

Last Name: _____ First Name: _____

**Crandall University
GEOGRAPHY 1013**

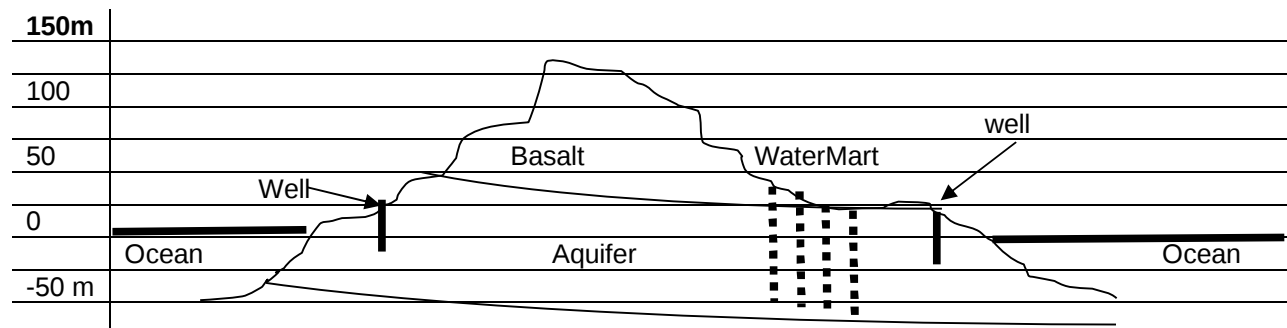
Lab 4: Hydrology

Print this lab off. Complete it. And then scan/photo it and send it as ONE PDF document through Canvas. Please do send it as ONE PDF document with the pages in order. Before you send it, make sure it is legible. If you cannot read it, neither can I 😊

This lab looks at hydrology – groundwater and river systems. Groundwater and river systems profoundly affect landscape development and landscape features. And water is key to human activity! We need water to drink. We need water for agriculture and other food provision. We need water for waste treatment. This lab examines the relationship some of these effects.

A. Groundwater

Hilleville Neck is a narrow peninsula on the ocean coastline. It is surrounded by seawater on three sides. This is an area that gets a substantial amount of precipitation each year. Below is a cross section.



1. The upper reaches of Hilleville Neck are basalt. Is basalt
 - a. ☐ porous, or
 - b. ☐ nonporous
2. Would this basalt
 - a. ☐ provide good groundwater storage
 - b. ☐ not provide good groundwater storage
3. The aquifer is sandstone. Sandstone is
 - a. ☐ porous
 - b. ☐ nonporous
4. Would this sandstone aquifer
 - a. ☐ provide good groundwater storage
 - b. ☐ not provide good groundwater storage

5. The water in the aquifer is fresh water. There are no rivers or lakes. This would have come from:

- a. ☐ flowing in from the ocean on either side
- b. ☐ from precipitation infiltrating into the ground
- c. ☐ other (explain):

6. The residents of Hilleville – with modest farms – get their drinking water from two wells into the aquifer. Now WaterMart, a company that bottles drinking water, is pumping out groundwater as part of a new water bottling plant on Hilleville Neck. They drilled several large wells (the dashed lines).

They bottle the equivalent of 5 million litres of water per year.

The Neck receives the equivalent of 4 million litres of precipitation per year.

What would be the long-term consequences for the aquifer?

- a. ☐ the total amount of freshwater would remain unchanged
- b. ☐ the total amount of freshwater would decrease
- c. ☐ the total amount of water would increase
- d. ☐ other (explain)

7. After a year, the residents notice their two wells have gone dry! Government scientists discover the water table is now lower than ever before, because:

- a. ☐ it must have just been a dry year
- b. ☐ the residents must have been taking longer showers
- c. ☐ WaterMart is pumping out more than the area receives
- d. ☐ other (explain)

