COASTAL ENGINEERING

FIELD TRIP GUIDE

INTRODUCTION

This field exercise would introduce the students to the coastal environment, allow them to see at first hand examples of coastal engineering projects in Trinidad, the types of coastal protection structures constructed and gather basic coastal data and information using simple equipment. At the completion of the field exercise they would have become familiar with some coastal terminology and obtain a basic understanding of the coastal environment. Appendix 1 gives some basic terminology of the coastal environment. Appendix 2 provides an example layout of a field data observation sheet, which may be used for guidance. Finally, Appendix 3 provides some guidelines for field data collection techniques which may be used on site.

DEPARTMENT OF CIVIL ENGINEERING AND THE ENVIRONMENT
THE UNIVERSITY OF THE WEST INDIES
ST AUGUSTINE
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APPENDIX 1

Glossary of Terms

(Refer to http://www.coastalwiki.org/wiki/Definitions_of_coastal_terms for more definitions**)**

Accretion
The buildup of land by the action of forces of nature.

Bar
A submerged embankment of unconsolidated material built on the sea floor in shallow water by waves and currents.

Beach
The zone of unconsolidated material that extends landward from the low waterline to the place where there is a marked change in material or physiographic form or to the line of permanent vegetation.

Beach Scarp
An almost vertical slope along the beach caused by erosion as a result of wave action. It may vary in height from a few centimeters to several meters.

Berm
A nearly horizontal part of the beach or backshore formed by the deposit of material by wave action.

Breaker
A wave breaking on the shore, over a reef, etc.

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

Erosion
The loss or displacement of coastal land caused by the actions of wind, waves, currents, tides, wind driven water, surface run-off, storms or underground water seepage.

Groyne
A structure built perpendicular to the shore.

Longshore Current
The current in the breaker zone moving essentially parallel to the shore, usually generated by waves breaking at an angle to the shoreline.

Revetment

A facing of stone, concrete, etc, built to protect an eroding shoreline

Spit
A small point of land or a narrow shoal projecting into a body of water from the shore.

Tide
The periodic rising and falling of the water that result from gravitational attraction of the moon and sun and other astronomical bodies acting upon the rotating
earth.

Figure 1: Schematic Diagram of the Coast

(extracted from http://www.coastalwiki.org/wiki/Definitions_of_coastal_terms)

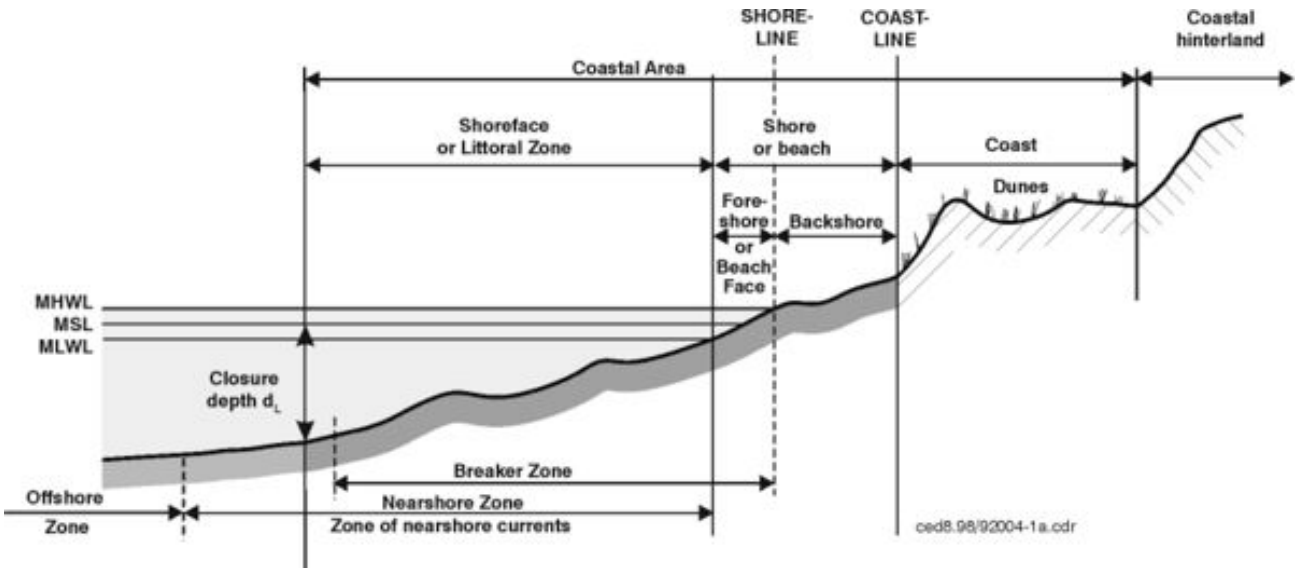


Figure 2: Main Types of Breakers

(extracted from Introduction to Coastal Processes and Geomorphology)

