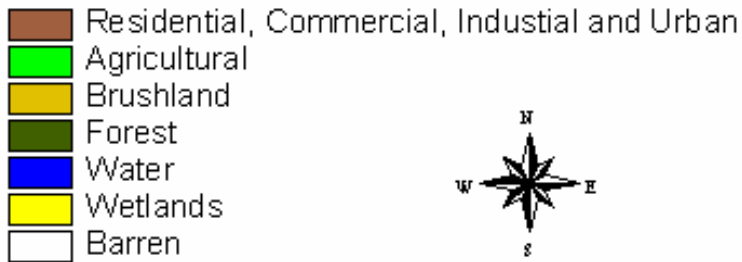
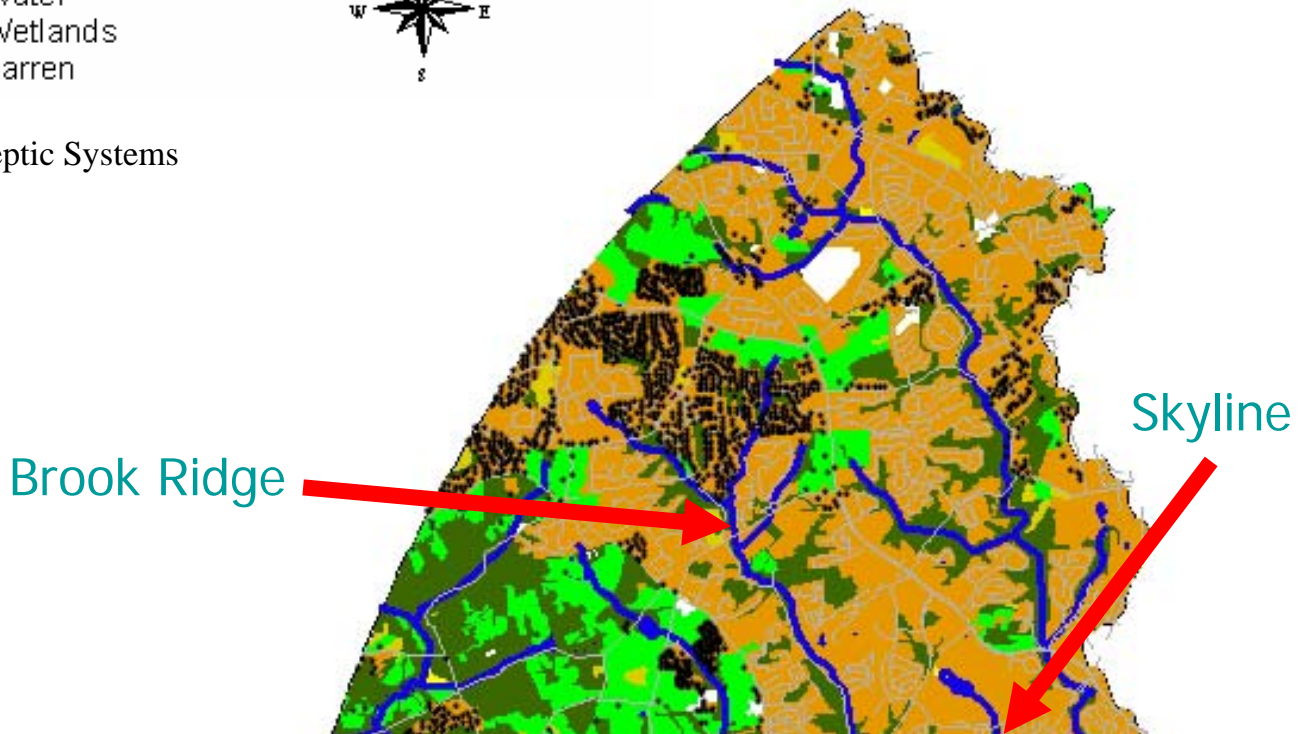


SEPTIC SYSTEMS AS A SOURCE OF BACTERIA, NITROGEN, AND PHOSPHORUS



- Septic Systems



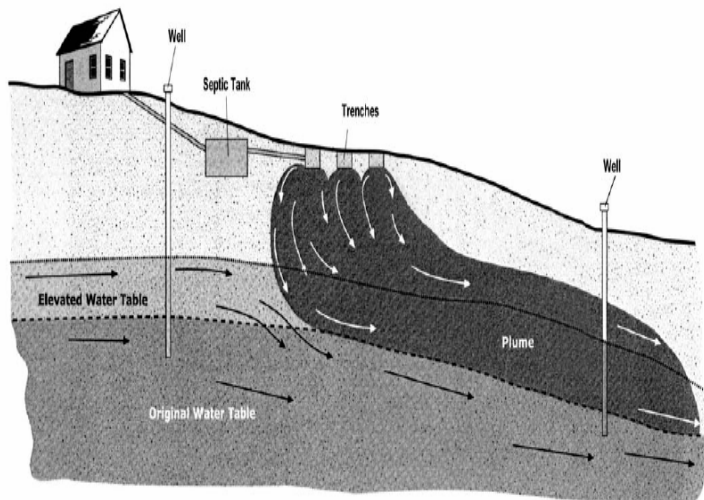
Issue Definition

A Septic system consists of a tank and soil absorption field. The septic tank receives both solids and water from the homes and businesses they treat. The tank allows organic solids to settle and some digestion of those solids by microorganisms will occur. Most of the solids will remain in the tank while the liquid (effluent) will drain into the soil adsorption field. The soil adsorption field consists of a trench or bed cut into the soil that is filled with gravel and a piping system to distribute the effluent throughout the absorption field. The effluent contains pathogens (bacteria) and nutrients (nitrogen and phosphorus), which are harmful to ground and surface waters when in excessive amounts.

