NAME: _____ **PERIOD:** _____ **DATE:** _____

LAB PARTNERS: _____ **LAB # 14**

BEACH PROFILE AND CHANGING SHORELINE INVESTIGATION

CLAIM:

From our observation over time the beach profile and shoreline change shape. After completion of this investigation students will be able to demonstrate and explain these changes using Evidence and Reasoning.

SEP's:

Throughout this lab, the SEP's (Science Engineering Practices) will be touched upon:

1. Asking questions and defining problems
2. Developing and using models
3. Constructing explanations

CROSSCUTTING CONCEPTS:

This lab will serve to demonstrate the following Crosscutting Concepts:

1. Patterns
2. Cause and Effect
3. Systems and System Models

PHENOMENON:

Students will watch 82 Years of Beach Erosion - Time Lapse

https://youtu.be/aXP5I14YSR4

DISCUSSION:

INTRODUCTION

The shoreline is a dynamic environment, affected by many processes including waves, tides, wind, and human activities. It is important to understand the long-term trends of erosion and deposition on a beach, because the beach helps prevent damage to man-made structures. One method of analyzing a shoreline is to take profiles or cross sections of a beach over a period of time. Figure 1 shows a generalized beach profile. By comparing successive profiles, it can be determined whether waves are building up the beach, deposition, or taking material away, erosion.

OBJECTIVES

At the conclusion of this investigation you will be able to:

1. Explain what a Barrier Island is and describe its features.

2. Connect all erosional and depositional processes and how they shape the Barrier Island and Shoreline
3. Relate the effect of beach erosion and deposition during summer and winter
4. Compare two beach profiles.

MATERIALS
Internet access, Colored pencils, Calculators, Rulers

APPROXIMATE 2 periods

TIME PROCEDURE

1. Phenomenon Students will watch 82 Years of Beach Erosion - Time Lapse and discuss Coastal erosion and deposition.

2. Long Island's Dynamic South Shore A Primer on the Forces and Trends Shaping Our Coast https://www.nps.gov/fiis/learn/nature/upload/longislandsdynamicsouthshore_150dpi_11-08-07.pdf
    a. go to the Long Island's Dynamic South Shore website and familiarize yourself with Long Island's dynamic ever changing coast line.

3. Answer questions about Longshore currents

4. Calculate the rate of change for each new measurement recorded on the growth of Fire Island Inlet using the chart below. (show your work).

5. Explain why Montauk is eroding away and Fire Island Inlet is increasing in size.

6. Using Profile A data in Table 1, plot the height of the beach and the distance from the dunes on Profile A on the worksheet. Connect the points with a smooth line.

7. For Profile B data in Table 1, repeat step 2, on Profile B on the worksheet.

8. Use a colored pencil or marker to mark sea level at a height of zero feet on the two graphs (Figure 2) on the worksheet

9. Label the following zones on each profile: dunes, berm, foreshore, and sandbar.

10. Answer questions on beach profile and erosion.

11. Explain measures and engineering techniques to help slow beach erosion.

Fire Island

Fire Island is a barrier beach located south of Long Island, New York. It is typical of the barrier beach system found along the eastern coast of the United States. A barrier island is a ridge of sand that is parallel to a shoreline and about 3km to 30 km (2mi to 19 mi.) offshore. Waves and winds are constantly reshaping the Barrier Island

Long Island's Dynamic South Shore A Primer on the Forces and Trends Shaping Our Coast
https://www.nps.gov/fiis/learn/nature/upload/longislandsdynamicsouthshore_150dpi_11-08-07.pdf

a. go to the Long Island's Dynamic South Shore website and familiarize yourself with Long Island's dynamic ever changing coast line.

Longshore Drift/Longshore Current

https://youtu.be/U9EhVa4MmEs

Longshore Sediment Transport: Not Quite a "River of Sand" As already described, waves hitting the shore can move sand landward or seaward in a cross shore direction. Waves approaching the shore at an angle also create currents which carry sand parallel to the coastline in the surf zone. For the majority from the East towards the West on Long Island. This movement of sand is called longshore sediment transport or longshore current. The amount of sand moved depends on the size and frequency of the waves. Bigger waves move much more sand, which means that storms, with their large waves, are very important in controlling the distribution of sand along the shore. The size of the waves responsible for moving most of the sediment on the south shore is controlled by three variables: the speed of the wind over the water, the distance the wind blows over water (called the fetch), and the length of time the wind blows. The fetch of winds blowing towards the east is limited by the presence of New Jersey. This limits the size of the waves which carry sand east along the New York Atlantic shore. The fetch for winds blowing towards the west is virtually unlimited. As a result, the waves driving longshore transport to the west are generally stronger than the waves moving sand east. Although sand is moved in both directions, more sand tends to be moved to the west resulting in a net transport of sand from east to west in most years. The rate at which sand moves along the coast is usually measured in units of cubic yards per year. To envision a cubic yard, think of a volume of sand about the size of a typical clothes washing machine.

Longshore Questions

1. What causes the Longshore Drift/Current.

2. Which direction does the majority of sand move in Long Island's Longshore Drift/ Current and explain why this happens.

