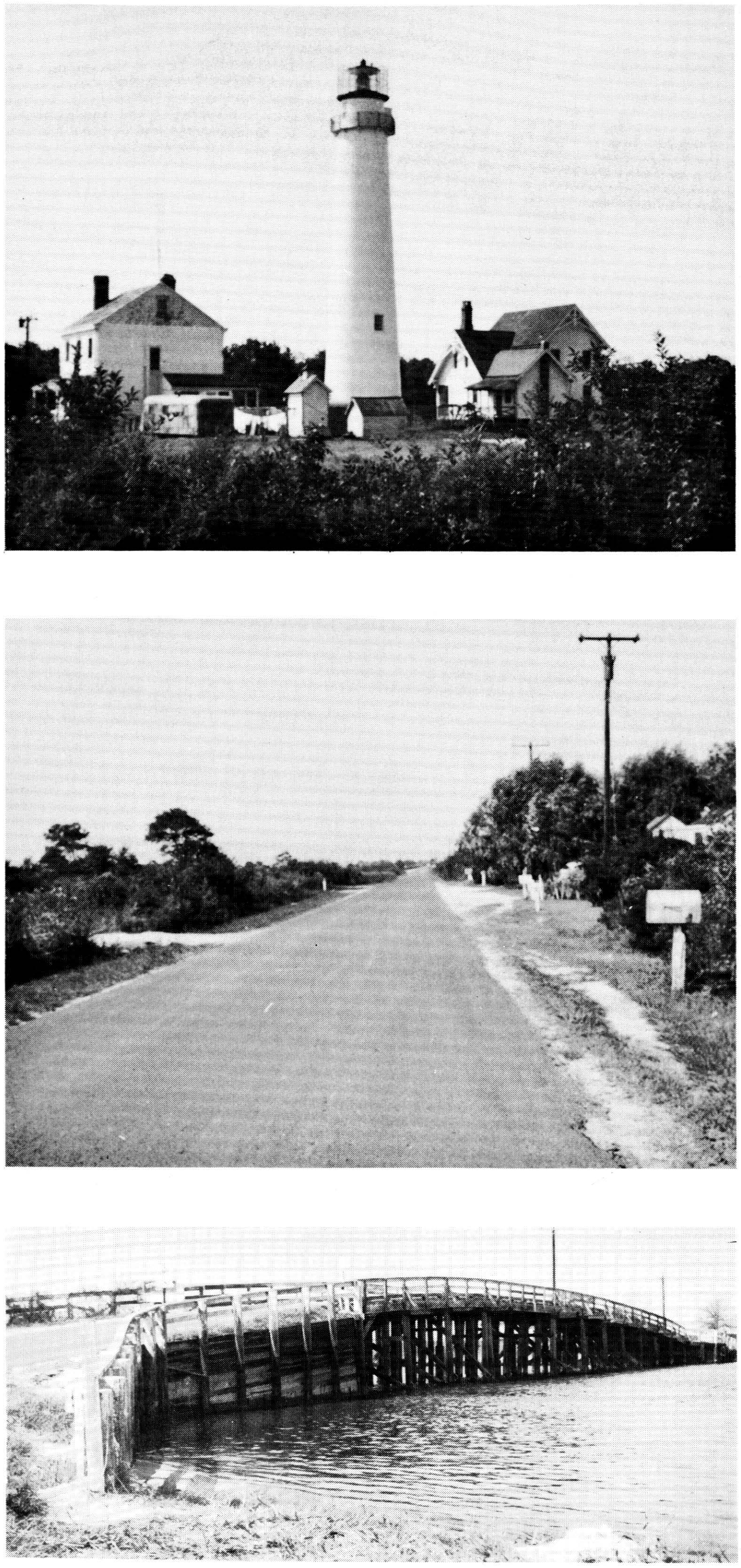
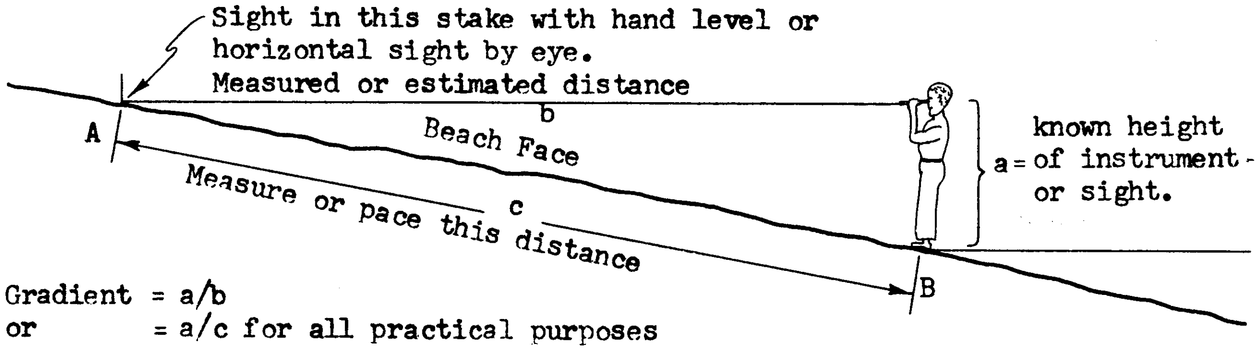


Figure 37.

Details of landmarks such as the above lighthouse or the towers in Figure 28 are important when making a landfall. Roadways, bridges over waterways, etc. are important ground-photo subjects.

Figure 38a

GRADIENT MEASUREMENT (Foreshore Beach Face)

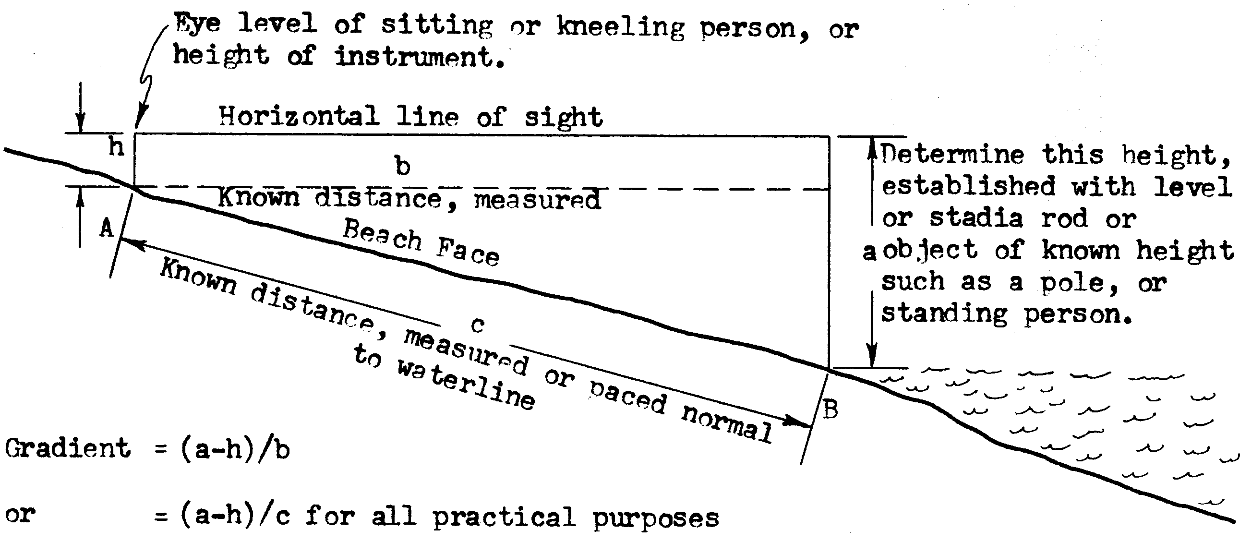


Gradient $= a/b$

or $= a/c$ for all practical purposes

Figure 38b

GRADIENT MEASUREMENT (Foreshore Beach Face)

