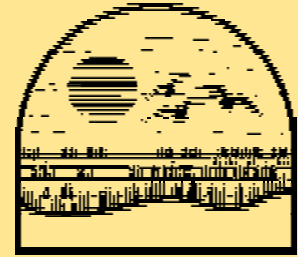


Septic Systems in Coastal North Carolina: Basics for a Healthy Environment

No. 4



Why should you be concerned about septic systems?

When septic systems are designed, constructed, and maintained properly, they are an effective method of treating and disposing of household wastewater in coastal North Carolina. In contrast, poorly planned and maintained systems can fail and contribute to nonpoint source pollution and public health concerns.

In coastal North Carolina, failures may result in nutrient loading of our coastal and estuarine waters, shellfish closures due to fecal coliform inputs, groundwater contamination, and health problems. Even properly functioning systems may release potentially harmful levels of nitrogen and synthetic chemicals into the soil and groundwater if septic systems are misused. It is critical for local governments and citizens to consider the consequences of malfunctioning and misused septic systems and take action to prevent negative impacts.

According to 1990 census data, approximately 60% of homes in the 20 Coastal Area Management Act (CAMA) counties in North Carolina rely upon septic systems for wastewater disposal (see Table 1). This is compared to an average of about 50% statewide, indicating that the communities with the most direct link to our estuarine waters have the greatest potential to negatively impact the environment.

Reliable data regarding the

number of failing systems in these counties is not available. However, it is likely that in addition to homeowners who are aware of problems with their systems and undertake repairs, there are others who do not know how to recognize and repair failures. Some impacts of improperly functioning systems are not visible and may occur without homeowners' knowledge. It is essential that people are educated about the appropriate use and maintenance of septic systems.

When septic systems fail,

untreated wastewater can seep up and puddle on the land surface rather than percolate down through the soil for treatment. This untreated effluent may contain disease-causing organisms and nutrients that contribute to nonpoint source pollution.

Rains can flush the polluted standing water from lawn surfaces to nearby waters. Along much of North Carolina's coast, estuaries are the receiving waters, where shellfish populations can be adversely affected by *(continued on page 4)*

Table 1. Wastewater disposal in the 20 CAMA Coastal Counties

County	Population	Wastewater Disposal (Housing Units)			Sewer Usage (%)	Septic Usage (%)
		Sewer	Septic	Other		
Beaufort	47,173	5,620	15,479	789	25.68	70.72
Bertie	28,700	2,682	8,143	727	23.22	70.49
Brunswick	55,240	6,277	32,929	531	15.80	82.87
Camden	5,904	26	2,296	144	1.05	93.11
Carteret	60,501	11,614	26,141	443	30.40	68.44
Chowan	17,435	2,869	4,592	146	37.72	60.37
Craven	83,808	18,175	14,586	458	54.71	43.91
Currituck	13,736	1,037	6,196	134	14.08	84.10
Dare	26,740	4,173	20,637	50	16.79	83.01
Gates	12,159	94	4,226	492	1.95	87.82
Hertford	22,523	3,639	4,799	432	41.03	54.10
Hyde	12,787	1,144	3,650	352	22.23	70.93
New Hanover	120,284	40,657	16,075	344	71.23	28.16
Onslow	159,202	28,182	24,071	517	53.41	45.61
Pamlico	14,099	702	6,200	200	9.88	87.30
Pasquotank	31,298	6,574	5,540	184	53.46	45.05
Pender	28,855	2,802	12,200	435	18.15	79.03
Perquimans	10,447	1,109	3,691	172	22.30	74.24
Tyrrell	3,856	467	4,391	173	9.28	87.28
Washington	18,050	2,750	2,213	187	53.40	42.97
Total	772,797	140,593	218,055	6,910	38.46	59.65

Septic System Basics

Septic systems are onsite wastewater treatment and disposal systems. When installed and maintained properly, septic systems provide a safe and effective method of treating household wastewater. They are often installed in rural and suburban areas of coastal North Carolina where public sewage disposal systems are not available.

There are four main components to all septic systems: source, septic tank, drainfield, and soil beneath the drainfield. Wastewater is generated through the use of a home's kitchen, bathroom, and laundry facilities. This liquid, particularly "blackwater" from toilets, may contain pathogenic organisms, solids, organic matter, and nutrients including nitrogen and phosphorus. Wastewater from throughout the home flows to a pipe that enters the second main component of the septic system, the holding tank, commonly referred to as the septic tank.

