



Rocky Mountain Mapping Center

Coastal and Geo-Resources Activity from USGS Rocky Mountain Mapping Center

Hydrology: Coastal Processes

Coastal lands and sediments are constantly in motion. Breaking waves move sand along a coast, eroding sand in one area and depositing it on an adjacent beach. Tidal cycles bring sand onto the beach and carry it back into the surf.

In many areas, prevailing winds produce waves that consistently approach the coast at oblique angles. Even the slightest angle between the land and the waves will create currents that transport sediment along the shore. These longshore currents are a major cause of sand migration along beaches. Note that on the coast below, prevailing winds come from the southeast, producing a south-to-north longshore current. Sand particles move from south to north.

1) In the map below, which direction is the longshore current moving? (3 points)

From _____ to _____

The natural movement of sand is not only a nuisance but is a potential economic loss for owners of beachfront property. Imagine buying a house on the beach only to discover a year later that the beach has disappeared! When this movement results in a net loss of sand from the beach, the natural process may be considered by owners to be a serious threat. To prevent beach loss, structures called groins and jetties are often constructed from shore out into the water. These solid structures impede the drifting of the sand by longshore currents.

2) Given the above discussion of longshore currents and groins, which side of the groin will a beach expand? (3 points)

On the updrift side On the downdrift Side

Sediment carried past a groin may be deposited as shoals offshore in deeper water and remove from the active coastal sediment budget, further increasing downdrift erosion.

3) On the map below showing the same area as in question 1, draw the new sand line after groins were constructed (4 points):

Examine the USGS topographic map of Ocean City, Maryland, paying particular attention to the position of Fenwick Island and Assateague Island, and the jetties on both sides of the Ocean City Inlet.

4) Given that waves usually strike the beach from the northeast, which island receives less sediment than it did before the jetties were constructed? (3 points)

_____ Island

A line connecting Fenwick and Assateague Island could would have been straight in 1849, when the islands "lined up." Jetties were constructed between the islands soon afterward.

Note that Assateague Island by the date of the map had been offset from Fenwick Island.

5) What is the date of the last revision of the map? (1 point) _____

6) Why is Assateague Island offset from Fenwick and why is the offset increasing? (5 points)

7) What is the distance of the offset? _____ feet (2 points)

_____ meters (2 points)

8) Calculate the rate of the offset in meters per year: (4 points)

9) What direction is Assateague Island moving? (2 points)

From _____ to _____

Geo-Resources: Nonmetals

The word "mining" usually conjures up images of metals, such as aluminum, copper, and zinc. Approximately 40,000 pounds (lb) of minerals must be mined each year per person in the USA to maintain the current standard of living. While 1,340 lbs of metals are needed for each person, 20,550 lb of nonmetals must be mined. The bulk of these nonmetals are sand, gravel, stone, cement, and clays to construct buildings, airports, dams, water systems, and highways.

Because great volumes of gravel are needed, it is not economical to transport it over 50 miles from its source.

10) Given the above discussion, in the USA would you expect a greater number of copper and gold mines, or a greater number of gravel pits? Circle your answer. (3 points)

Copper and gold mines

Gravel Pits

Gravel deposits are products of erosion of bedrock and surface materials and the subsequent export, abrasion, and deposition of these particles.

11) Name one method by which these particles are transported by nature after they are eroded: (3 points)

Examine the USGS topographic map of Arvada, Colorado. Find the gravel pits. If you need to, look at the USGS symbol legend sheet to find what the symbol for gravel pit looks like.

12) Near which natural feature are all of the gravel pits on the Arvada map located (choose one and circle your answer): (2 points)

railroads lakes streams highways hills

13) Explain why your answer and answers to questions 11 and 12 confirms the chief natural method by which gravel is transported: (4 points)

Weather: Analysis from Topographic Maps

Examine the USGS topographic map of Isolation Peak, Colorado.