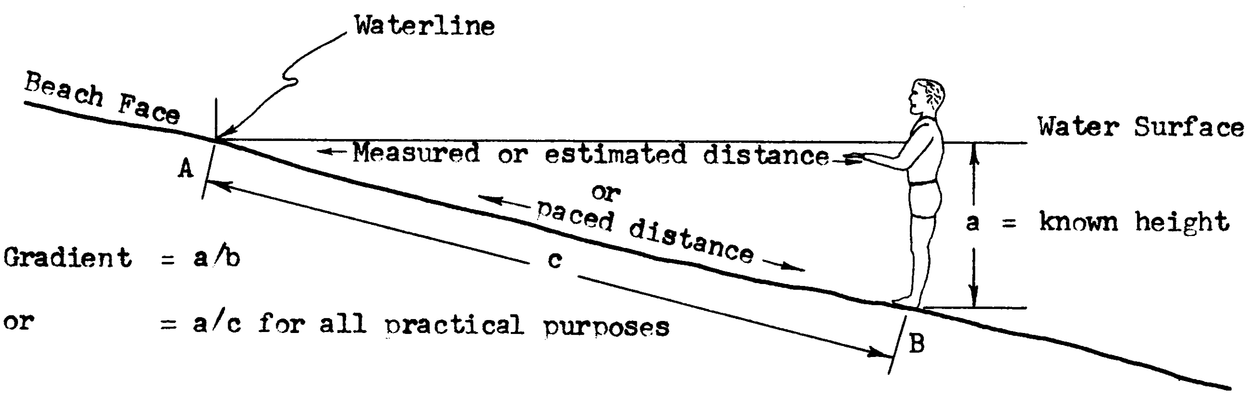


Gradient $= (a-h)/b$

or $= (a-h)/c$ for all practical purposes

Figure 38c

GRADIENT MEASUREMENT (Nearshore Bottom)



Gradient $= a/b$

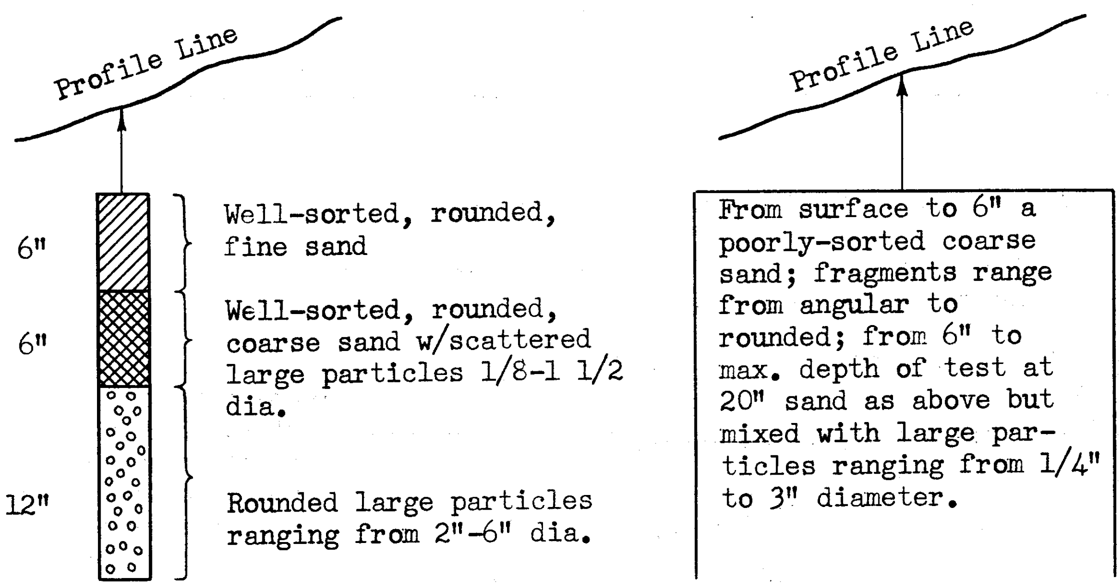
or $= a/c$ for all practical purposes

Figure 39.

