Beach Profiling Field Trip Map

We will meet at the **north end of the beach volleyball courts located along Highway 101 (Carlsbad Blvd) just north of the "warm waters" jetties.** These are the jetties west of the highway a short way north of the Carlsbad power plant (the big blocky building with the tall smokestack).

Map location (latitude-longitude): **33.139835, -117.339957**

Note: access is best if you approach from the north along Highway 101 (Carlsbad Blvd). If you approach from the south, you will need to do a U-turn at Tamarack and double back to the south. Park along the highway **near the volleyball courts north of the jetties.**

Please don't be late. It will take about 20 minutes to get there from the Oceanside campus, or 25 minutes from the San Elijo campus. Portable outhouses are available at the beach.

Name:_____

Beach Profiling Field Trip

(Adopted from an exercise developed by Al Trujillo and Patricia Deen, Palomar College)

In this lab, you will measure and compare the size of the beach in two places. You will also compare the present size of the beach to its size at an earlier time. You will then use your knowledge of beach processes to interpret and explain what you find, and predict what the beach here will probably look like six months in the future.

Natural Beach Processes

Beaches change their size and shape due to the movement of sand. Sand moves toward the beach and away from the beach according to the seasons.

During the winter, larger storm-generated waves pull sand away from the beach and deposit the sand in longshore bars several hundred feet offshore. The resulting **winter beach** is typically narrow, steep, and covered with large rocks that were exposed when the sand moved offshore. ***Note: the winter beach usually persists far into the spring.***

During the summer, smaller waves gradually push sand back toward the beach. The resulting **summer beach** is typically wide and sandy, and most of the rocks are typically covered over with sand. ***Note: the summer beach usually persists well into the fall, before winter storm waves begin.***

Sand also moves along the beach (parallel to the beach) in the direction the waves are moving, a process called **longshore transport** or **longshore drift**. Structures built along the beach can interfere with longshore drift, changing the shape of the beach in different places. On any given day, the direction of longshore drift may to the south or to the north, depending on the direction the waves are coming from. Or, there may be no longshore drift at all if the waves are coming straight in to the beach. However, measured over the entire year, there is a **net southward drift of sand** along our coast, because most of the time the waves come out of the west and northwest. *Think: with net southward longshore drift, where would you expect to see wider beaches: on the north sides versus the south sides of jetties?*

