

WATERSHEDS WORK - BUCKS COUNTY

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"The health of our waters is the principal measure of how we live on the land."

-Luna Leopold

A watershed is a natural drainage basin that captures and channels precipitation into streams, rivers, and ultimately oceans. Effective stormwater management within a watershed is crucial for mitigating flooding, erosion, and water pollution by mimicking nature's processes through green infrastructure and sustainable practices. This holistic approach treats stormwater as a valuable resource rather than a waste product.

What is Stormwater Management?

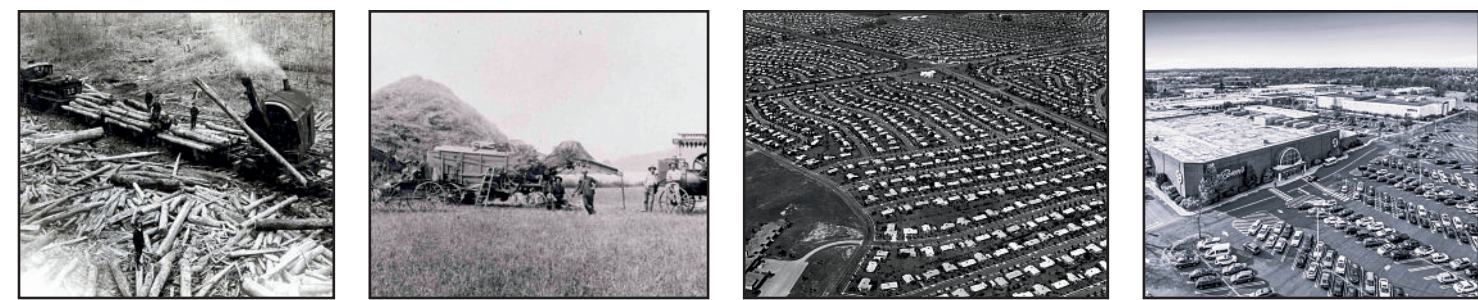
Stormwater is defined as the runoff generated when precipitation from rain and snowmelt flows over land or impervious surfaces without infiltrating into the ground. As it flows, stormwater runoff collects and transports pollutants to surface waters.

Over time, changes in land use have altered elements of the hydrologic cycle. Increasing frequency and severity of rainfall onto less permeable surfaces produce higher volumes of stormwater runoff, leading to diminished water quality in our surface waters.

Stormwater management aims to mitigate these issues by reducing and treating runoff from impermeable surfaces, thereby enhancing the quality and quantity of water that enters our streams. Here are some key considerations to improve the health of our waterways.



Land to Sea: A lesson in Land use and Water quality.

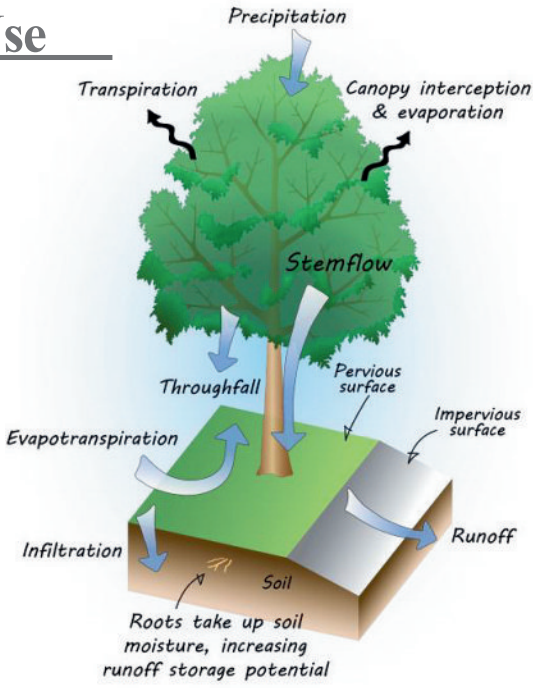


Historical and Ongoing Changes in Land Use

In the vast forests of the late 17th century Penns' Woods, 90% of precipitation was captured by the dense canopy, with leaves intercepting drops and branches guiding water down to the roots for absorption, sustaining tree growth.