In the septic tank, substances of different densities separate and form layers. Solids settle out to the bottom, creating a sludge layer. Grease and fats move to the top of the liquid and form a scum layer. Gases rise to the uppermost parts of the tank.

Septic tanks built since the mid-1980's have a partial wall dividing the two chambers of the tank, which slows down the flow of liquid through the tank and allows more solids to settle out of the wastewater. Another improvement to septic tanks is an effluent filter installed at the exit of the tank. Required on all tanks installed from January 1999 to the present, this filter catches fine particles suspended in the liquid effluent so that they do not exit the tank and clog the drainfield. After flowing

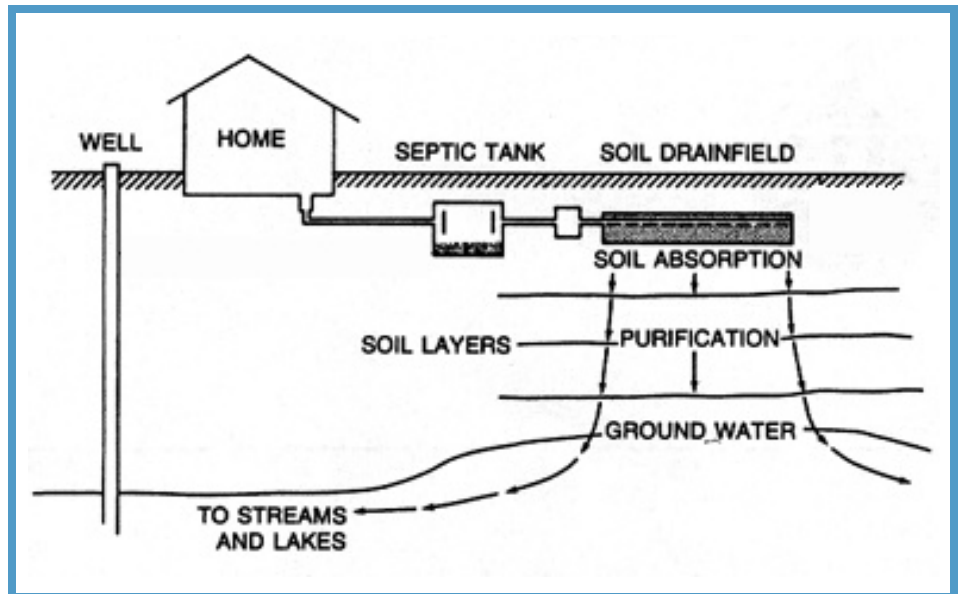


Figure 1. Components of a conventional septic system

(Adapted from "SoilFacts: Septic Systems and Their Maintenance" by Hoover, 1997)

through the effluent filter, clarified wastewater is distributed through pipes to the drainfield, where a majority of biological treatment takes place. The effluent from the tank is sent to a central distribution box, or D-box, which in turn distributes wastewater to a number of pipes under the ground surface in the drainfield. The liquid slowly drains out of the pipes and percolates through the soil beneath the drainfield, the final component of the septic system.

The characteristics of the soil beneath the drainfield are extremely important. Oxygen must be present and water absent so that pathogenic organisms, which are generally anaerobic, will die off or be consumed by aerobic bacteria. With appropriate soil conditions beneath the drainfield, a majority of disease-causing organisms are effectively removed.

In addition to the biological processes removing pathogens,

chemical reactions reduce the concentration of nutrients in the soil. Through a process called nitrification, ammonium, an ion harmful to humans, is converted to nitrate by oxygen-consuming bacteria. This conversion, like the biological treatment, occurs at a maximum rate where there is sufficient oxygen in soil pore spaces.

The four main components described above are common to all septic systems. Designs vary a great deal, and each septic system is engineered for specific site characteristics. Soil conditions, topography, and lot size determine what adaptations need to be made for each system. In the coastal plain of North Carolina, soil problems include high water tables, clayey soils, and hardpan. Combined with flat topography and small lot sizes, many adaptations need to be made.

Septic systems that are designed according to site conditions and installed and maintained properly are safe and effective for wastewater disposal in coastal North Carolina. 🌱

What can homeowners do?

Septic system failures are a concern for the community as a whole; however, it is the actions of individual homeowners that affect septic system health. Educating homeowners about appropriate septic system practices is essential to overall environmental and public health in coastal North Carolina.