METHODS OF RECORDING BEACH MATERIALS

BAR DIAGRAM

WRITTEN DESCRIPTION

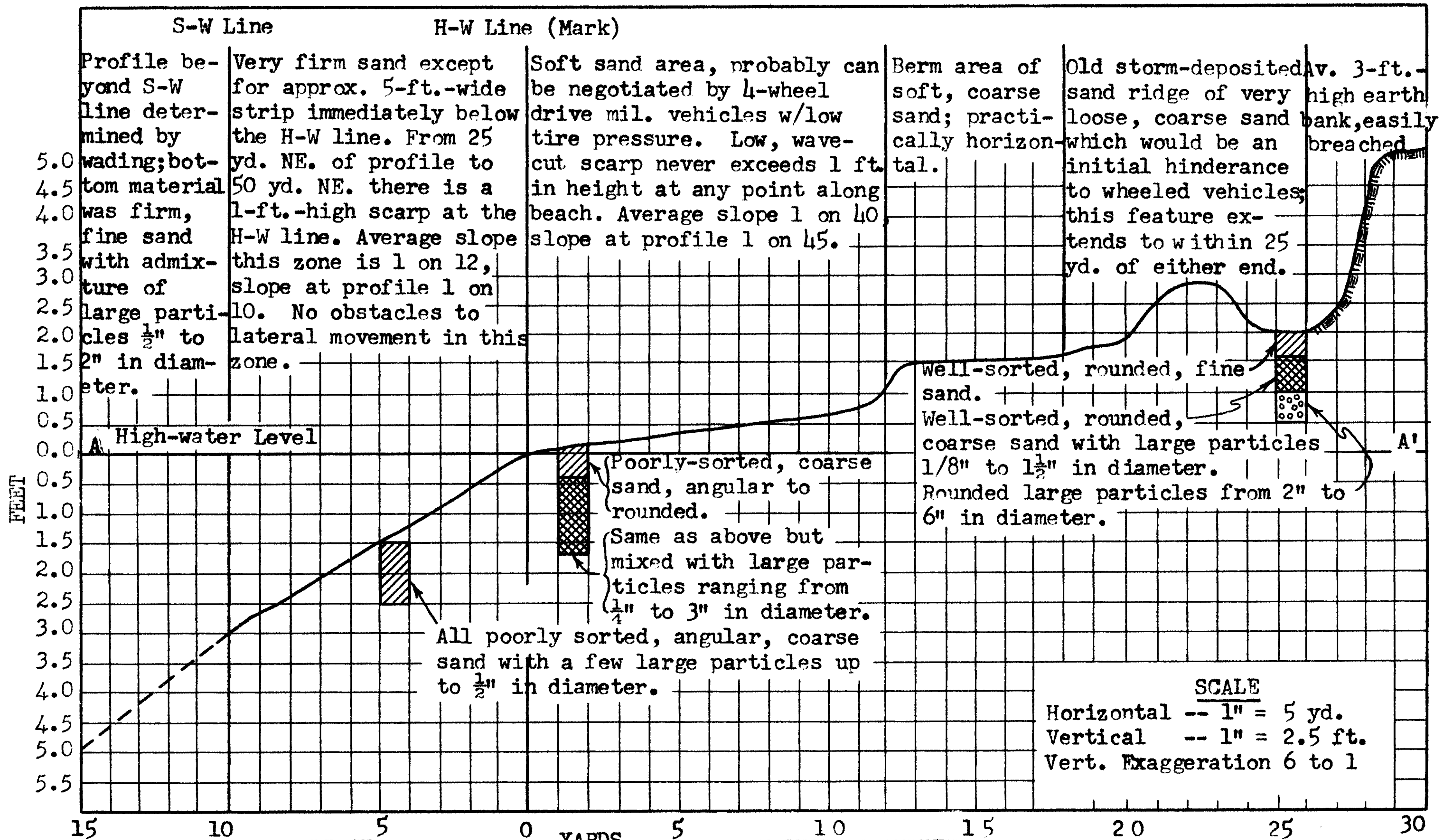


Note: A heavy vertical line may be substituted for the bar. If the diagram is drawn to scale on the profile graph the depth figures on the left can be omitted.

PROFILE LOCATION:
600 yd. E. of W. end (A-A')

Figure 40
BEACH PROFILE

Date: ____________
Time & Zone: ____________



BEACH

1000 yd. straight beach approx. 2 mi. E. of ____________ from UMT Coord. _____ to _______.

METHOD OF SURVEY

Steel tape & hand level.

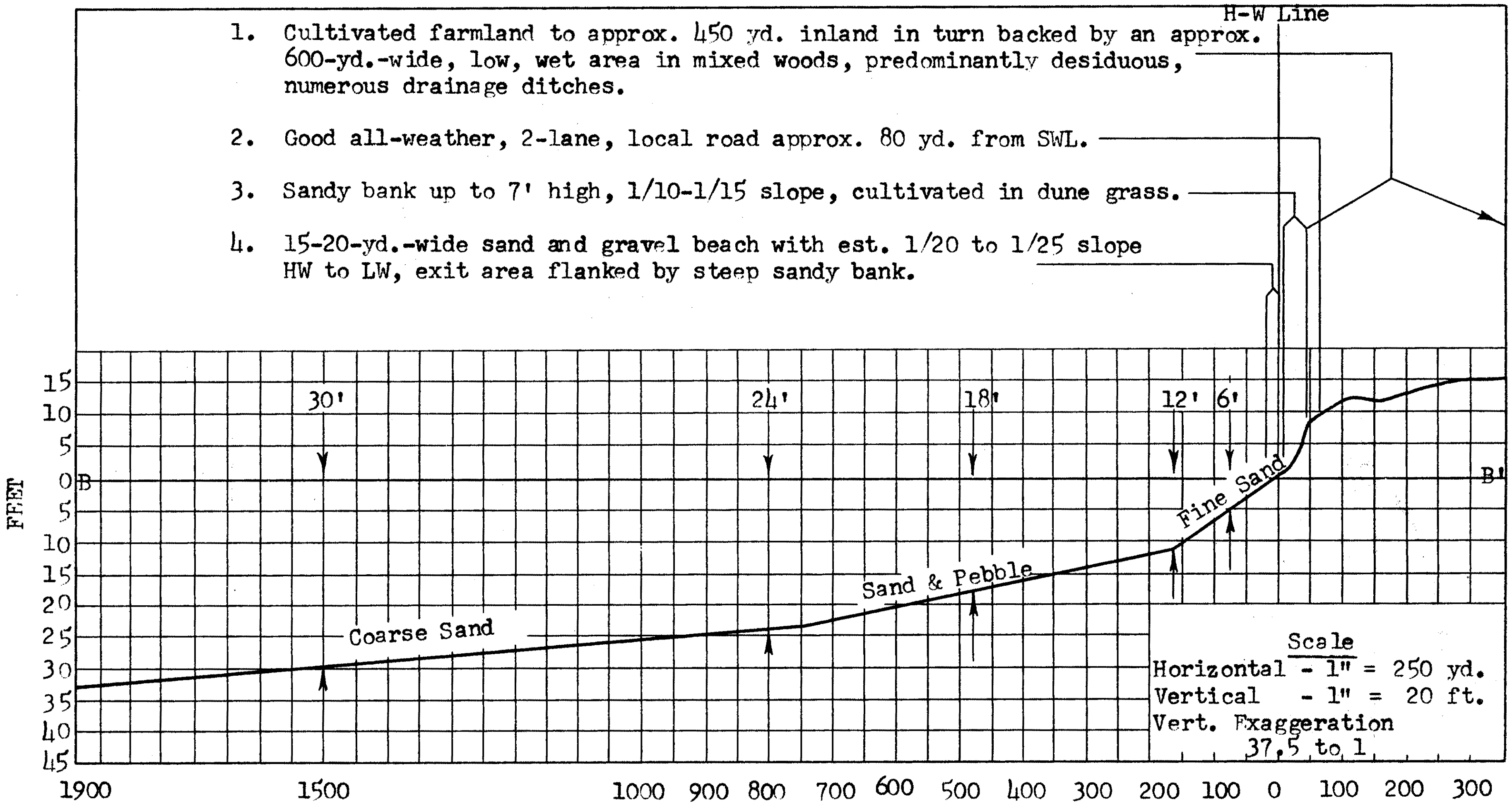
REPRESENTATION

Profile characteristic of beach from 250 yd. W. to 250 yd. E. of profile line.

PROFILE LOCATION:
200 yd. W. of E. end (B-B')

Figure 41
GENERAL PROFILE (INCL. NEARSHORE AREA)

Date ____________
Time & Zone ____________



BEACH
1,000 yd. straight beach, approx. 2 mi. E. of __________ from UMT Coord. ________ to ____________.

METHOD OF SURVEY
Combination hand-line, tape, & map & chart analysis.

REPRESENTATION
Representative of approach conditions, beach width, & road location.