3. How does different size sediments move along the beach, explain your answer?

4. What are the results of beach erosion and beach deposition when groins are placed on the beach? (Image 1)

Image 1

Image 2

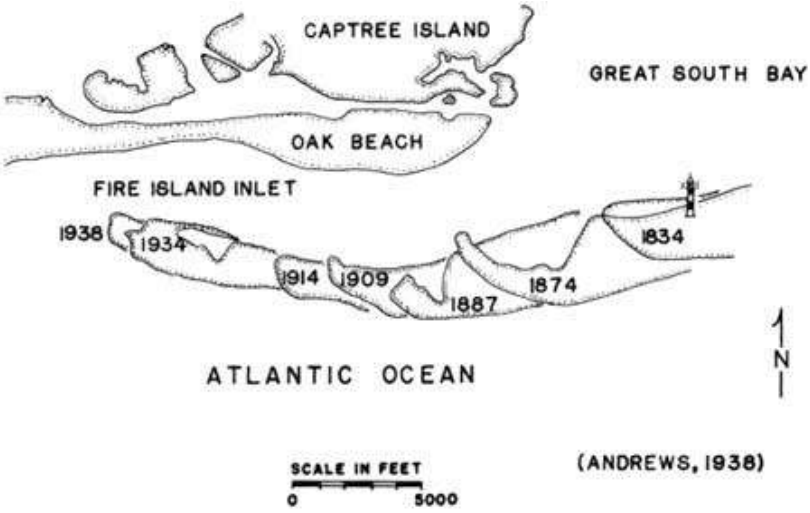
Figure 18. Sand moves in both directions along the shore, but generally more sand moves to the west than to the east resulting in a net westerly transport. There is considerable uncertainty in the values shown here due to variability in the rates of movement at different times and places and difficulties associated with trying to measure the amount of sand moving along the coast.

5. Use your knowledge of Earth Science and the geological landscapes of Long Island to explain the different Cubic tons of sand movement at different locations along Long Islands Barrier Islands. (Image 2)

6. Do you believe setting up groins on the beach are positive or negative, supporting your answer?

7. Calculate the rate of change for each new measurement recorded on the growth of Fire Island Inlet using the chart below.

$$\text{Rate of change} = \frac{\text{change in value}}{\text{time}}$$



Years	Show Your Work	Answer
1834-1874		
1874-1887		
1887-1909		
1909-1914		
1914-1934		
1934-1938		

12. Which Dates had the greatest rate of change?

13. Explain why Montauk is eroding away and Fire Island Inlet is increasing in size.

Beach Profile:

Winter Berm Compared to Summer Berm, Go to website and fimilizae yourself with Science of the Shore – A Tale of Two Beaches: Winter & Summer Beach Profiles

https://www.friendsofibsp.org/breaking-news/science-of-the-shore-a-tale-of-two-be aches-winter-summer-beach-profiles/

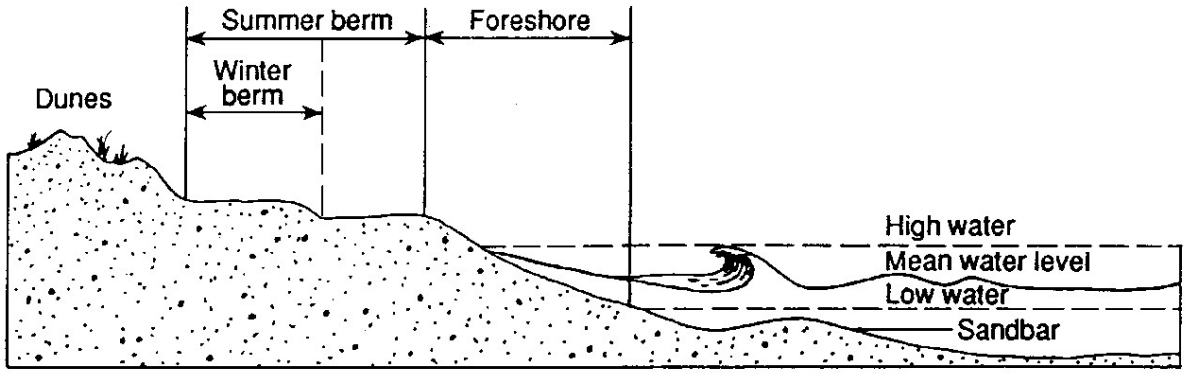


Figure 1. Generalized summer beach profile.

Two profiles of the beach were made at the same location over a period of six months. One was made during January (winter) and the other during June (summer). The data for each profile are found in Table 1.

A beach profile shows several features that may change as a result of seasonal weather conditions. During the winter months, waves are generally high, and there are more storms, producing more frequent waves. Wave and tide action tend to erode the beach by carrying away material that may be deposited offshore, forming an underwater sandbar. Because of this erosion, the berm, the nearby horizontal section of a beach usually known as "the beach," is narrower in the winter months than in the summer months. The foreshore, the section between the low tide shoreline and the beginning of the berm, is less steep in winter than in summer. The foreshore is regularly covered and uncovered by the rise and fall of the tide.