As forests were cleared for agriculture, about one half of precipitation was captured by land, but the other half was lost to surface runoff, leading to soil erosion. Layers of sediment stacked in the valleys, vulnerable to streambank erosion..

With further development into residential, commercial, and industrial areas, impervious surfaces like rooftops and pavement capture no more than 25% of precipitation. The rest, 75-90%, becomes surface runoff, flowing into creeks and streams.



Water flowing across land surfaces collects pollutants from a large area. This non-point source pollution delivers sediment and nutrients to waterways, negatively impacting water quality and aquatic habitats. Many Bucks County waterways are impaired by Total Suspended Solids (TSS), soil and human-made particles suspended in water.

Suspended solids leave water murky - less sunlight penetrates the water column and as settling occurs, the stream bottom and leaves of aquatic plants are coated with fine sediments. This stunts plant growth and makes it difficult for aquatic organisms to find food or mates.

Nutrient pollution (phosphorus and nitrogen) encourages algal blooms, the single celled plants float in the water column and block sunlight from rooted aquatic plants. Rooted plants provide crucial habitat (food and cover), nutrient cycling, and deliver oxygen to the water column.

Harmful Algal (Cyanobacteria) Blooms, known as HABS, are also spurred by nutrient pollution - some species release toxins that are harmful to wildlife, humans, and their pets. As blooms die and decay, oxygen is pulled from the water which can lead to unpleasant odors and fish kills.

Water Quality

No turning back: What can we do? Screen, Slow, Soak, Store

Screen

Clean water begins with changing our behaviors. What we apply or spill on land eventually ends up in our waterways, harming stream and river ecosystems. Wildlife and human recreational use can also be affected.

Common household cleaning products may be safe for us to use in our homes, but cause problems in aquatic systems. To maintain healthy streams, reduce use of chemicals, and dispose of unused or empty products properly.



Pollutants to watch for:

- Fertilizers & Pesticides
- Salt
- Pool Water
- Detergents
- Sediment
- Stains and Paints
- Trash & Litter

Good Housekeeping:

- Reduce use
- Follow labels
- Keep it clean
- Encourage infiltration
- Consider non-toxic alternatives

Slow

Water running over smooth surfaces like asphalt, concrete, and turfgrass gains speed and energy, leading to erosion and transport of sediment and pollutants into waterways. This runoff, called sheet flow, can be directed by natural or constructed channels, swales, or gullies towards bodies of water.

What can we do?

To mitigate sheet flow, strategically planting native plants, shrubs, and trees in strips or beds can slow down and reduce runoff. Vegetation acts as obstacles, encouraging infiltration and minimizing the flow of water.

Specifically, reducing surface area of manicured turfgrass lawns by creating native perennial beds or hedgerows of native shrubs enhances infiltration capacity - lowers the volume of water flowing across the surface.

When surface flow is slowed down and is able to infiltrate into the soils, our groundwater can be filtered and recharged to meet our population's water demand.



Soak



When a rain event delivers a stream of water from roadsides, rooftops, or driveways, if not managed it will deliver the water downhill, laden with pollutants, directly to streams.

Water containing pollutants can be directed into areas with plants growing, like basins or vegetated channels. The plant roots absorb the polluted water from the soil. The water and pollutants travel up the stems and into the leaves. The roots filter out the pollutants from the water, and the leaves release clean water back into the atmosphere through evaporation.

Rain gardens are excavated basins sized to the volume of water to be treated. Filled with a soil mix that encourages infiltration, the soils act like a sponge, holding the water in place until it is used by plants or enters the groundwater. Replacing impervious patios, driveways, and other surfaces with permeable pavement allows water to seep through into the soils instead of running off into surface water.