Dredging and Beach Size

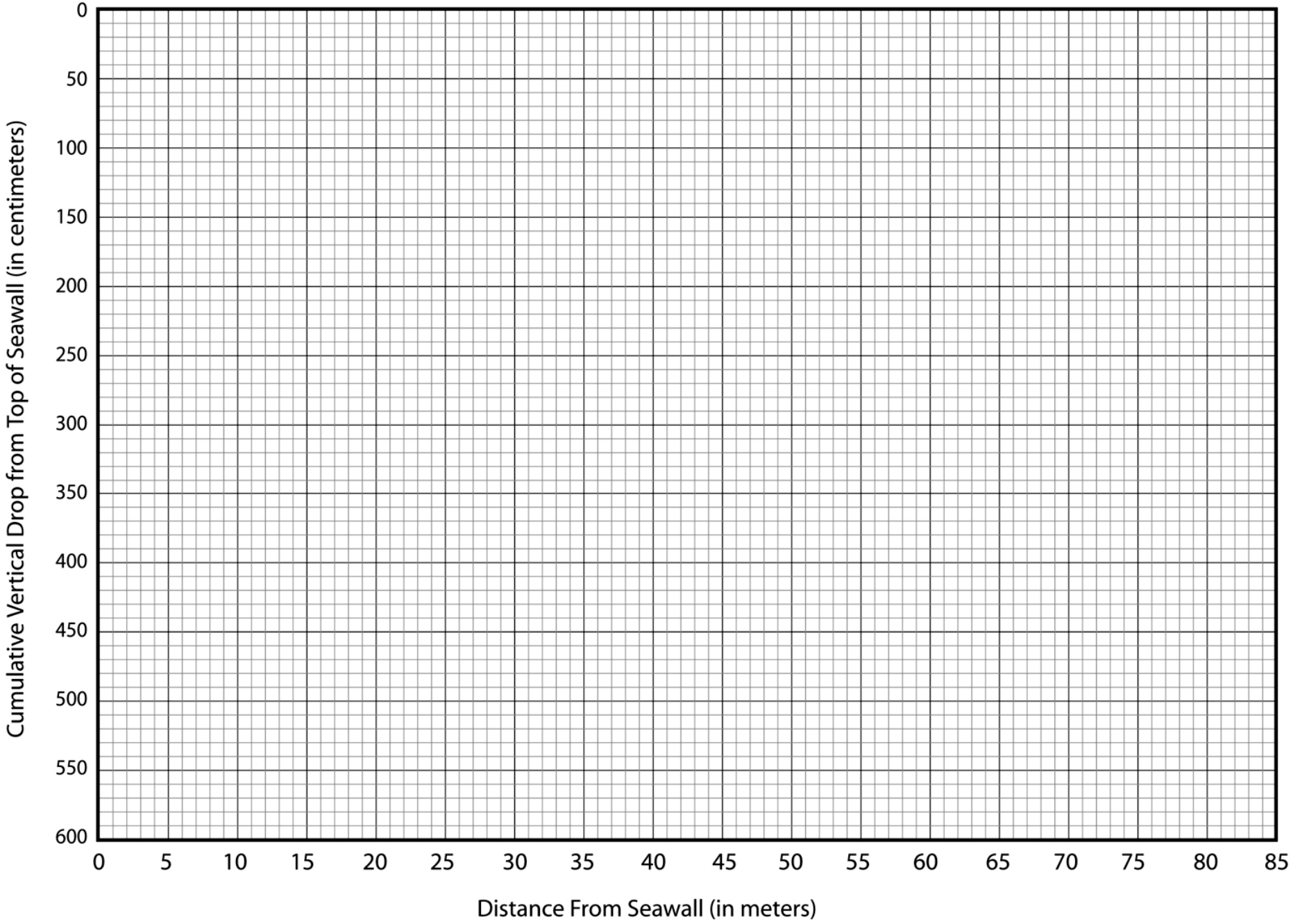
Every few years, the beach at this location gets a big deposit of new sand dredged out of Aqua Hedionda Lagoon. When that happens, the beach becomes much larger for a number of months. These artificial increases in the size the beach are periodically imposed on top of the natural processes (described above) that affect beach size. This can make interpretation of our data a bit tricky—but we'll do the best we can. How long sand lasts on our beaches is important both for our local economy and for our quality of life here in San Diego.

Beach Profiles

We will be measuring the size and shape of the beach using **beach profiles.** A beach profile is a graph that shows the changing height of the beach from the upper part of the beach down to the low tide level. Beach profiles are generally <u>vertically exaggerated</u> in order to better show changes in the size and shape of the beach. Accurate beach profiles are useful for monitoring changes in beaches over time. This is particularly important in southern California, because rapid human development of the coastline has altered sand supply and sand movement on our beaches.

You will be measuring beach profiles in two different places along the beach: the **south profile** location and the **north profile** location. You will also be comparing the profiles that you measure <u>today</u> with profiles <u>measured in a previous season</u>. You will use your knowledge of beach processes to interpret the differences that you detect between the south and north profiles, and the variations in the size of the beach at different times of year.

BEACH PROFILE GRAPH



BEACH PROFILE DATA Note: For both of our beach profiles, we will use the top of the seawall as our starting point.

SOUTH PROFILE

Vertical distance from the top of the seawall to the beach: _____ centimeters
(Put this value in the Vertical Drop and Cumulative Drop columns for Station 0.)

Station number	Distance from Seawall (meters)	Vertical Drop (centimeters)	Cumulative Drop (centimeters)
0	0		
1	5		
2	10		
3	15		
4	20		
5	25		
6	30		
7	35		
8	40		
9	45		
10	50		
11	55		
12	60		
13	65		
14	70		
15	75		
16	80		

NORTH PROFILE

Vertical distance from the top of the seawall to the beach: _____ centimeters
(Put this value in the Vertical Drop and Cumulative Drop columns for Station 0.)

Station number	Distance from Seawall (meters)	Vertical Drop (centimeters)	Cumulative Drop (centimeters)
0	0		
1	5		
2	10		
3	15		
4	20		
5	25		
6	30		
7	35		
8	40		
9	45		
10	50		
11	55		
12	60		
13	65		
14	70		
15	75		
16	80		

SOUTH PROFILE FROM A TYPICAL SUMMER/FALL BEACH in the past

Vertical distance from the top of the seawall to the beach: 102 centimeters
(Put this value in the Vertical Drop and Cumulative Drop columns for Station 0.)