FIGURE 42

Beach Inspection Check List

(Items to be checked in the field)

ITEM 1. BEACH LOCATION

1. Beach Designation:
2. Direction and Distance from Reference Point (R.P.):
   Direction, Distance, Ref. Point (R.P.)
3. Coordinates of Ends (or center of short beaches):
4. Total Length:

ITEM 2. DESCRIPTION OF TERMINATIONS

ITEM 3. METHODS EMPLOYED FOR MEASUREMENT OF:

1. Horizontal Dimensions
2. Gradients
3. Depth of Water
4. Position of Features

ITEM 4. OBSTRUCTIONS

1. Unusable Parts
   a. Location
   b. Description
2. Separations
   a. Location
   b. Extent
   c. Description
3. Interruptions
   a. Location
   b. Extent
   c. Description
4. Structures (on or backing beach)
   a. Location
   b. Type
   c. Description

ITEM 5. BEACH WIDTHS AND GRADIENTS (Put on Profile Diagram)

1. Location
2. Time & Time Zone
3. Backshore
   a. Width

        b. Gradient
        c. Remarks
    4. HW Mark — SWL
        a. Width
        b. Gradient
        c. Remarks

ITEM 6. BEACH MATERIALS AND TRAFFICABILITY (Put on Profile Diagram)

1. Location
2. Particle Size
    a. Foreshore
    b. H-W Zone
    c. Backshore
3. Sorting (Well or Poorly Sorted)
    a. Foreshore
    b. High-Water Zone (H-W Zone)
    c. Backshore
4. Shape of Particles
    a. Foreshore
    b. High-Water Zone (H-W Zone)
    c. Backshore
5. Trafficability
    a. Foreshore
    b. H-W Zone
    c. Backshore

ITEM 7. COASTLINE (Beach-Hinterland Demarcation)

1. Location
2. Nature
3. Height
4. Slope
5. Surface and Trafficability

ITEM 8. EXITS FROM THE BEACH

1. Location
2. Nature
3. Width
4. Surface
5. Gives Access to—
6. Obstructions to Exit

ITEM 9. DESCRIPTION OF HINTERLAND TERRAIN

ITEM 10. DESCRIPTION OF ROUTES AND TRANSPORTATION FACILITIES

ITEM 11. NEARSHORE DEPTHS AND MATERIALS (Put on Profile Diagram)

1. Location
2. Time
3. Depth
4. Distance off High-Water Line (HWL)
5. Bottom Material
6. Trafficability

ITEM 12. NEARSHORE HAZARDS

1. Type (Rock, reef, islet, structure, etc.)
2. Reference Point (R.P.)
3. Azimuth
4. Distance
5. Time
6. Nature (description)

LEGEND

BS --Backshore
FS --Foreshore
HWM--High-water mark
HWZ--High-water zone
RP --Reference Point
SWL--Backshore

Figure 43.

BEACH INFORMATION FORM
(To be filled out in field)

ITEM 1. BEACH LOCATION	
	1. Beach Designation
	2. Direction & Distance from RP
	a. Direction
	b. Distance
	c, RP
	3. Coordinates of Ends (or center of shore beach)
	a.
	b.
	4. Description of Terminations
	a.
	b.
	5. Total Length
ITEM 2. GRAPHIC & DOCUMENTARY REFERENCES	
	1. Maps
	2. Charts
	3. Photos
	4. Documents
ITEM 3. METHODS EMPLOYED FOR MEASUREMENT OF:	
	1. Horizontal Dimentions
	2. Heights & Elevations
	3. Gradients
	4. Depths of Water
	5. Position of Features

ITEM 4. OBSTRUCTIONS (Usable Parts, Separations, Interruptions)

Location	Extent	Description

ITEM 5. BEACH WIDTHS AND GRADIENTS

Location	Time & Zone	Backshore		HWM-SWL		Remarks
		Width	Grad.	Width	Grad.	

ITEM 6. BEACH MATERIALS

Location	Particle Size			Particle Shape		
	FS	HWZ	BS	FS	HWZ	BS

ITEM 7. TRAFFICABILITY

Location	FS	HWZ	BS	Remarks

ITEM 8. EXITS FROM BEACH

Location	Nature	Height	Slope	Gives Access To	Obstructions To:

ITEM 9. NEARSHORE DEPTHS AND MATERIALS

Location	Time	Depth	Dist. off SWL	Bottom Material	Trafficability

ITEM 10. NEARSHORE HAZARDS

RP	Azimuth	Distance	Nature (Depth, extent, description)

ITEM 11. COASTLINE (Beach/Hinterland Demarcation)

Location	Description

ITEM 12. HINTERLAND DESCRIPTION	
Location	Description

ITEM 13. ROUTES & TRANSPORTATION

FIGURE 44

Ground Photography Check List

Beach Area

Long views and panorams showing
1. Shape
2. Extent
3. Overall features

Close-ups (3' to 6' mostly) showing
1. Composition
2. Trafficability
3. Gradient
4. Pertinent features

Beach Flanks

Panorama or distant shots showing
1. Location
2. Character

Offshore Area

Distant or medium views to show
1. Nearshore approaches
   a. Gradient indicators
   b. Surf
   c. Hazards

Close-ups showing
1. Structural detail
2. Identifying features

Exits and Communications

Distant views showing
1. Location (relation to other features)
2. Road and cross-country routes

Medium views showing
1. Exits areas looking landward
2. Important features of routes of egress
3. Communications systems

Close-ups showing
1. Surface materials
2. Condition & types of communications system

Hinterland

Panorama or distant views from high point showing
1. Inter-relation of coastal elements

Medium views showing

1. Individual features (dunes, ridges, bluffs, etc.)

Close-ups showing

1. Surface material and vegetation

Structures and Installation

Distant views showing

1. Location

Medium views showing

1. Type
2. Size
3. Condition
4. Structural detail

GLOSSARY OF TERMS

Glossary of Terms in General Use in Coastal and Beach Intelligence for Amphibious Operations

The following glossary of terms includes special, technical, and scientific terms used in this guide with which the user may not be familiar. There is a great need for standardization of these terms and agencies and authorities interested in these fields are now at work attempting to reach standardization. This glossary has been condensed to include only such terms deemed to be pertinent to the type of information collection performed by attachés and similar collectors, keeping in mind the means at hand for such collectors and the manner in which such collections may be made. Reference to, and use of these terms in reporting will insure understanding between the collector of information and the analyst or producer of intelligence.

AGROUND. Resting on the bottom of a body of water.

APPROACH. The zone of the sea which extends indefinitely seaward from the shoreline at mean low water springs (tidal) or mean sea level (non-tidal).

APPROACH, ASSAULT. Area where naval vessels maneuver (when directly engaged in landing or fire-support operations).

APPROACH, CONVOY. The area through which the assault convoy passes during the 12 hours immediately preceding an assault, (on its way to the lowering position—which is 7 nautical miles seaward from the beach, unless otherwise specified).

ATOLL. A ring-shaped coral island or islands enclosing or nearly enclosing a lagoon.

BACKSHORE. That portion of the beach lying between the foreshore and the coastline and covered by wave uprush during exceptional storms only.

BACKWASH. (1) The seaward return of the water following the uprush of the waves. Also called "Backrush." (2) Water waves thrown back by an obstruction such as a ship, breakwater, cliff, etc.

BANK. (1) The rising ground bordering a lake, river, or sea; on a river designated as right or left as it would appear to a man facing downstream. (2) An elevation of the sea floor of large area, surrounded by deeper water; a shoal, or shallow.

BAR. An offshore ridge or mound submerged at high tide, of sand, gravel, or other unconsolidated material, especially at the mouth of a river or estuary or lying parallel to and a short distance from the beach.

BARRIER BEACH. A beach separated from the mainland by a bay, lagoon, or marsh.

BAY. A recess in the shore of a sea or lake between two capes or headlands, usually not as large as a gulf but larger than a cove. An embayment, see also BIGHT.