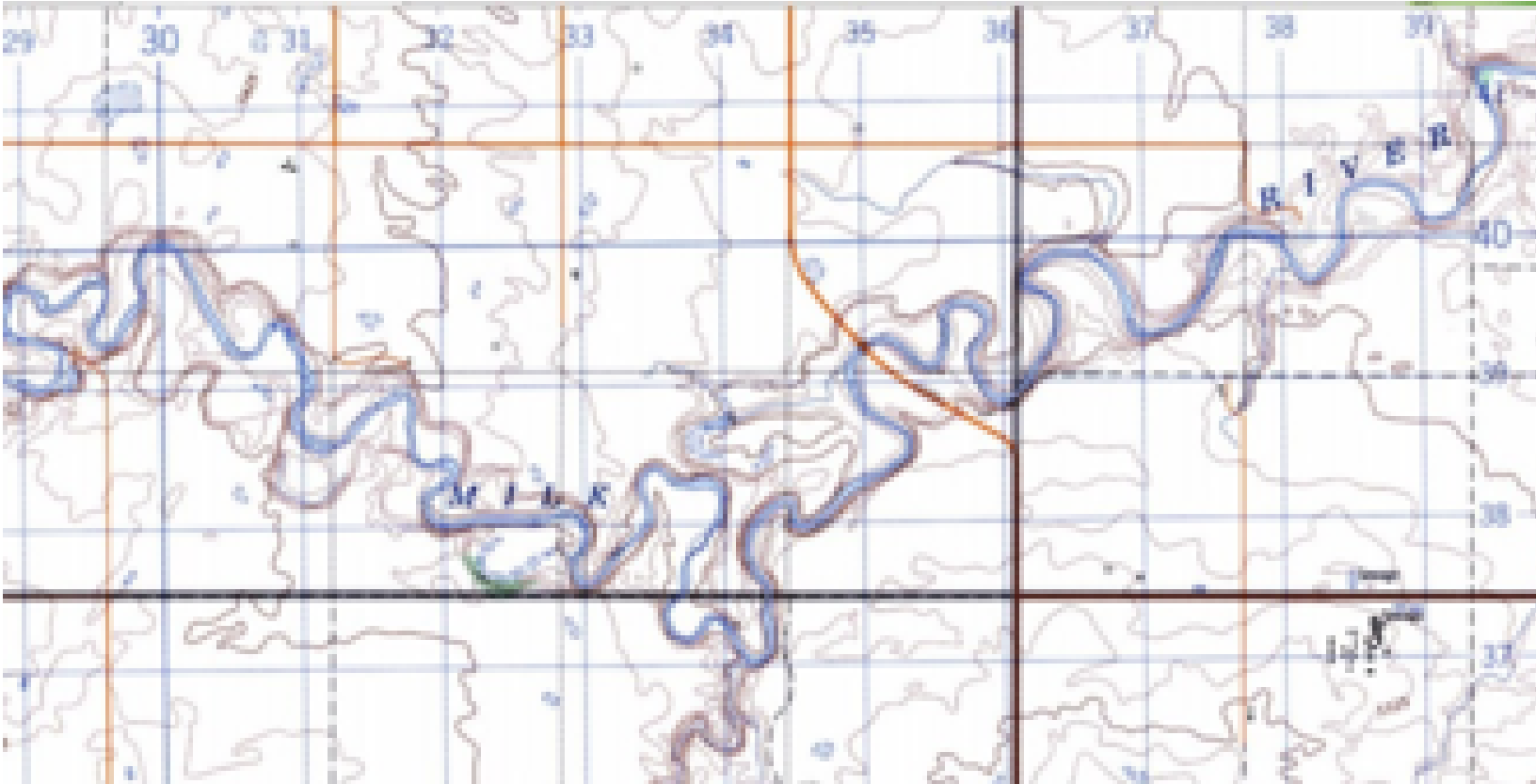
8. WaterMart's solution is to tell the residents that their wells must be silting up. They need to dig deeper wells, to about 50m below sea level. Reluctantly the residents do that. For a couple of years, life is good again. But now the water quality is decreasing rapidly. There is water, but it tastes terrible. When health department officials test water in the wells, they likely find

- a. ☐ that minerals from the earth's core have leached in
- b. ☐ that WaterMart has been secretly poisoning the groundwater
- c. ☐ that acid rain has negatively affected ground water quality
- d. ☐ that sea water has been infiltrating the aquifer
- e. ☐ other (explain)

After 10 years, even WaterMart has run out of freshwater in the aquifer. The plant closes. The company moves on to Wimbledon Neck on another part of the coastline ...

B. River Systems

Here is a section of the Milk River, in southern Alberta, a relatively flat area of silt and clay. (If you are having trouble reading this, check out the full map on the Labs homepage ("For Lab 4, here is **82H01 - Milk River, Alberta**")



1. Note the semicircular lake between 322378 and 328379, formed when a curve of the river was cut off.
 - a. A curve on a river is called: _____
 - b. What is this type of lake called? _____
 - c. Circle AND label with a "C" another of these lakes on the map above
 - d. Circle AND label with a "D" another place you could expect one of these lakes to form soon

C. River Flow

Consider NTS 21 H\16. The surface of the Tantramar Marshes area, just east of Sackville, is largely composed of sand, gravel and other *loosely consolidated sediments*. Notice the Tantramar River valley has a very wide, flat valley bottom. Take a look at the valley's slope (from the west [the hills behind Sackville] to the east [Fort Cumberland Ridge]). The valley is quite flat! Notice the shape of the river.

