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CE321.01
Professor Kney
Laboratory 2
In this laboratory, we observed eight different sites within both the upper and lower Bushkill creek watershed during a field trip on September 10, 2016. We had five tour guides, including Professor Kney, to provide insight to different aspects of the watershed, specifically the effects of upstream water pollution and abandoned infrastructure, and the possibilities of improvements of the water quality.

In general, the land in the upper watershed was much less developed than the land in the lower watershed. The roads were surrounded entirely by trees and the street we drove on was very narrow. The land itself was mostly shale, which is resistant to erosion and thus not highly conductive, and dominated by woodlands and agriculture. The land in the lower watershed was much more industrialized and populated, between the surplus mill dams, the Huntsman iron oxide pigment plant, and the Plant Ops. These observations make sense: since anything that happens upstream will affect the water downstream, it is important to keep the upper watershed away from pollution. As Andy Fedor said, we fail as a society when we stop worrying about our downstream impact.

Some of the main nonpoint source pollutions observed on the tour were agricultural fields, roadways, and sediment from the mill dams. Agricultural fields utilize fertilizers, weed killers, and pesticides, all of which contain harmful chemicals that mix with our water sources. Roadways, such as Route 33, which was to the right of our location of at the cement quarry, are examples of nonpoint source pollution because eventually all of the oil that leaks onto the roads will be carried with storm water into local bodies of water. Lastly, the mill dams were examples of nonpoint source pollution because of the sediments that the dams cause to build up and the erosion created by the dam. Eventually a low oxygen zone in the bottom layer of the water is created and decomposition here becomes anaerobic, letting off methane pollution.

There were also numerous examples of nonpoint source pollution. The wastewater treatment plant that stood to our left at the cement quarry emptied into the Bushkill and potentially contains bacteria that would contaminate the river. At this location there was also an old smokestack for the kiln that heated up limestone for making cement, which would release pollutants like sulfur dioxide and nitrogen oxides into the atmosphere. The Huntsman iron oxide pigment plant also creates point source pollution because it has to
purify the water that it releases, causing the water to have a conductivity of 5000 microsiemers per centimeter.

The use of riparian woodlands buffers is a nonstructural Best Management Practice that helps manage erosion and pollution. The riparian buffers follow the flow of streams to slow down water more efficiently than grass turf, helping water to infiltrate and get pollutants out of the runoff. Also, the slower the water, the less erosion and less altering of peak flows and volume. This use of riparian woodlands to eliminate runoff pollution is an example of how ecosystems provide free services like pollution control and flow control instead of having to create engineering made solutions, which are subject to breaking and requiring updates.

As we learned at Site 2, green infrastructure is a cost-effective approach to manage wet weather impacts by restoring and mimicking the natural water cycle. The Jacobsburg State Park incorporated many of these green features to make up for being built in wildlife. Only materials within a 500 mile radius were used on the building itself, which is very insulated to contain heat and has a green roof to mitigate runoff. It also has heating controlled by geothermal energy and lights controlled by an automatic switcher. To manage stormwater runoff, the park utilizes both native plants, like milkweeds and golden rods, which extract water from deeper levels of the ground, and an underground detention vault that helps sediment to settle out and filter through gravel.

The main environmental regulations and guidelines brought up throughout the fieldtrip were those of Best Management Practices, or BMPs, which are methods that help prevent or reduce pollution from nonpoint sources. Some examples of these are the installation of riparian buffers and using post construction storm water management to mimic natural hydrology after construction, which was an approach employed by the Jacobsburg State Park. Other regulations are created by the National Pollution Discharge Elimination System (NPDES), which requires you to get a permit for any water that empties into a river, and the Municipal Separate Storm Sewer (MS4) Program, which administers the storm water requirements of the federal Clean Water Act. Sediment and obstructions to waterways are also covered by NPDES. An overall emphasis on this trip was the high amount of permitting involved in any engineering related to water.
Still on the topic of environmental regulations, we also learned that there are four levels of quality for watersheds and that these levels have a large influence on the amount of regulations on the area. Since warm water holds less oxygen than cold water and is thus not ideal for aquatic organisms, warm water fisheries have the least amount of special protections. High quality, cold-water fisheries are more protected but can obtain grants for industry. Most of the Bushkill Creek watershed is qualified as high quality, cold water. Exceptional quality watersheds have the tightest regulations on development and typically have very little room for adjustment with potential industry and structural grants. Sobers Run in Bushkill Township is a stream of this status.

To maintain the integrity of a watershed, citizens can be aware of where the upper watershed is versus the bottom watershed and then try to prevent new industries forming in the upper watershed; since anything that happens upstream affects downstream, it is important that this water stays clear of any type of pollution. Citizens can also proactively try to be compliant with civil engineers and environmental scientists. On the trip, Dr. Colosi mentioned several different occasions during which the general public refused to listen to the advice of engineers and scientists, especially when it came to removing the old dams that are polluting the Bushkill watershed. People should try to accept that although aesthetics and culture are important, messing with the environment could drastically harm future generations’ water sources.

Aside from the previously mentioned aesthetics and culture of dams, there are close to no positive aspects of the numerous mill dams left abandoned in Lions and Penn Pump Park. Sediment buildups at the dams kill the local habitats and cause methane pollution while preventing estuaries upstream from getting recharged. Animals in the water surrounding the dams such as shad are unable to return to their original habitat where they reproduce. The dams are also old and thus subject to structural failures that will pollute the waters and cause floods. And although people insist on keeping the dams around, they don’t realize that they can be negatively impacted on a personal level: the dams are nearly impossible to spot while in the water, cause currents in two different directions, and make the water highly bubbly, all making the rivers very dangerous for an average person to be in. A sustainable engineer could improve these dams by building
spillways to provide release of flows or by building effective fish ladders (not similar to the ones at our eighth destination) to help the local species navigate despite the dams.