BEACH. (n.) The zone of unconsolidated material which extends landward from the waterline to the place where there is marked change in material or physiographic form...or to the line of permanent vegetation (usually the effective limit of storm waves). The seaward limit of the beach, unless otherwise specified, is the mean low water. A beach includes FORESHORE and BACKSHORE; also SHORE.

BEACH (TO). To run or drive (as a boat) onto a beach; to strand.

BEACH FACE. The section of the beach normally exposed to the action of wave uprush.

BEACH LENGTH. The distance along the beach at the water's edge at high water and/or low water between the ends of the beach. USABLE BEACH LENGTH is the overall length minus any unusable parts, that is, separated or obstructed portions.

BEACH PROFILE. (See PROFILE, BEACH).

BEACH RIDGE. An essentially continuous mound of beach material that has been heaped up by wave or other action. Ridges may occur singly or as a series of approximately parallel deposits behind the beach.

BEACH WIDTH. The horizontal dimension of the beach as measured normal to the shoreline. See BEACH for limits.

BERM (BEACH). A nearly horizontal portion of the beach or backshore formed by the deposit of material by wave action. Some beaches have no berms, others have one or several.

BERM CREST. The seaward limit of a berm, generally the highest point of a berm.

BIGHT. A slight indentation in a shoreline or a bay, usually crescent shaped.

BLUFF. A high, steep bank composed of relatively unconsolidated sediments.

BOTTOM. The ground or bed under any body of water; the bottom of the sea.

BOTTOM (NATURE OF). The composition or description of the bed or an ocean or other body of water; e.g. clay, coral, gravel, mud, ooze, pebbles, rock, shells, shingle, hard, or soft.

BREAKER. A wave breaking on the shore, over a reef, etc. Breakers may be (roughly) classified into three kinds although there is much overlapping: Spilling breakers, Plunging breakers, or Surging breakers. Spilling breakers break gradually over quite a distance; Plunging breakers tend to curl over and break with a crash; and Surging breakers peak up but then instead of spilling or plunging they surge up the beach face.

BREAKER DEPTH. The still-water depth at the point where the wave breaks; also BREAKING DEPTH.

BREAKWATER. A structure protecting a harbor, anchorage, or basin from waves.

BULKHEAD. A structure separating land and water areas, primarily designed to resist earth pressures.

CAPE. A relatively extensive piece of land jutting seaward from a continent or large island, prominently marking a change or notably interrupting the coastal trend; a prominent feature such as a peninsula or headland.

CAUSEWAY. A raised road, as across marshy ground or shallow water, on a solid structure of masonry and/or earth.

CHANNEL. (1) A natural or artificial waterway of considerable extent which either periodically or continuously contains moving water or which forms a connecting link between two bodies of water. (2) A large strait, as the English Channel. (3) The deepest portion of a stream, bay, or strait through which the main volume or current of water flows.

CHART DATUM. The plane or level to which soundings on a chart are referred. It is usually taken to correspond to a low-water stage of the tide.

CLAY. An aggregate of unconsolidated mineral particles that has a plasticity when wet and is hard when dry; it consists mainly of particles less than 0.074 mm in diameter.

CLIFF. A high, steep face of rock, a precipice.

COAST. A strip of land of indefinite width (may be several miles) which extends from the shore inland to the first major change in terrain features.

COASTAL PLAIN. A generally level plain bordering on the sea or shore.

COASTAL TERRAIN. (1) The area or zone of land of indefinite width adjoining the coastline (landward limit of the beach or shore) and extending inland to the first major terrain barrier; (2) if no major terrain barrier is present, the coastal terrain extends about 15 miles inland.

COASTLINE. The line that forms the boundary between the coast and the shore.

COBBLE. A rock fragment, generally rounded, more than 3 inches in diameter. A very large cobble is a boulder.

CONCEALMENT. The act or result of acts designed to hide or disguise men or material from the enemy; the application of camouflage techniques with the aim of denying information as to the existence, nature, disposition, or purpose of installations, equipment, or activities. Concealment offers protection from observation only.

CORAL. The calcareous skeletons of various anthozoans and a few hydrozoans, also these skeletons when solidified into a stony mass. Many tropical islands, reefs, and atolls are formed from coral.

CORAL HEAD. A round massive structure composed of coral.

CORAL LEDGE (fringing reef). A coral formation fringing the shore and not separated from it by a lagoon.

COVE. A small sheltered bay or bay-like recess in the coast.

COVER. Shelter or protection, either natural or artificial, from enemy fire.

CREEK. (1) A stream, less prominent than a river in any region, and generally tributary to a river. (2) Also, a small narrow bay which extends farther inland than a cove and is relatively long compared with its width. It is smaller than a firth.

CURRENT. A flow of water.

CURRENT, COASTAL. One of the offshore currents flowing generally parallel to the shoreline with a relatively uniform velocity (as compared to the littoral currents). They are not related genetically to waves and resulting surf, but may be composed of currents related to distribution of mass in ocean waters (or local eddies), wind-driven currents and/or tidal currents.

CURRENT, DRIFT. A broad, shallow, slow-moving ocean current.

CURRENT, EBB. The movement of the tidal current away from shore or down a tidal stream.

CURRENT, FLOOD. The movement of the tidal current toward the shore or up a tidal stream.

CURRENT, INSHORE. Any current inside the breaker zone.

CURRENT, LITTORAL. The nearshore currents primarily due to wave action; e.g., Longshore currents and Rip currents.

CURRENT, LONGSHORE. The inshore current moving essentially parallel to the shore, usually generated by waves breaking at an angle to the shoreline.

CURRENT, OFFSHORE. (1) Any current in the offshore zone. (2) Any current flowing away from shore.

CURRENT, PERMANENT. A current that runs continuously independent of the tides and temporary cause. Permanent currents include the fresh-water discharge of rivers and the currents that form the general circulatory systems of the oceans.

CURRENT, RIP. A narrow current of water flowing seaward through the breaker zone. A rip current consists of three parts: (1) the "feeder currents" flowing parallel to the shore inside the breakers; (2) the "neck"—where the feeder currents converge and flow through the breakers in a narrow band or "rip"; and (3) the "head"—where the current widens and slackens outside the breaker line.

CURRENT, STREAM. A narrow, deep, and fast-moving ocean current.

CURRENT, TIDAL. A current caused by the tide-producing forces of the moon and the sun and is a part of the same general movement of the sea that is manifested in the vertical rise and fall of the tides. See also CURRENT, FLOOD and CURRENT, EBB.

CUSP. One of a series of low mounds of beach material separated by crescent-shaped troughs spaced at more or less regular intervals along the beach face.

DATUM PLANE. The horizontal plane to which soundings, ground elevations, or water surface elevations are referred. Also REFERENCE PLANE. The plane is called a TIDAL DATUM when defined by a certain phase of the tide. The following datums are ordinarily used on hydrographic charts:
MEAN LOW WATER—Atlantic Coast (U.S.), Argentina, Sweden and Norway;
MEAN LOWER LOW WATER—Pacific Coast (U.S.);
MEAN LOW WATER SPRINGS—Great Britain, Germany, Italy, Brazil, and Chile;
LOW-WATER DATUM—Great Lakes (U.S. and Canada);
LOWEST LOW WATER SPRINGS—Portugal;
LOW WATER INDIAN SPRINGS—India and Japan;
LOWEST LOW WATER—France, Spain, and Greece;

A common datum used on topographic maps is based upon MEAN SEA LEVEL.