The hills above Sackville (along the west side of the map), the Fort Cumberland Ridge, and the hills in the southeastern corner of the map are predominately *relatively resistant bedrock*. Consider the course of the Reservoir Brook (905821-888874). Reservoir Brook is trying to cut through solid rock.

Contrast, in your mind, the shape of the Reservoir Brook valley (very narrow, with steep sides) with the Tantramar River.

Also contrast, in your mind, the slope of the Reservoir Brook (from its source, high in the hills) to where it joins Carters Brook at Frosty Hollow ... it's steep!

- a. Why do you suppose the Tantramar River has developed extensive meanders while the Reservoir Brook hasn't? (Consider slope, geology, valley shape, etc.)

- ☐ the Tantramar has a small slope, is narrow, and has a bed made of solid rock
- ☐ the Tantramar has a small slope, is narrow, and has a bed of loose material
- ☐ the Tantramar has a small slope, is wide, and has a bed made of solid rock
- ☐ the Tantramar has a small slope, is wide, and has a bed of loose material
- ☐ the Tantramar has a steep slope, is narrow, and has a bed made of solid rock
- ☐ the Tantramar has a steep slope, is narrow, and has a bed of loose material
- ☐ the Tantramar has a steep slope, is wide, and has a bed made of solid rock
- ☐ the Tantramar has a steep slope, is wide, and has a bed of loose material

- b. What would you estimate the **relative** velocity of each river to be? (which flows faster) Why?

- ☐ the Tantramar flows faster; its slope is steeper
- ☐ the Tantramar flows faster; its valley is wider
- ☐ the Tantramar flows faster; its bed is composed of loose materials
- ☐ Reservoir Brook flows faster; its slope is steeper
- ☐ Reservoir Brook flows faster; its valley is narrower
- ☐ Reservoir Brook flows faster; its bed is composed of solid rock

- c. If data suggested that the **average discharge** of each river (m^3/second) were approximately the same, give two possible explanations for this, this given that the Tantramar River appears to be much larger? (pick **two** ...)

- ☐ Reservoir Brook may be more turbulent
- ☐ Reservoir Brook may be deeper
- ☐ Reservoir Brook is straighter
- ☐ Reservoir Brook may be flowing faster
- ☐ the Tantramar has more meanders
- ☐ the Tantramar flows through loosely consolidated materials

- d. Two dams are located on Ogden Mill Brook (908887-930866), a stream similar in form to Reservoir Brook. Why do you think they were built here and not on the Tantramar River? Choose two advantages of Ogden Mill Brook over the Tantramar for dams:

- ☐ Ogden Mill Brook is shorter than the Tantramar
- ☐ Ogden Mill Brook has less water (m^3/second) flow
- ☐ Ogden Mill Brook is in a steep, narrow valley; the Tantramar a wide, shallow valley
- ☐ Ogden Mill Brook flows more quickly than the Tantramar
- ☐ the water in Ogden Mill Brook is clearer than the Tantramar
- ☐ the Tantramar flows through more human settlements

- e. Consider NTS 83 C\3. Please give the name of one major braided rivers or streams (refresh your memory on braided streams if you need to).

- f. If you were standing on the banks of these braided streams, describe:

- i. the valley shape: ___ U-shaped? ___ V-shaped?
- ii. the river slope (along the length of the stream): ___ steep ___ shallow
- iii. the appearance of the river and its bed (what would you see?)
- ___ sand, gravel, and loose sediments ___ bare bedrock

- g. Several major streams on this map, 83 C/3, are **NOT** braided. If you were standing on the banks of these non-braided rivers, describe:

- iv. the valley shape : ___ U-shaped? ___ V-shaped?
- v. the river slope (along the length of the stream): ___ steep ___ shallow
- vi. the appearance of the river and its bed (what would you see?)
- ___ sand, gravel, and loose sediments ___ bare bedrock

- h. What do you think are the determining factors between whether a stream in an alpine area is braided or not based on your observations from this map?

Braided streams ...

- ___ are located in valley bottoms, draining glaciers
- ___ are running down the sides of alpine valleys

Braided streams ...

- ___ tend to have steep slopes, lengthwise
- ___ tend to have shallow slopes, lengthwise

Braided streams ...

- ___ tend to form among sand, gravel, and loose sediments
- ___ bare bedrock