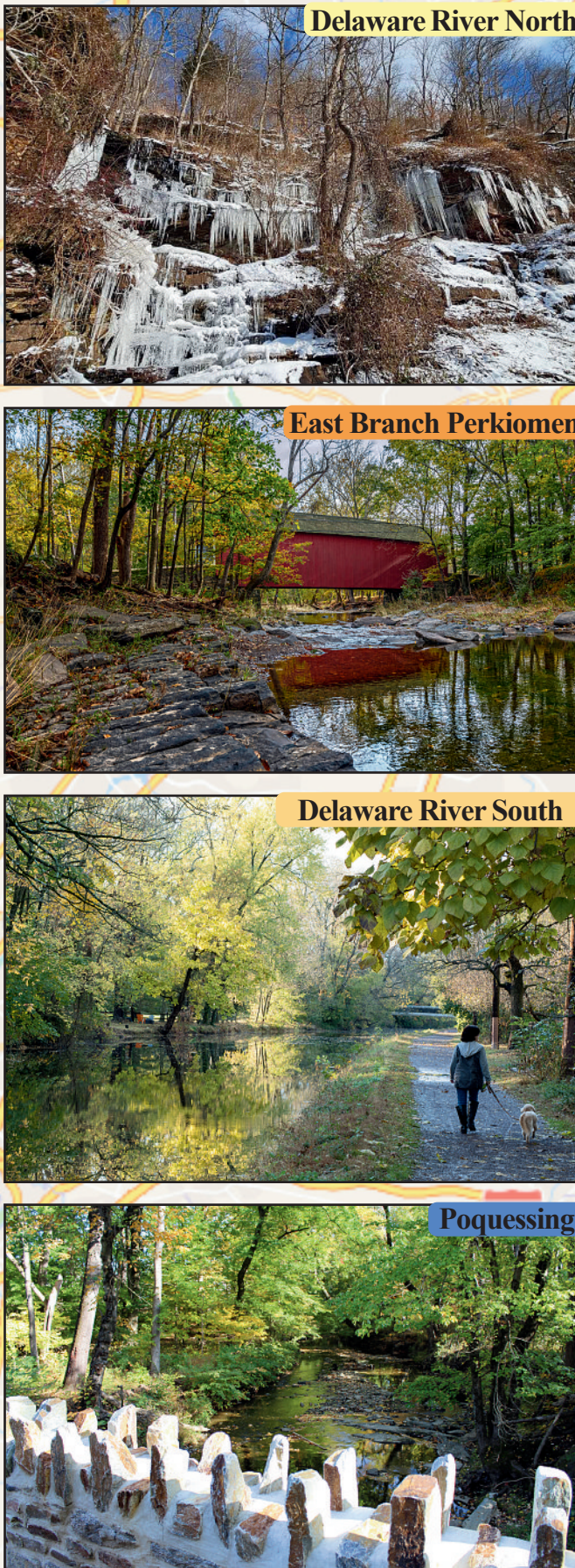
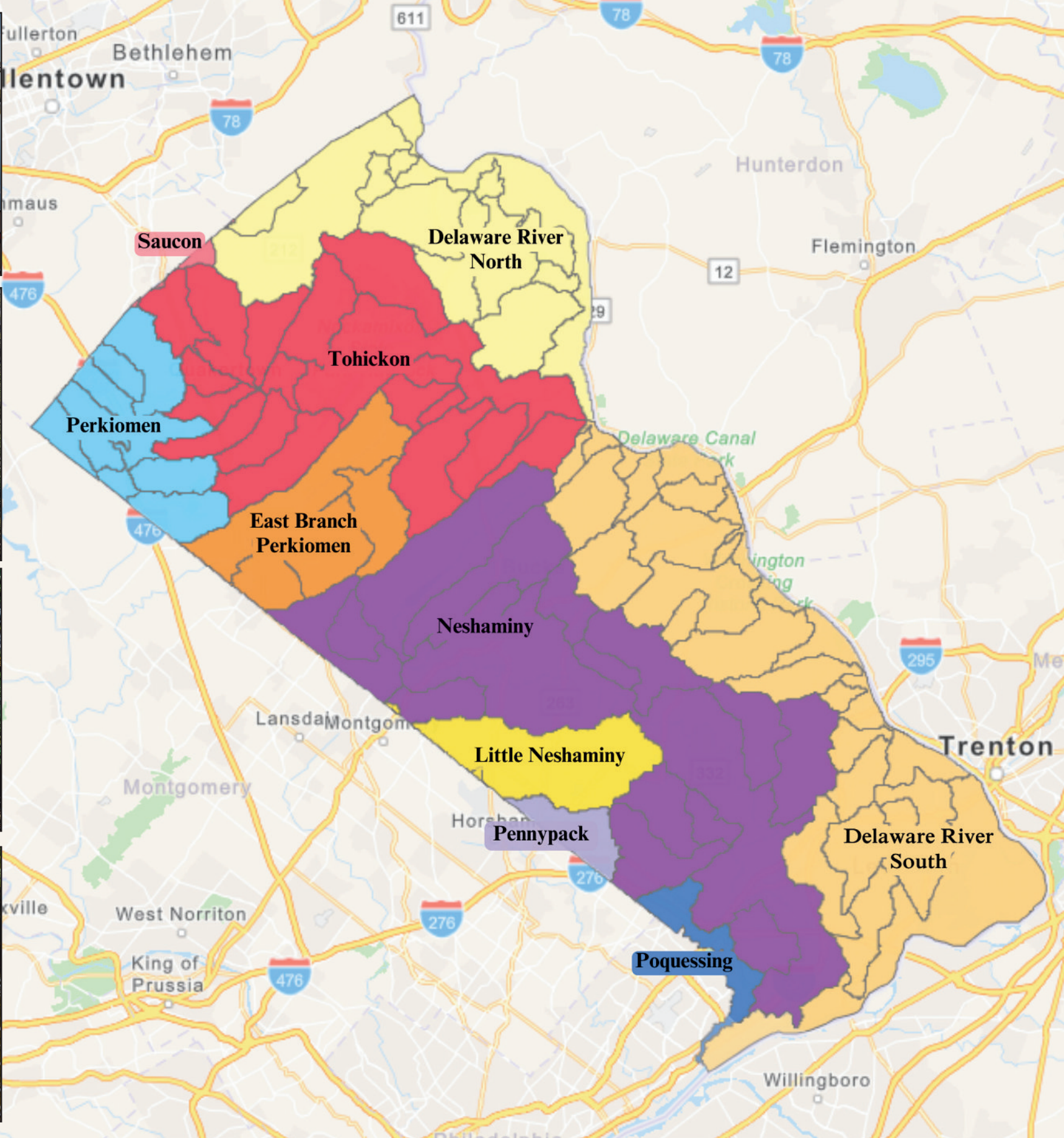
Rainwater can be harvested from home landscapes for non-drinking uses. Rain barrels and cisterns collect water from gutters and downspouts. Water can be drained from the containers as needed OR released into green spaces more slowly than during a rain event.