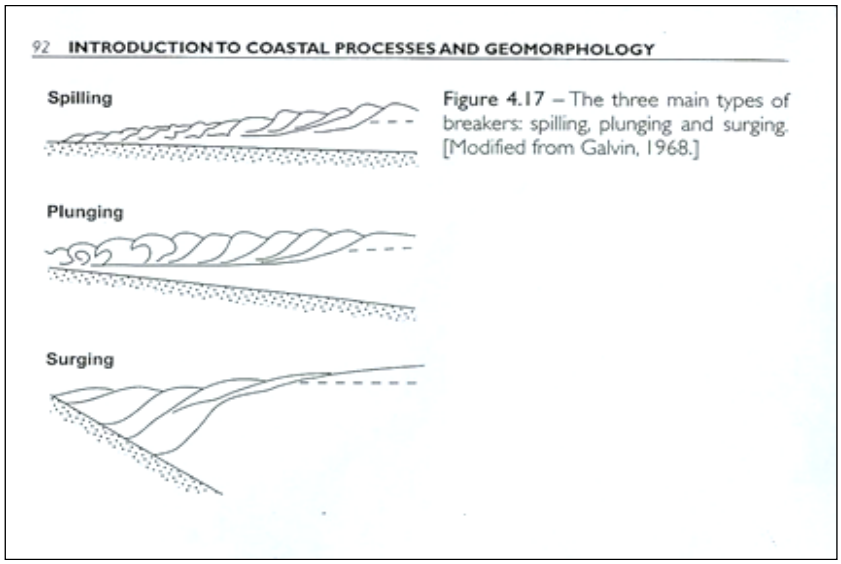
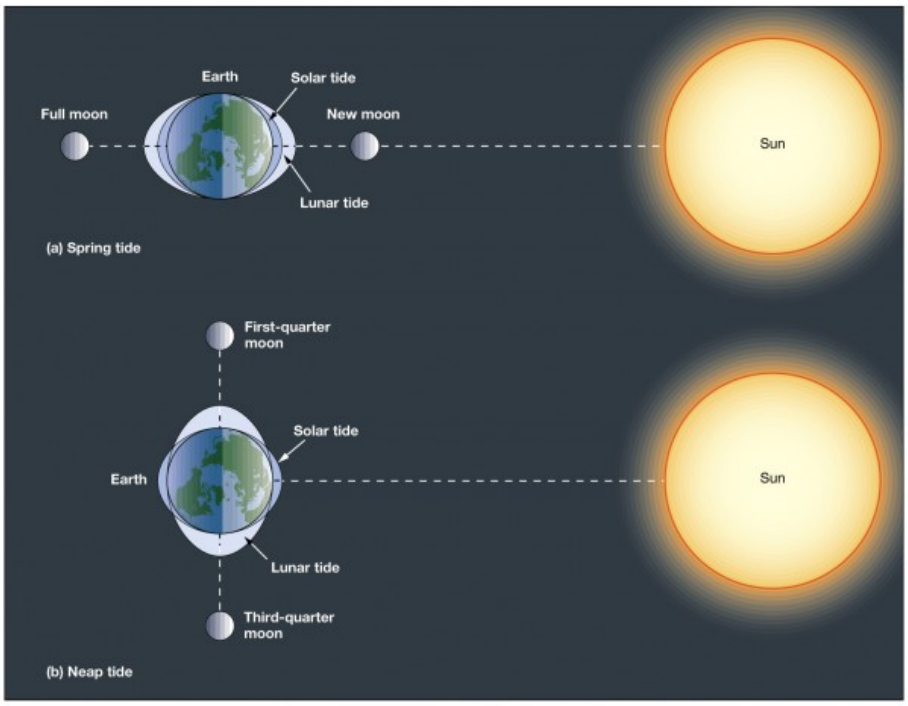


Figure 3: The stages of the tide

(extracted from http://earthsky.org/space/quarter-moon-earth-at-perihelion-and-neap-tide)



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APPENDIX 2

FIELD OBSERVATIONS AND MEASUREMENTS

Beach/Bay:

Date of Field Survey:

PHYSICAL CHARACTERISTICS

Elevation of land:

Geomorphic features present:

- ❑ Beach ❑ Dunes ❑ Cliffs ❑ Reefs ❑ Headland
- ❑ Stacks ❑ Caves ❑ Cusp ❑ Mangrove
- ❑ Spit ❑ Lagoon ❑ Seagrass ❑ Bar

COASTAL PROCESSES

Wind Speed (m/s) and Direction:

State of the tide:

- ❑ Spring ❑ Neap
- ❑ High ❑ Low ❑ Rising ❑ Falling

Type of Breaker:

Breaking Wave Height (m):

Breaking Wave Period (s):

Wave Approach (Direction):

Longshore Current Direction:

Longshore Current Speed (cm/s):

Rip Current (Indicate if present and describe):

BEACH DYNAMICS

Width of Beach (HWM to Vegetation/Cliff Line):

Slope of Beach:

Beach Sediment Colour:

Grain Size:

- ❑ Coarse
- ❑ Medium
- ❑ Fine

Type of Coastal Vegetation:

Is there any evidence of accretion or erosion?

If there is erosion what is the likely cause of erosion or accretion:

Are there any erosion control structures or beach enhancement practices in place (indicate details and status)

- ❑ Seawall
- ❑ Breakwater
- ❑ Revetment (riprap)
- ❑ Groynes
- ❑ Gabion Baskets
- ❑ Sand Nourishment

LAND USE INFORMATION

Structures /Infrastructure present:

Current back beach land-use:

Is there any drainage or other outfalls (cross-shore)?

Access Road Description:

Present Beach Use:

OTHER ENVIRONMENTAL DATA

Append other information, photos, and diagrams.

APPENDIX 3

METHODOLOGY FOR THE COLLECTION OF FIELD DATA

1. Wind
   A light object such as a small piece of paper is thrown into the air and the direction in which it is blown by the wind is observed. A compass is used to determine the direction. Wind direction could also be determined by observing the fall direction of dry sand grains. A hand-held anemometer can be used to record the wind speed.

2. Direction of Wave Approach
   Wave approach direction should be measured by means of a hand-bearing compass. The compass must be held with the arm pointed perpendicular to the incoming wave front (or wave crest).

3. Wave Height
   Wave heights should be measured outside the breaker zone. The measuring rod should be held vertically in the water and as waves pass the rod, the difference in the height between crest and trough, (Figure 2) is noted. Three measurements must be observed and recorded.

4. Breaking Wave Height
   Breaker heights must be measured in the breaker zone, and where possible, the first line of breakers is selected for this purpose. The measuring rod should be held vertically in the water making sure that the base of the rod touches the sea bed between breakers is observed. The difference between these measurements is the breaker height. In rough sea conditions it may not be possible to physically measure wave heights or breaker heights. These heights must be visually estimated under these conditions.
   As each breaker passes the rod, the heights of the crest and the water level between breakers are observed. The difference between these measurements is the breaker height (Figure 2).

5. Wave Period
   Wave period is measured by counting ten (10) wave crests (not breakers) that pass a fixed point, during a time interval. The period is calculated by dividing the time interval by the number of waves observed.

6. Longshore Current Speed
   Longshore currents flow parallel to shore within the surf zone (Figure 1). In order to measure these currents, a floating object should be thrown into the surf zone. The object must not be too small so as to reduce wind drift. A small dry coconut or piece of drift wood would be adequate. A few seconds should elapse for the object to flow in the water, and then a starting point should be marked on the beach where timing must begin. The

