Watershed Wisdom –Mother Nature's Watershed: Slowing the Flow

Last week we discussed Mother Nature's watershed design. This week we will focus a bit more on vegetated buffers, and how and why they work. Like many topics in nature, what seems very simple at first becomes more complex as you look closer and examine the underlying processes.

As we discussed last week, much precipitation that reaches the earth's surface, especially in forested areas, never actually runs off but is recycled to the atmosphere through the processes of "evapotranspiration," or in the case of snow and ice, "sublimation." Water that reaches the ground (rain or melted snow) begins flowing down hill toward the nearest lake or wetland. In relatively flat regions with pervious soils, most of the water will infiltrate and become groundwater. If the soil is completely saturated, especially in moderately sloped areas with relatively uniform vegetated surfaces, more of the runoff will take the form of what hydrologists call "sheet flow," a relatively uniform slow flow across the surface as the name implies. Think of water seeping across a gently sloping lawn. In steeper areas or areas with a lot of impervious surfaces, runoff will rapidly become what engineers call, "concentrated flow." This is water actively flowing in gutters, pipes, or channels.

The form the runoff takes determines how fast it runs off and what contaminants get taken up. Pollutants in water can be either in dissolved form or attached to suspended solids. Groundwater flows very slowly – on the order of a foot or two per day- through a medium (soil) that acts as a filter. Groundwater can dissolve minerals or other contaminants in the soil but if the soil is clean, the water will be, too, which benefits all of us who drink well water. Sheet flow moves on the order of one to five feet per minute. It can dissolve things like fertilizer or weedkillers from lawns and pick up dust, bacteria, or hydrocarbons from exposed surfaces but doesn't flow fast enough to be erosive. Concentrated flow coming off impervious surfaces can flow very quickly, typically a foot per second or more. Because kinetic energy of moving water increases as the square of the velocity, rapidly flowing water is capable of both eroding exposed soil and carrying it off as suspended solids. These solids often have contaminants such as phosphorus, oil or grease attached, especially on the finer soil particles. When the polluted water eventually reaches a large pond or lake, the velocity will slow and the suspended sediment will settle out distributing the contaminants throughout the lake. Even clean soil particles have a negative impact on the lake as the fine sediments fill in the pores of clean sand and gravel bottoms that fish and other aquatic organisms need to reproduce.

To prevent the pollutants from reaching the lake, the flows need to slowed so that the sediment can settle out **before** reaching the lake and as much runoff as possible infiltrated instead of flowing directly into the lake. Under Mother Nature's system, the riparian (along the bank) vegetated buffers slow the flows and allow infiltration into porous wetland soils wherever possible. At typical groundwater speeds, it takes about a month to flow through a fifty foot buffer so natural cleansing mechanisms can remove contaminants, even most dissolved contaminants. For sheet flow, the same fifty feet takes about 15-20 minutes, basically allowing some settling of particulates but no removal of dissolved contaminants. Concentrated flows will pass directly through the buffer in less than a minute so get virtually no treatment. In future columns, we will talk

more about preventing concentrated flows and converting them to sheet flows or groundwater flows so they can be treated.