Station number	Distance from Seawall (meters)	Vertical Drop (centimeters)	Cumulative Drop (centimeters)
0	0	88	88
1	5	7	95
2	10	24	119
3	15	3	122
4	20	10	132
5	25	18	150
6	30	28	178
7	35	4	182
8	40	-10	172
9	45	20	192
10	50	85	277
11	55	92	369
12	60	72	441
13	65	59	500
14	70	43	543
15	75	35	578
16	80		

DATA ANALYSIS and QUESTIONS

1. On the blank graph, plot THREE different beach profiles. For each one, plot **Cumulative Drop** (centimeters) on the vertical axis versus **Distance from Seawall** (5-meter intervals) on the horizontal axis. Label each profile clearly as:

   South profile today
   North profile today
   South profile from the past

2. Your beach profiles are vertically exaggerated, meaning that changes in the height of the beach (vertical axis) are shown in different measurement intervals than the horizontal distance (horizontal axis). Determine the vertical exaggeration of your profiles by following the steps below.

   Horizontal scale: distance represented by 1 interval (1 box) on the horizontal axis:

   _____ centimeters (Note: 1 meter = 100 centimeters)

   Vertical scale: distance represented by 1 interval (1 box) on the vertical axis:

   _____ centimeters

   Vertical Exaggeration = $\frac{\text{Horizontal scale (cm)}}{\text{Vertical scale (cm)}}$ = _____

3. What is the net direction of longshore drift along our coast here? Why does the sand move this direction? Draw a simple sketch, as if you were high in the air looking down on the coast from above, showing how the waves typically approach at an angle from a certain direction, so that they move the sand in a particular direction. Indicate the direction of longshore drift with an arrow. Add a North arrow to your sketch, labeled "N," to indicate which way is north.

4. Based on your answer above, explain how and why your **north** profile and **south** profile are different. Think about how the jetties in this area interrupt the movement of sand. Use a simple sketch, looking down at the beach from above, showing the two jetties, the different sizes of the beach in the north versus south, and an arrow showing the direction of longshore drift.

5. Look at the waves today, observing how they break, whether or not they are approaching the shore at an angle, and whether or not there appears to be a longshore current. *(Hint: look at the bubbles in the surf zone; do they appear to be drifting along the shore either north or south?)* Based on this, what is the direction of longshore drift today? (Your answer may or may not be the same as in 3 above. Look at the water and decide based on what you see.)

6. Compare your **south profile <u>today</u>** with the **south profile <u>from the past</u>**. How are they different? Why do you think there is a difference? *Hint: review the introductory information several pages back that explains the <u>summer beach</u> versus <u>winter beach</u> cycle and how long those conditions persist.*

7. Thinking about seasonal changes in southern California beaches between winter and summer, draw a <u>fourth beach profile</u> on your graph showing your prediction of **what the north profile will look like six months from now**. Label the line "**North profile six months from now**" on your graph. Explain below why you drew the line the way that you did. *Note: your answer should make sense with your reasoning in #6 above.*

8. For this final question, consider the following information. The two pairs of **jetties** in this area create open channel connections between the ocean and Aqua Hedionda Lagoon. One pair of jetties is north of the location of our north profile, and the other pair is south of the location of our south profile. The electrical power plant uses water from the lagoon for cooling the plant machinery. To do this, the power company must ensure that the lagoon and the channels at both sets of jetties are not plugged with sand. The power company therefore needs to dredge the sand regularly—an expensive procedure necessary to keep the jetty channels open. By agreement with the city of Carlsbad, when the power company dredges sand, it puts 30% of the dredged sand on the beach north the north jetties, and splits the remaining 70% between the beach that we are on and the beach south of the south jetties. The city of Carlsbad wants the sand distributed this way in order to widen these popular city beaches. The power company cooperates with the city, but if the decision were up to the power company, it might do two things differently: 1) place <u>all</u> of the dredged sand south of the south jetties, and 2) make the north jetties longer. ***Explain the power company's reasoning***, relating your answer to what you wrote for question 3. above.