DELTA. An alluvial deposit, usually triangular, at the mouth of a river.

DEPTH. The vertical distance from the still-water level (or datum as specified) to the bottom.

DEPTH, CONTROLLING. The least depth of water in the navigable parts of the waterway, which limits the draft of vessels.

DIKE (DYKE). A wall or mound built around a low-lying area to prevent flooding or to delimit an area of reclamation or fill.

DOCK. (1) The water area between parallel piers; also called slip; (2) general term used for wet or dry docks. Although "dock" is often used synonymously with wharf, this is not the proper use of the term.

DOLPHIN. A built-up mooring post or buoy, usually wooden, erected on shore or in the water or in a dock.

DROWNED VALLEY. A valley which has been flooded in its lower part by the water of a sea or lake as a result of the sinking of the land or, more commonly, of the rising of the water level.

DUNES. Ridges or mounds of loose, wind-blown material, usually sand.

EDDY. A circular movement of water of comparatively limited area formed on the side of a main current. Eddies may be created at points where the main stream passes projecting obstructions.

EMBANKMENT. An artificial bank, mound, dike, or the like, built to hold back water, carry a roadway, etc.

EMBAYMENT. An indentation in a shoreline forming an open bay.

ESCARPMENT. A more or less continuous line of cliffs or steep slopes facing in one general direction which are caused by erosion or faulting.

ESTUARY. (1) that portion of a stream influenced by the tide of the body of water into which it flows; (2) an arm of the sea at the lower end of a river.

EXIT. Any natural or artificial feature of the ground by means of which troops and/or vehicles can pass from the beach into the hinterland.

FAIRWAY. The parts of a waterway kept open and unobstructed for navigation.

FATHOM. A unit of measurement used for soundings. It is equal to 6 feet (1.83 meters).

FETCH. (1) In wave forecasting, the continuous water area over which the wind blows in essentially a constant direction. Sometimes used synonymously with fetch length; also generating area. (2) In wind setup phenomena (WIND TIDE) for enclosed bodies of water, the distance between the points of maximum and minimum water surface elevations. This would usually coincide with the longest axis in the general wind direction.

FIRTH. A narrow arm of the sea; also the opening of a river into the sea.

FJORD (FIORD). A narrow, deep, steep-walled arm of the sea formed by the drowning of a glaciated valley.

FLANK. The right or left side, when facing in the direction of the objective or viewed from seaward; normally identified by compass bearings.

FLEET ANCHORAGE. A protected anchorage of sufficient size and depth of water to accommodate a large number of naval vessels, (British usage (class A) specifies at least 4 square miles of clear anchorage in not less than 7 fathoms of water).

FORESHORE. The part of the shore, lying between the crest of the berm and the ordinary low-water mark, which is ordinarily traversed by the uprush and backrush of the waves as the tides rise and fall.

FOUL GROUND. An area studded with dangers to navigation.

FOUL BOTTOM. An area in which it is inadvisable to anchor owing to the quality of the bottom.

GRADIENT (SLOPE). The degree of inclination to the horizontal. Usually expressed as a ratio; 1:25 or 1 on 25, indicating one unit rise in 25 units of horizontal distance—or in a decimal fraction (.04); degrees (2°18'); or percent (4%). It is sometimes described by such adjectives as: steep... moderate...gentle...mild...or flat.

GRAVEL. Unconsolidated, rounded fragments of rock, between 4.76 mm. and 76 mm. (3") in diameter.

GROIN (BRIT. GROYNE). A shore protective structure (built usually perpendicular to the shoreline) to trap littoral drift, or retard erosion of the shore. It is narrow in width (measured parallel to the shoreline); and its length may vary from less than one hundred to several hundred feet (extending from a point landward of the shoreline out into the water). Groins may be classified as permeable or impermeable; impermeable groins having a solid or nearly solid structure; permeable groins having openings through them of sufficient size to permit passage of appreciable quantities of littoral drift.

GROUND SWELL. A long ocean swell which rises to prominent height in shallow water.

GULF. A relatively large portion of sea, partly enclosed by land.

HARBOR. An area of water more or less protected from wind and waves and affording a natural or artificial haven for ships. A harbor becomes part of a port when used for cargo transfer or other business between ship and shore.

HEAD (HEADLAND). A point or portion of land jutting out into the sea, a lake, or other body of water; a cape or promontory; Usually specifically a promontory especially bold and cliff-like.

HIGH-WATER LINE. In strictness, the intersection of the plane of mean high water with the shore. The shoreline delineated on the nautical charts of the Coast and Geodetic Survey is an approximation of the high-water line.

HIGH-WATER MARK. That mark left on the beach by the wave-wash at the preceding high water and which therefore does not necessarily correspond to the high-water line. The high-water mark is usually plainly visible and easily established whereas the H.W. line is difficult to use in the field since it is, in its true sense, a line established by instrument survey and takes considerable time to pinpoint, however in normal practice the H.W. mark is usually referred to as the H.W. line.

HINTERLAND. The region lying behind the coast.

HOLDING GROUND. The condition of the bottom of an anchorage area; called good or poor according to whether or not the material of which the bottom is composed will prevent a ship's anchor from dragging.

HOOK. A spit or narrow cape, turned landward at the outer end, resembling a hook in form.

HYDROGRAPHY. The science of studying, measuring, and describing oceans, seas, rivers, and other waters, together with the marginal land areas and fundamental elements which have to be known for the safe navigation of such areas. The publication of such information in a form suitable for the use of navigators is a necessary adjunct to the science of hydrography.

ICE PACK. A large area of floating pieces of ice driven together more or less closely.

INLET. A narrow channel connecting two water bodies, especially in coastal areas.

INTERIOR. The country extending indefinitely inland of the hinterland.

INTERMITTENT STREAM. A stream that flows only during, and for short periods after, rains or periods of snow melt; characteristic of dry areas.

ISTHMUS. A narrow strip of land, bordered on both sides by water, that connects two larger bodies of land.

JETTY. (1) (U. S. usage) On open seacoasts, a structure extending into a body of water, and designed to prevent shoaling of a channel by littoral materials, and to direct and confine the stream or tidal flow. Jetties are built at the mouth of a river or tidal inlet to help deepen and stabilize a channel. (2) (British usage) Jetty is synonymous with "wharf" or "pier."

JUNGLE. (1) (popularly) An impenetrable growth of vegetation, or an area having such a growth. (2) (specifically) The transition zone between the rainforest and the savanna, characterized by an impenetrable growth of brush, low trees, and tall coarse grass. The jungle is characteristic of tropical areas with heavy rainfall and brief dry seasons.

KELP. The general name for several species of large seaweeds. A mass of growth of large seaweed or any of various large brown seaweeds either floating or submerged.

KEY. A low insular bank of sand, coral, etc.; as one of the islets off the southern coast of Florida. Also CAY.

KNOLL. (1) A submerged elevation of rounded shape rising from the ocean floor, but less prominent than a seamount. (2) A small rounded hill.

LAGOON. A shallow body of salt or brackish water that is partly or completely cut off from the sea by a barrier beach or similar depositional feature. Also the inner body of water enclosed by a barrier reef or atoll.