During the summer months, waves are generally low and flat and tend to deposit sand and other particles on the beach. This deposition builds up the berm, making it wider, and steepness the foreshore. Sandbars may disappear.

Table 1
Beach profiles of Fire Island, New York.*

Profile A		Profile B	
Height above sea level (ft.)	Distance from dunes (ft.)	Height above sea level (ft.)	Distance from dunes (ft.)
3.4	0	3.2	0
3.2	6	3.0	8
3.0	12	2.8	16
2.8	24	2.6	26
2.8	30	2.4	36
2.8	36	2.0	44
3.0	54	1.6	50
2.8	64	1.0	60
2.4	72	0.6	68
1.8	78	0.2	78
1.4	86	-0.2	88
0.6	98	-0.6	98
0.0	108	-1.0	110
-0.4	118	-1.0	118
-0.4	122	-0.8	128
-0.2	130	-1.4	142
-0.6	136		
-0.8	138		
-1.2	146		
-1.4	156		

* English units are used rather than metric units because the data were collected in English units. Conversion to metric units would result in fractional data that are more difficult to use.

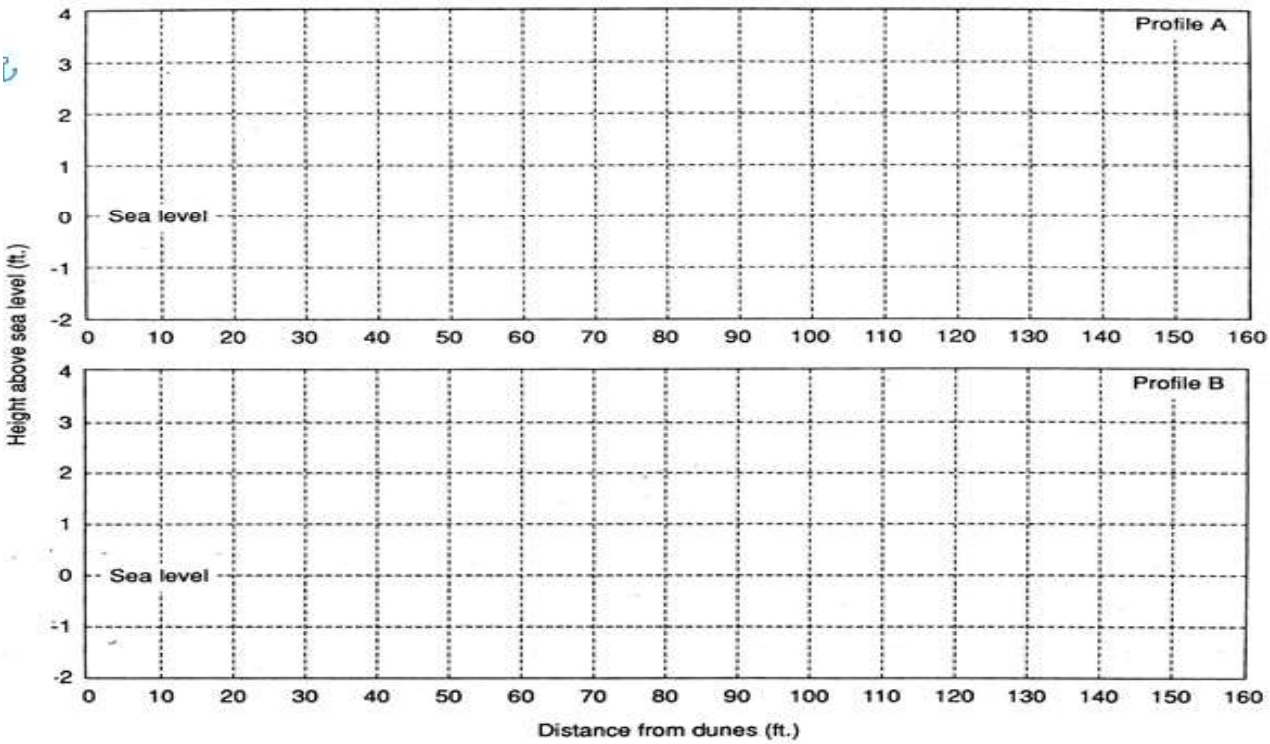


Figure 2. Summer and winter beach profiles of Fire Island, New York.

Label the following zones on each profile: dunes, berm, foreshore, and sandbar.

Beach Profile Questions:

1. Which profile was made in January? How can you tell?

2. Which profile was made in June? How can you tell?

3. Why do beaches typically show seasonal variations?

4. Explain your own experiences when you stand along the surf zone at the beach, describing what natural phenomenon is happening to your feet and why.

5. Watch the video on, Janeen Minguillo, project manager, U.S. Army Corps of Engineers, New York District, discuss the recently completed Fire Island to Moriches Inlet Stabilization Project, and the challenges associated with completing the project https://youtu.be/QQratRsDDI8

    a. What is the Stabilization Project and how are they accomplishing it?

    b. What are some of the challenges the engineers had to face?

    c. How and what will benefit from the Stabilization Project?