

ESS 110: Introduction to Geology Dr. Woltemade Streams Field Exercise	Name: _____ Section (circle): 8:00 AM 9:30 AM 11:00 AM
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Completing this exercise will give you first-hand experience with many stream features and introduce you to the stream channel and wetland restoration project on Burd Run, Shippensburg, PA. First, read the [Woltemade and Wood \(2002\) article](#) and chapter 13 in the text. You will need to refer to the article to answer some of the questions. You should wear shoes that you don't mind getting dirty or wet.

Instructions

Go to the [Shippensburg Township Park](#), located along Burd Run on Britton Road (near the access road to the SU Spiritual Center) and spend an hour or so walking along the creek-side trail. As you walk, answer the questions below and identify the features listed in **bold**.

1. Overview: Enter the trail along the stream near the parking lot and read the large sign.		
Flow in Burd Run contributes to what downstream watersheds (name three)?		
Into what body of salt water does this water eventually flow?		
Look at the limestone outcrop across Britton Road. These rocks are over 450 million years old. Notice that the rock layers are dipping steeply into the ground (they have been tilted since original deposition in horizontal layers). Because limestone, a carbonate rock, dissolves in contact with weak acids (precipitation and ground water), there are enlarged bedding planes and joints in the rock that allow water to easily flow through it. This provides a pathway for pollutants to travel from surrounding land uses into the groundwater. You will revisit this story at the end of your park visit.		
Based on earlier experiences in this course, what environment did this limestone form in (circle one)?	<input type="checkbox"/> deep ocean <input type="checkbox"/> stream valley <input type="checkbox"/> beach	
As you first come to the stream's edge, look upstream under the Britton Road bridge. This stream section is relatively steep, generating high flow velocities, especially during floods. This rapidly flowing water is directed toward the cut bank of a bend, which is protected by rip-rap , trees (from live stakes), and rock vanes . These features minimize bank erosion and direct the water away from the bank, toward the center of the channel. On the far side of the stream channel you should see a point bar on the inside of the bend.		
What is the dominant size of sediments that make up the surface of the point bar (circle one)?	<input type="checkbox"/> gravel <input type="checkbox"/> sand <input type="checkbox"/> silt (mud)	
The point bar and bed load sediments are not derived from the local limestone (note the different color). They have been transported a few miles from South Mountain and are only temporarily stored here before being transported further downstream in the next flood.		

2. Interpretive sign #2.

Throughout the park, the stream channel constantly changes from **pools** to **riffles**. You can complete the following questions anywhere along the stream where you see **riffles** and **pools**.

What size sediment dominates the streambed at **riffles**? Circle one;

gravel sand silt

At a **riffle**, throw a small stick into the water and time it as it floats for a distance of 10 feet (estimate as best you can). What is the velocity of the water?

$$\text{Velocity} = \text{Distance}/\text{Time} = 10 \text{ feet} / \text{seconds elapsed} = 10 \text{ ft.} / \text{_____ sec} = \text{_____ ft} / \text{sec}$$

What size sediment dominates the streambed at **pools**? Circle one:

gravel sand silt (mud)

At a **pool**, throw a small stick into the water and time it as it floats for a distance of 10 feet. What is the velocity of the water?

$$\text{Velocity} = \text{Distance}/\text{Time} = 10 \text{ feet} / \text{seconds elapsed} = 10 \text{ ft.} / \text{_____ sec} = \text{_____ ft} / \text{sec}$$

3. Interpretive sign #3.

The **root wads** and **log vanes** here are difficult to see in the stream, as they are now several years old and are largely overgrown. Examine the photos and the interpretation on the sign. The **root wads** were installed in the stream bank on the outside of bends (there are a total of 11 in the entire park).

What is the purpose of the root wads?

4. Interpretive sign #4.

Read the description of **rip-rap** placed near the bridge (large rocks to protect against high-energy flow) and on other bends (smaller rocks used where erosive power is not as high) and information on **live stakes**.

What tree species are the **live stakes**?

Estimate the current height of the trees that have grown from the live stakes (note there are hundreds of these trees right along the channel—they have lots of thin, wispy branches and small leaves). Note that they have grown to this height since they were planted in 2001-2002.

$$\text{Tree height} = \text{_____ feet.}$$

5. Interpretive sign #5.

Stream **meanders** exist all along the stream within this park, but were not present before the 2001-2002 restoration project. Replacing the artificially straight stream with the meandering pattern added about 300' of length to the stream, also reducing the channel slope.

What is the benefit of the stream meanders and the flatter slope?

6. Interpretive sign #6.

You have been walking all along the "**forested riparian buffer.**" The trees you see are Pennsylvania native species that were planted in 2001-2002.

Name three benefits of a forested stream corridor:

- 1.
- 2.
- 3.

7. Interpretive sign #7.

This wetland was restored by blocking an old drainage ditch, allowing water to stay within the wetland for a few days before flowing into the stream. Water enters the wetland from a limestone spring, flows through the wetland, and exits into Burd Run. The spring water is polluted with excess nutrients, but water quality is substantially improved within the wetland, as nutrients are removed from the water.

What is the key nutrient removed in this wetland?

Why is this nutrient a concern?

8. Conclusion

As you walk back toward the parking lot, look for the limestone **spring** that generates the flow of water into the wetland (across Fogelsonger Road from the wood-sided house). Why do you think the groundwater flowing from the **spring** is polluted with excess nutrients? Provide a brief explanation, noting surrounding land use and key characteristics of the limestone geology that you observed at the trail beginning.

Glossary

bedding planes – upper and lower surfaces of a sedimentary rock layer – the contact area between two layers of rock.

bed load – stream sediments transported by sliding and rolling along the stream bed, usually composed of sand, gravel, and larger sediment

cut bank – the outside of a meander bend where high flow energy causes bank erosion and channel migration.

dip – the angle at which a geologic structure, such as a **bedding plane**, dips into the ground (relative to a horizontal plane).

forested riparian buffer – a streamside area planted to trees to provide a buffer between adjacent land uses (e.g. farming, urban development) and the stream channel.

joint – a fracture within bedrock, often found in sets of many parallel fractures.

live stakes – trees planted by driving a cutting (essentially a stick about 3' long and 1-2 inches in diameter) into the ground, where it will sprout roots and new shoots. This planting technique is common along restored stream channels.

log vanes – logs placed into the stream bank and extending into the stream channel such that they will direct the flow away from the bank and toward the center of the channel. Water cascading over these structures often creates a small plunge pool on the downstream side, adding diversity to aquatic habitat.

meanders – bends in a stream channel. Meanders form naturally as part of the process that generates an equilibrium between flow velocity, erosive energy, and sediment transport.

point bar – a deposit of sediment on the inside of a **meander** bend.

pools - deeper sections of the stream with slow-moving water

rip-rap – rocks placed along a stream bank (or lakeshore, oceanfront, etc.) to protect against bank erosion. Rip-rap is sized such that expected flows will not erode or transport the rocks (i.e. they won't move).

riffles - shallower sections of the stream with faster-moving water

rock vanes – similar to **log vanes**, but constructed from placed rocks.

root wads – the root end of a tree, including 10-15' of the tree trunk, placed in the stream bank with the root end exposed in the bank / stream water in order to provide protection against bank erosion. The roots also provide aquatic habitat for small fish and other organisms.

spring – a location where water flows from the ground back onto the surface

vortex rock weir – a rock structure shaped like a chevron (^) with the center in the middle of the stream channel and pointing upstream. Water flowing over the structure is directed toward the center of the stream channel, protecting banks from erosion and creating a small plunge pool below the structure.