LANDING BEACH. The sea and land areas and the air space required for the approach, landing, and movement inland of assault forces. Depending upon such factors as approaches, length, exits, and inland terrain, a landing beach (area), a minor beach (area), or a landing place.

LANDING CRAFT. (LC): (1) Any of numerous naval vessels especially designed for putting ashore troops and/or equipment, especially in amphibious beach assault. (2) U.S. Navy usage—this term is generally applied to non-ocean-going vessels of less than 150 feet overall, that are designed for landing operations. LC designation is therefore used, with approriate modifications to indicate particular types of these craft. (See LCI, LCM, etc.).

LANDING PLACE. Any natural or artificial feature adjacent to the shoreline that: (1) permits the landing of small parties for reconnaissance; (2) provides secondary facilities for units of main forces. It is unsuitable for the landing and deployment of assault troops and vehicles on a broad front.

LANDING SHIPS. (LS): U.S. Navy usage—this includes oceangoing vessels of over 200 feet overall, that are specifically designed for landing operations. LS designation is therefore used, with appropriate modifications to indicate particular types of these ships. (See LSU, LSD, etc.).

LANDING VEHICLES. (LV): U.S. Navy usage—small units used in landing operations that can be used on land or in water. LV designation is therefore used for these vehicles. (See LVT).

LCI. Landing Craft, Infantry.

LCM. Landing Craft, Mechanized.

PORT. A harbor plus terminal facilities. The term may be used to designate an entire harbor improved for the transaction of business between water and land carriers, or it may be applied to indicate one terminal development within a harbor.

PROFILE, BEACH. Intersection of the surface of the beach with a vertical plane drawn perpendicular to the shoreline. Sectional elevation through the beach and surf perpendicular to the shoreline.

PROMONTORY. A high point of land extending into a body of water; a headland.

QUAY (pronounced KEY). A stretch of paved bank, or a solid artificial landing place made beside navigable water, for convenience in loading and unloading vessels.

QUICKSAND. Loose, yielding wet sand which offers no support to heavy objects. The upward flow of the water has a velocity that eliminates contact pressures between the sand grains and causes the sand-water mass to behave like a fluid.

RAMP. (1) A strip of stone or concrete built on a beach to facilitate landing, unloading, and/or hauling up of small craft. (2) A bulkhead hinged at the bottom, which is dropped from the bow or stern of a vessel to discharge passengers and cargo on a beach. (3) A strip of sand bulldozed to the bow of an LST or LSU.

REEF. A chain or range of rock or coral, elevated above the bottom of the sea, generally submerged and dangerous to surface navigation.

REEF, ATOLL. A ring-shaped, coral reef, often carrying low, sand islands, enclosing a body of water.

REEF, BARRIER. A reef which roughly parallels land but is some distance offshore, with deeper water intervening.

REEF, FRINGING. A reef attached to an insular or continental shore.

REEF, PINNACLE. A small coral pinnacle rising within a lagoon, often coming close to the water surface.

RIA. A long narrow inlet, with depth gradually diminishing inward.

RILL MARKS. Tiny drainage channels in a beach caused by the flow seaward of water left in the sands of the upper part of the beach after the retreat of the tide or after the dyingdown of storm waves.

RIP. A body of water made rough by the meeting of opposing tides or currents.

RIPPLE MARKS. Small, fairly regular ridges in the bed of a waterway or on a surface caused by water currents or winds. As their form is approximately normal to the direction of current or wind direction, they indicate both the presence and the direction of currents or winds.

RIPRAP. A layer or facing of stones randomly placed to prevent erosion, scour or sloughing of a structure or embankment; also the stone so used.

ROADSTEAD. A place for vessels to anchor, usually exposed or only partially protected. Commonly used for the transfer of cargo to lighters or as a temporary anchorage for vessels waiting to enter port.

ROCK. Any solid mineral matter occurring naturally in large quantities; also a particular mass of this matter.

ROCKS, AWASH. Those rocks exposed at any stage of the tide between mean high water and the sounding datum or exactly awash at these planes.

ROCKS, BARE. Those rocks extending above the plane of mean high water.

ROCKS, SUNKEN. Those rocks covered at the sounding datum, but potentially dangerous to navigation.

RUBBLE. (1) Loose, angular, water-worn stones along a beach. (2) Rough, irregular fragments of broken rock. (3) Debris from wrecked masonry structures.

RUNNEL. A corrugation of the foreshore (or the bottom just offshore) formed by wave and/or tidal action.

SALTPAN. An artificial pond or basin in which water is evaporated by exposure to the air for the purpose of obtaining salt.

SAND. An unconsolidated material consisting predominantly of grains with a diameter range from 4.76 mm. (passing No. 4 sieve) to 0.074 mm. (retention on a No. 200 sieve). Most sands consist largely of quartz, but some consist of other minerals or of rock fragments.

SCARP. An almost vertical slope along the beach caused by erosion by wave action. It may vary in height from a few inches to several feet, depending on wave action and the nature and composition of the beach.

SEA. (1) (a) An ocean. (b) A large body of (usually) salt water smaller than an ocean. (2) Waves caused by wind at the place and time of observation. (3) State of the ocean or lake surface in regard to waves.

SEA LEVEL. See MEAN SEA LEVEL.

SEA, (STATE OF). Description of the sea surface with regard to wave action.

SEA APPROACH. The zone of the sea which extends indefinitely seaward of the low-water shoreline (tidal) or mean-water shoreline (non-tidal).

SEAWALL. A structure separating land and water areas primarily designed to prevent erosion and other damage due to wave action. See also BULKHEAD.

SEAWEED. A characteristic plant growth in sea water.

SEDIMENT. An aggregate of unconsolidated particles of mineral or rock which has been transported and deposited by water, wind, ice, or the action of gravity.

SEICHE (sāche). A periodic oscillation of a body of water whose period is determined by the resonant characteristics of the containing basin as controlled by its physical dimensions. These periods generally range from a few minutes to an hour or more. (Originally the term was applied only to lakes but now also to harbors, bays, oceans, etc.).

SHALLOW WATER. Water of such a depth that surface waves are noticeably affected by bottom topography. It is customary to consider water of depths less than half the surface wave length as shallow water.

SHINGLE. (1) Loosely and commonly: any beach material coarser than ordinary gravel, especially any having flat or flattish pebbles. (2) Strictly and accurately: beach material of smooth, well-rounded pebbles that are roughly the same size. The spaces between pebbles are not filled with finer materials. Shingle gives out a musical note when stepped on.

SHOAL (noun). A detached elevation of the sea bottom composed of sand, gravel, or similar material (but not rock or coral) which may endanger surface navigation. Verb: to become shallow gradually.

SHORELINE. The intersection of a specified plane of water with the shore or beach. (e.g. The high-water shoreline would be the intersection of the plane of mean high water with the shore or beach).

SILT. (1) Fine-grained soil that has a low plasticity in relation to the liquid limit (the moisture content at which the soil passes from a plastic to a liquid state) or is entirely nonplastic and consists mainly of particles less than 0.074 mm. (passing through No. 200 sieve) in diameter. The individual grains are largely angular in shape. In the Army's Unified Soil Classification System, silt and clay are considered fines and are differentiated on the basis of plasticity, not by the dimensions of the particles. (2) Soil consisting dominantly of mineral grains between 0.074 and 0.005 mm. in diameter.