This causes less erosion and surface runoff pollution. Rain barrels can be custom built or purchased preassembled. Cisterns have a larger capacity and can be installed under or above ground.

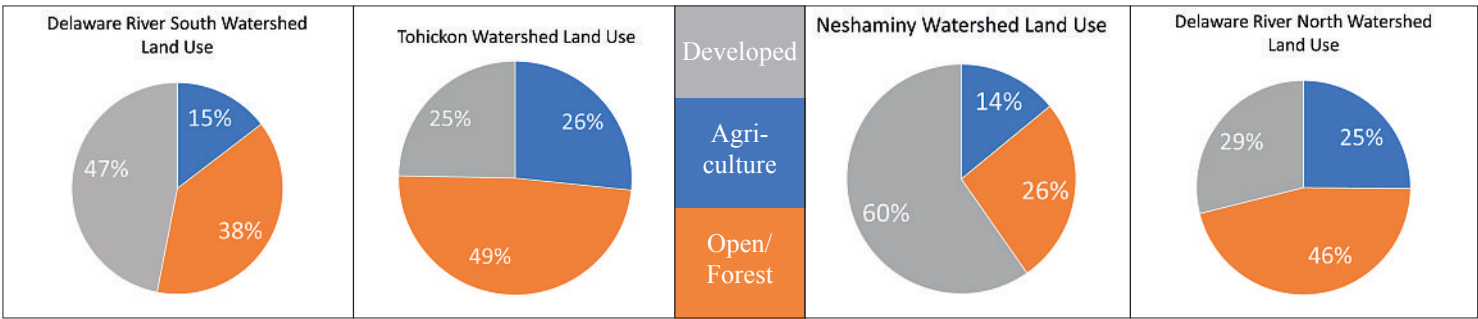
Store

Bucks County Watersheds

Bucks County Conservation District



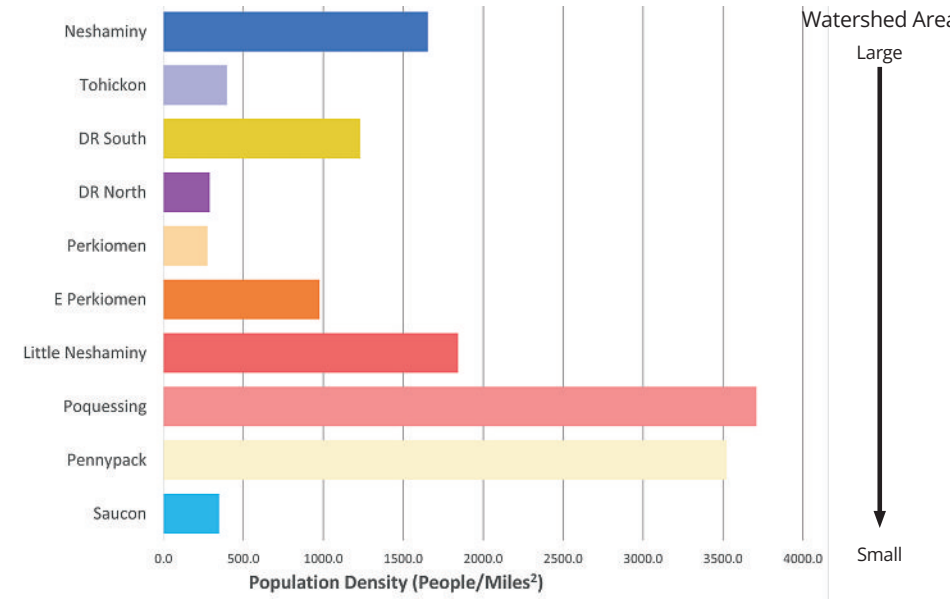
Land Use: Major Bucks County Watersheds



The graphs above represent land use of the four largest Bucks County Watersheds: Delaware River North, Delaware River South, Tohickon, and Neshaminy.

Four main categories of land use are displayed. They are, in order of the least to greatest volumes of surface runoff are: Open/Forest - Agriculture - Developed (Commercial/Residential) - Other. Higher proportions of developed lands increase storm driven volume and velocity of surface water and create larger pollutant loads.

Population Density: Bucks County Watersheds

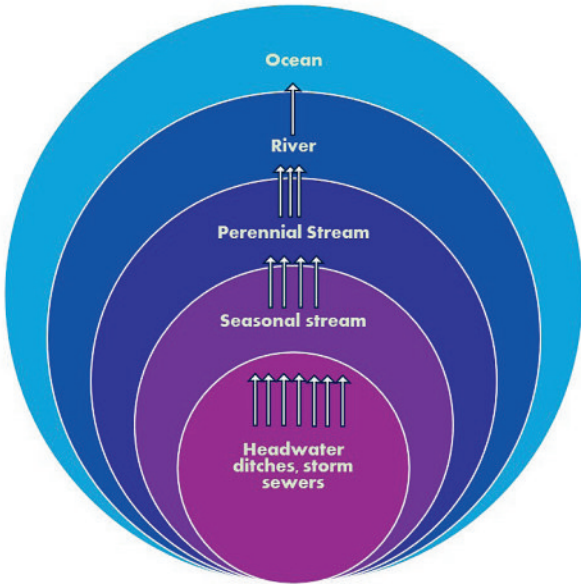


The population density of Bucks County Watersheds, reported by individuals per square mile, displayed to the left.