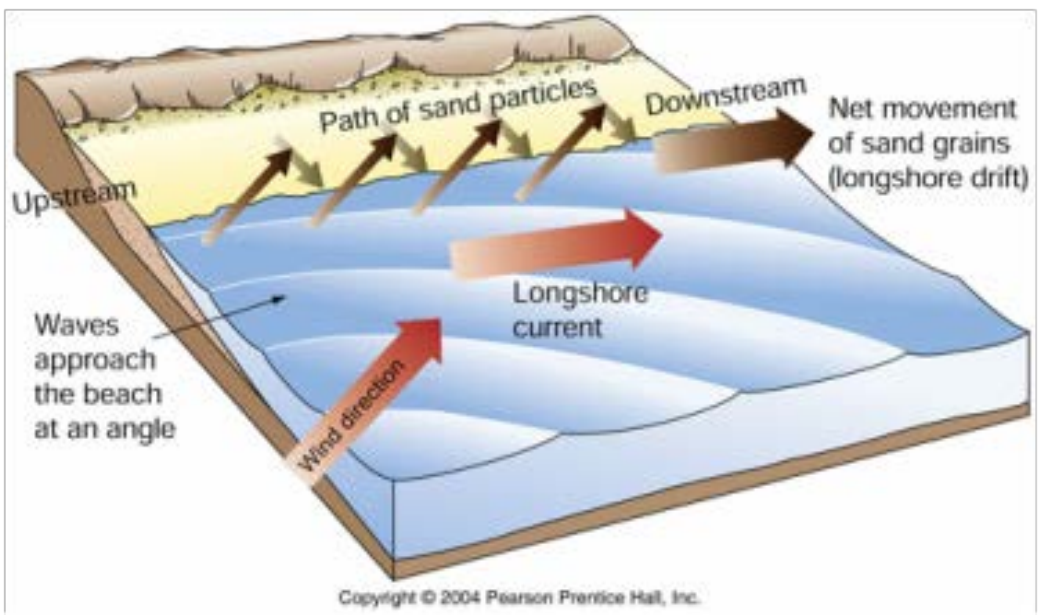
object should be followed while maintaining an imaginary line, perpendicular to the shore between the observer and the object. After one minute has elapsed, the finishing point should be marked on the beach and a measuring tape used to obtain the distance between the starting and finishing points. The speed is calculated by dividing the distance by the time. The current direction must also be taken using a compass. The exercise should be repeated three times, and on each occasion the floating object should be thrown to different distances within the surf zone. The average of the three measurements should be used as the longshore current speed.

In the event the object becomes beached before the end of the one minute interval, the distance to the point just before beaching should be measured and the speed calculated using the time recorded.

When there is no surf zone and waves break directly on the beach, then longshore current measurements should be made in close proximity to the shore.

Figure 1: Formation of Longshore Current

(extracted from https://cape-cod-geologic-history.weebly.com/longshore-current.html)



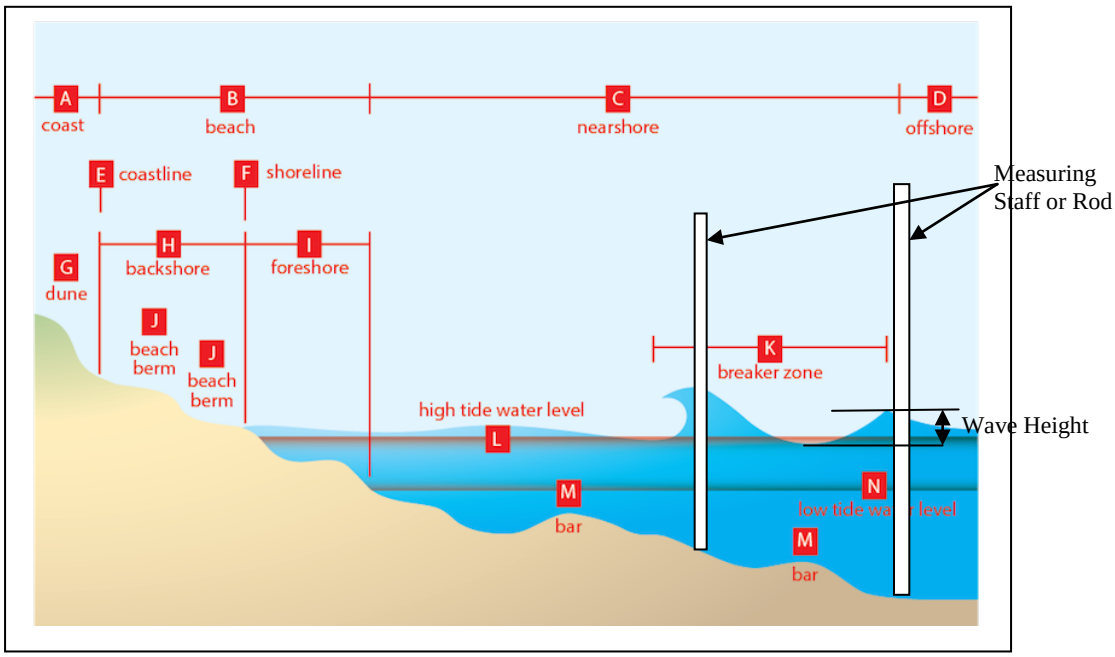


Figure 2: Measurement of Wave and Breaker Heights
(adapted from https://manoa.hawaii.edu/exploringourfluidearth/physical/coastal-