SLOPE OF NEARSHORE BOTTOM. Between the mean low-water shoreline (tidal) or mean-water shoreline (non-tidal) and a known depth a specified distance offshore or the 30-foot depth contour.

SLOUGH (slōō). (1) A small muddy marshland or tidal waterway which usually connects other tidal areas. (2) A tide-land or bottom-land creek.

SOUND. (noun) A relatively long waterway connecting two larger bodies of water.

SOUNDING. A measured depth of water. On hydrographic charts the soundings are adjusted to a specific plane of reference (SOUNDING DATUM).

SPIT. An elongated deposit of water-borne sediment which extends from the shore, terminates in the water, and which is exposed at least at low tide.

SPUR. A sharp branch or projection from the side of a hill or mountain.

SQUALL. A violent wind which rises suddenly, has a brief duration, and dies suddenly. It is usually of only local importance and is generally associated with a temporary shift in wind direction.

STANDING WAVE. A type of wave in which the surface of the water oscillates vertically between fixed points, called nodes, without progression. The points of maximum vertical rise and fall are called antinodes or loops. At the nodes, the underlying water particles exhibit no vertical motion but maximum horizontal motion. At the antinodes the underlying water particles have no horizontal motion and maximum vertical motion. They may be the result of two equal progressive wave trains travelling through each other in opposite directions. Sometimes called STATIONARY WAVE.

STATUTE MILE. A unit of distance equal to 1760 yards or 5280 feet, used when measuring distances over land.

STILL-WATER LEVEL. That plane or surface of the water which would exist, at any given moment of observation, provided the water surface were still. Frequently abbreviated to MSL. The plane migrates with changes in tide or other fluctuations of the water level.

STILL-WATER LINE. That line of juncture between the land and sea which would exist at any given moment of observation if the water surface were still. The line migrates with the tide or other fluctuation in the water level.

STRAIT. A relatively narrow waterway between two larger bodies of water. See also SOUND (noun).

SURF. The wave activity in the area between the shoreline and the outermost limit of breakers.

SURF ZONE. (1) The more or less continuous belt of breakers along a shore or over an obstruction such as a shoal or reef. (2) The area between the outermost breakers and the limit of wave uprush.

SWAMP. (noun) A tract of wet spongy land, frequently inundated by fresh or salt water, and characteristically dominated by trees and shrubs.

SWELL. Wind-generated waves which have advanced into regions of weaker winds or calm and are decreasing in height.

TIDAL BORE (bore). A very rapidly rising tide, having an abrupt foaming front of considerable height, occurring in certain relatively narrow rivers and estuaries where the range of tide is large. The tidal bore is a wave of translation and advances rapidly up the river or estuary. Also called "eager", "mascaret", or "pororoca."

TIDAL CURRENT. See under CURRENT.

TIDAL FLATS. Areas bordering the oceans which are covered and uncovered according to the state of the tide.

TIDAL INLET. A natural inlet maintained by tidal currents, which connects a lagoon or bay with the open ocean.

TIDAL PERIOD. The interval of time between two consecutive-like phases of the tide.

TIDAL RANGE. The difference between the level of water at high tide and low tide.

TIDAL RISE. The height of water above the datum of a chart.

TIDE. The periodic rising and falling of the water that results from the gravitational attraction of the sun and moon upon the rotating earth.

TIDE, DIURNAL. A tide with one high water and one low water in a tidal day.

TIDE, EBB. That period of tide between a high water and the succeeding low water; a falling tide.

TIDE, FLOOD. That period of tide between low water and the succeeding high water; a rising tide.

TIDE, HIGH. HIGH WATER (H.W.) The maximum height reached each rising tide. HIGHER HIGH WATER (H.H.W.) The higher of the two high waters of the tidal day.

TIDE, LOW. LOW WATER (L.W.) The minimum height reached by each falling tide. LOWER LOW WATER (L.L.W.) The lower of the two waters of any tidal day.

TIDE, MIXED. In strictness, all tides are mixed but the name is usually applied without definite limits to the tides intermediate to those predominantly semidiurnal and those predominantly diurnal. A type of tide in which the presence of a diurnal wave is conspicuous by a large inequality in either the high- or low-water heights with two high waters and two low waters usually occurring each tidal day.

TIDE, NEAP. A tide occurring near the time of quadrature of the moon. The neap tidal range is usually 10 to 30 percent less than the mean tidal range.

TIDE, SEMI-DIURNAL. A tide with two high and two low waters in a tidal day, with comparatively little diurnal inequality.

TIDE, SLACK. The state of a tidal current when its velocity is near zero, especially the moment when a reversing current changes direction and its velocity is zero. Sometimes considered the intermediate period between ebb and flood currents during which the velocity of the currents is less than 0.1 knot.

TIDE, SPRING. A tide which occurs at or near the time of new and full moon and which rises highest and falls lowest from the mean level.

TOMBOLO. An area of unconsolidated material, deposited by wave action, or currents, which connects a rock or island to the mainland or to another island.

TOPOGRAPHY. The configuration of a surface including its relief, the position of its streams, roads, buildings, etc.

TRACK. An ungraded unsurfaced road usually passable only in dry weather; commonly a single pair of ruts on the natural land surface.

TRAFFICABILITY. The ability of terrain to sustain the flow of military traffic.

TRAIL. A path becomes a trail if it is blazed or otherwise marked.

TRAINING WALL. A structure of masonry or masonry and earth used to direct the flow of current in a river in order to stabilize and deepen the channel and to prevent the erosion of the riverbanks (similar to a jetty). A training wall differs from a groin in that it is usually aligned parallel to the channel and the direction of water flow.

TUNDRA. Arctic plain consisting of black, mucky soil and permanently frozen subsoil, and covered by mosses, grasses, etc.

UNDERTOW. A current, below water surface, flowing seaward; (also) the receding water below the surface from waves breaking on a shelving beach. Actually "undertow" is largely mythical. As the backwash of each wave flows down the beach, a current is formed which flows seaward. However, it is a periodic phenomenon. The most common phenomena expressed as "undertow" are actually the rip currents in the surf.

UNDERWATER GRADIENT. The ratio of the vertical drop or rise in a horizontal distance.

UPRUSH. The rush of water up onto the beach following the breaking of a wave.

USABLE BEACH LENGTH. See BEACH LENGTH.

WADI. A permanent intermittent streambed in an arid region.

WATERLINE. A juncture of land and sea. This line migrates, changing with the tide or other fluctuation in the water level. Where waves are present on the beach, this line is also known as the limit of backrush.

WAVE. A ridge, deformation, or undulation of the surface of a liquid.

WAVE HEIGHT. The vertical distance between a crest and the preceding trough.

WAVE LENGTH. The horizontal distance between successive wave crests measured perpendicularly to the crest.

WAVE PERIOD. The time for a wave crest to traverse a distance equal to one wave length. The time for two successive wave crests to pass a fixed point.

WHARF. A general term for any structure at which vessels berth. The term also is used specifically for a berthing structure of open construction aligned parallel with the shoreline.

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