14) Do most of the trees in this area grow at higher or lower elevations? Circle your answer. (2 points)

Higher elevations Lower elevations

15) Why? (2 points)

16) What does the location of the glaciers tell you about the weather patterns in this area? (5 points)

Hydrology: Ground Water Analysis

Examine USGS Hydrologic Investigations Atlas 170, Availability of Ground Water in the Dublin Quadrangle, Jackson Purchase Region, Kentucky.

A map such as this provides excellent information on availability and quality of water, if you needed to drill a well or manage a town water department. This map's subject is ground water, which is that part of precipitation that infiltrates through the soil to the water table. The unsaturated material above the water table contains air and water in the spaces between the rock particles and supports vegetation. See the figure below for details.

17) How is water held in the unsaturated zone? (2 points)

In the saturated zone below the water table, ground water fills the spaces between rock particles. Wherever the water-bearing rocks readily transmit water to wells or springs, they are called aquifers.

18) How is water held in the saturated zone? (3 points)

In the Jackson Purchase region of Kentucky shown on the map, water is held in 3 "areas" or types of underground material.

19) Read the legend in the upper right corner of the map and identify these three areas:

A. _____ (1 point)

B. _____ (1 point)

C. _____ (1 point)

Read the main body of text in the lower left corner of the map.

20) According to the text, which of the 3 areas you identified in question 19 represents the principal aquifer of this area of Kentucky? (2 points)

Examine the generalized columnar section and water-bearing character of geologic formations diagram in the upper left corner of the map.

21) What is the total thickness of the principal aquifer that you identified in question 20? (3 points)

22) Underneath this layer is a layer of clay. What is its name? (1 point)

23) Think about the clay you've used in school art classes or as a hobby. Does water easily pass through it? Circle your answer. (1 point)

Yes No

24) Is the clay you identified in question 22 an aquifer? Circle your answer. (2 points)

Yes No

25) Why? (4 points)

Look at the "generalized geologic section" from point A (written on sticker) at New Bethel Church northeast to point

B (written on sticker) at Mt Olive Church. This section is a cross section of the subsurface between these points.

26) Does the pure "sand" layer get closer to the surface or further away from A to B? Circle your answer. (2 points)

Closer

Further Away

27) Given your identification in question 20 of the principal aquifer of this area and your answer to question 26, would you expect more water to flow from a 400-foot well at New Bethel or Mt Olive? Circle your answer. (2 points)

New Bethel

Mt Olive

28) Why? (4 points)

Examine the circular symbol showing chemical composition of dissolved solids in the legend on the right side of the map, that indicates water quality from wells that were tested in the area. Note the well number in bold type (analysis number).

29) What mineral (for example, Na, Ca, etc) would you most likely find in your water if you drilled a well in the eastern half of this map? (3 points)

30) According to the chemical composition diagram, which of the 15 wells tested in this area contains the most dissolved solids? (3 points)

Well number _____

31) Of the 3 "areas" or types of underground materials that contain water that you identified earlier in question 19, into which material is the well in question 30 drilled into? (2 points)

Let's say you own land surrounding the railroad where it crosses Obion Creek at point C (on sticker) and want to drill a well there.

Notice that surface elevation is shown by gray contour lines on this map.

32) What is the surface elevation of the railroad where it crosses Obion Creek at point C (on sticker)? (2 points)

Examine the water-level contour lines showing the elevation of the saturated zone, or

aquifer.

Notice that water-level elevation is shown by blue contour lines on this map.

33) Are the elevations of the aquifer affected by the elevations of the hills and valleys in this area? Circle your answer. (2 points)

Yes No

34) Estimate the elevation of the saturated zone at Point C. (3 points)

35) How deep should you drill to ensure an adequate, steady supply of water; that is, to reach the saturated zone? (3 points)

At least _____

36) Label the elevations and distance in the following cross-section diagram of your well, based on your answers to questions 32, 34 and 35. (3 points)

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