Beside the typical septic systems in un-sewered areas, there are a significant number of homes served by seepage pits or cesspools. Seepage pits and cesspools are essentially reverse wells. Effluent drains into a hole in the ground which may be lined or unlined. These systems can easily clog, allowing waste to accumulate on the land surface and run off into streams and ditches. In some cases, effluent may seep through cracks and crevices in the weathered rock deep in the ground, potentially contaminating groundwater aquifers.

Wastewater plants, such as the one in Wilmington, can treat wastewater to a higher degree than individual septic systems. The Wilmington Plant has tertiary treatment, which means the wastewater goes through three different steps before it is discharged into the Brandywine River. The first step at Wilmington is a settling process, which allows the solids (sludge) to be removed. In the second step, the wastewater aerated, which helps reduce the level of pollutants in the effluent. The last step in the process before effluent is discharged is a polishing pond, where the wastewater chlorinated. This entire process removes a significant amount of pollutants (nitrogen, phosphorus, and bacteria). The typical septic system is only secondary level of treatment. With septic systems, most of the treatment occurs in the soil adsorption field, which has a limited capacity to treat effluent.

Septic systems are scattered throughout the Christina River Watershed. There are approximately 5,615 septic systems within the watershed's boundaries. The highest density is in the White Clay Creek watershed; however the Red Clay and Brandywine Creeks are close in numbers (Table1). The latter two watersheds also have the highest septic system failure rates. Between 1997 and 2004, 411 septic systems



Source: Adapted from NSFC, 2000.

were repaired in the Christina Watershed; 43 of those systems were eventually connected to a centralized sewer system.

Effluent Movement through the Soil

Below the Chesapeake and Delaware Canal, surface and groundwater are directly connected; consequently, impacts on one will affect the other. In the summer surface water flow is primarily groundwater seepage into the stream. Nutrients from septic systems will reach the surface water through the groundwater. Nitrate contributions from septic systems take years to be removed from the groundwater. However, in the Christina River Watershed, which is above the Canal, the connection between surface and groundwater is not as direct or obvious. The Christina River Watershed is in the Piedmont Province of Delaware which consists of hard (igneous and metamorphic) rock. As the rock gets close to the surface it becomes highly weathered. These rocks occur on gently rolling hills that have steep slopes and incised streams. When homes are placed on these landscapes in un-sewered areas, their septic systems tend to drain down-slope as the result of the geology and terrain. The down slope drainage often results in seeps or wet areas that can flow into surface water. As a result, New Castle County has restricted septic system placement on steeper slopes.

Water Quality Impacts

A typical household generates 10-15 pounds of nitrogen per year and 1-2 pounds of phosphorus per year. The 5,615 septic systems in the Christina River Watershed will generate between 56,150 to 84,225 pounds of nitrogen, some of which will enter ground and surface waters. Due to the nature of the soils in the Piedmont Province, very little phosphorus would likely reach surface streams or groundwater.

Bacteria Source Tracking (See Fact Sheet) has been used in a Mill Creek study to determine the source of bacteria found in the Creek (Table 2). Over a five day period, eleven surface water samples were collected from a

subdivision called Brookridge which is served by septic systems and is situated adjacent to Mill Creek, and from a subdivision called Skyline which is served by sewer (See map). From the stream samples collected, Brookridge had the highest human source of bacteria and natural sources at both sites accounted for 40 to 57% of the bacteria found in the creeks. The results of this study indicate that effluent from septics within the area reaches surface waters either through surface or groundwater pathways.

Table 1. Number of septic systems in the Piedmont Basin by Watershed as of July 2004.

Watershed	Total number of septic system in the ground	Septic systems repaired from 1997 to July 2004	Percent failure
Piedmont basin exclusive of the Shellpot and Naamans Creeks	5615	411	7.2
Brandywine	614	67	10.9
Red Clay Creek	1479	165	11.2
White Clay Creek	1823	129	7.1
Christina River	1699	50	2.9

Table 2. Bacteria sources, as a percentage, in two small creeks flowing through one subdivision served by septic systems and one subdivision served by a sewer district.

Bacterial Source	Brookridge-Septic Systems	Skyline-Sewered
Horse	0	20
Waterfowl	0	7
Deer	5	2
Raccoon	6	9
Rodent	8	15
Birds	26	24
Dog	8	12
Cat	2	0
Human	22	1
Sewage	5	1
Unknown	18	9

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CHRISTINA WATERSHED

This fact sheet was prepared for citizens and stakeholders by the Delaware Department of Natural Resources and Environmental Control, at the request of the Christina Tributary Action Team.

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