The Pennypack and Poquessing watersheds have significantly higher population densities because of their large populations living in a smaller area.

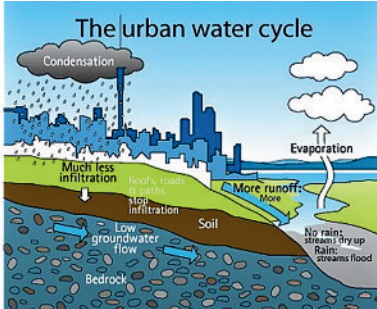
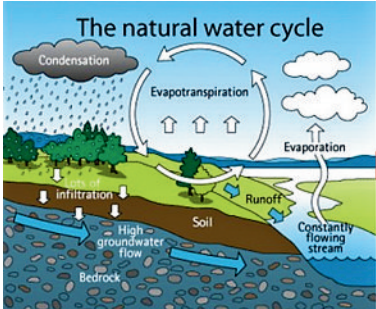
Following closely is the Neshaminy, and its main tributaries, characterized by extensive land development driven by higher population densities.

We all Live Downstream



Wherever you stand, the land below your feet is at once receiving and discharging water. Water flows downhill both at the surface and below ground. Aquifers are connected to groundwater that is connected to surface water that is connected to uplands.

Water storage and quality in the landside portion of the hydrologic cycle reflect conditions upslope. We must be mindful of how our behaviors influence land and water, as our choices affect our downstream neighbors.



Watershed Words Vocabulary for watersheds and stormwater.

Watershed: An area of land that collects and directs precipitation to a specific body of water.

Surface Water: Creeks, streams, springs, rivers, ponds, lakes, and oceans.

Groundwater: Freshwater stored below the surface, a drinking water source and replenishes surface waters during low precipitation.

Groundwater Recharge: Water moves from surface into below ground chambers (aquifers) that store fresh water.

Porosity: The measure of pore size and shape in soil, influencing its ability to retain water, air, and nutrients for plants and microorganisms.

Permeability: The measure of a material's ability to transmit fluids, related to soil porosity.

Good Housekeeping: Being mindful of household chemical used to protect ground and surface water.

Hydrologic (Water) Cycle: Movement of water between the earth's oceans, atmosphere, and land, involving precipitation as rain and snow, drainage in streams and rivers, and return to the atmosphere. The cycle involves evaporation, condensation, and precipitation.

Infiltration: The process by which water enters the ground and moves through soil via pores and cracks.

Evaporation: The transformation of liquid water to vapor entering the atmosphere from surface water, impervious surfaces, or soil.

Transpiration: The process of water movement through a plant and its evaporation from aerial parts, such as leaves, stems and flowers.

Evapotranspiration: The combined process of water movement from Earth to the atmosphere, encompassing both evaporation and transpiration.

Natural Systems: Diverse native plant communities that, through biological processes, purify air and water and provide wildlife habitat.

Retention Basin: A constructed basin where collected water is temporarily stored to control how much is released.

Naturalized Basin: A modified retention basin that slows down water release and is planted with native plants to encourage infiltration.

Detention Basin: A man-made pond that slows down water flow, letting sediment settle to the bottom.

Bioswale: A plant-filled channel with sloping sides that collects water, and guides it to a larger water body, while encouraging infiltration.

Rain Garden: A depression, sometimes amended for drainage, that is planted with native vegetation to collect and hold rainwater, encouraging infiltration.

Riparian Buffer: A strip of land, at least 35 ft wide on each side of a waterway, planted with native trees and shrubs.