- **Inspect and pump septic tanks regularly.**

All septic tanks must be pumped periodically by a trained professional. A good guideline for septic tanks in coastal North Carolina is to pump tanks every 3-5 years. After a few regular inspections, this time can be adjusted to meet the needs of a particular system.

Failing to pump often enough can result in solids or scum overflowing out to the drainfield. This can lead to the clogging of pore spaces in the soil. When this type of problem is discovered, it is often too late to do anything to repair the existing system, and a replacement system must be installed.

It is also important for tanks to be inspected for structural integrity. Tanks that exceed their design life may leak effluent to the soils beneath them, causing contamination of soils and groundwater resources.

- **Conserve water in the home.**

Septic systems have a limited capacity to treat wastewater. In general, the less water used, the lower the chance of septic failure.

When less water is used in the home, wastewater is able to remain in the septic tank longer, allowing more solids and scum to separate out of the effluent. This also gives the drainfield more time to distribute and treat the effluent, and it reduces the risk of the soil becoming waterlogged and anaerobic.

Water conservation is particularly important during and after rain events, when the permeability of the soils is decreased due to greater water absorption from the surface.

- **Protect the drainfield.**

Preserving the integrity of the drainfield is critical. Parking on, driving over, or building on top of drainfields leads to soil compaction. This reduction in space between soil particles limits the ability of the system to treat wastewater. Trees should be avoided on the drainfield; however, grassy vegetation must be maintained to absorb nutrients. Water running off of paved surfaces and gutters should be diverted away from the drainfield. Landscaping can be used to keep excess water from waterlogging the soil.

- **Do not add septic tank cleaners, additives, or other chemicals.**

Substances that claim to eliminate the need to clean septic tanks push solids out into the drainfield, clogging pores in the soil and causing severe damage to septic systems. These substances may also contain carcinogens that can infiltrate groundwater supplies. Additives, including yeast, should also be avoided since they are not necessary and may cause solids to rise rather than settle out into the sludge layer.

Septic systems can handle small inputs of chemicals from cleaning products; however, heavy chemical inputs can cause nonpoint source pollution and kill the bacteria that work to break down biological wastes. Organic chemicals can also be harmful to septic systems. They flow untreated through the tank and the soil, leading to groundwater contamination.

- **Reduce the amount of solids added to wastewater.**

Decreasing the input of solids to septic systems reduces the depth of the sludge layer and can protect drainfields from overflows of solids.

Garbage disposals are the biggest contributor to this problem. They have the potential to double the solid load to septic tanks. Homeowners should use toilet tissue that easily breaks down and settles in water. Individuals should avoid using toilets and sinks for the disposal of greases and fats, cigarettes, sanitary napkins and applicators, coffee grounds, tissues, and other household wastes. 🌱

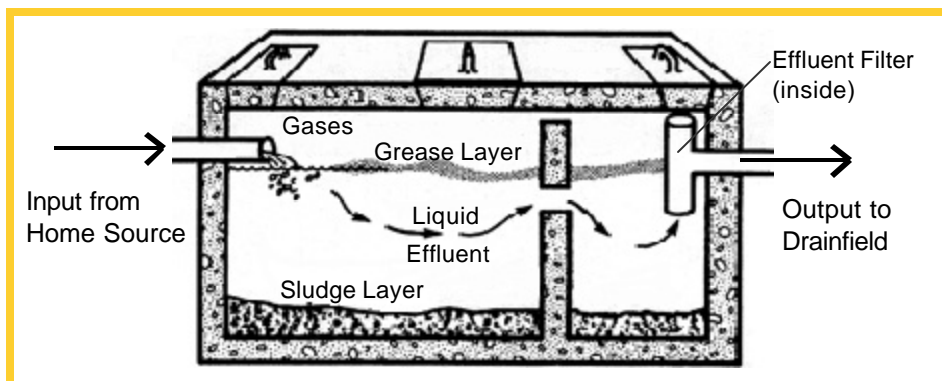


Figure 2. Generalized cross-section of a household septic tank

(Adapted from "SoilFacts: Septic Systems and Their Maintenance" by Hoover, 1997)

(continued from page 1)

pathogenic inputs from nonpoint sources. When fecal coliform and other pathogens are washed into estuaries, filter-feeding shellfish take these bacteria out of the water and concentrate them in their bodies. This makes the animals unsafe for human consumption and leads to shellfish bed closures.

Nutrient waste, particularly nitrogen, in the polluted stormwater may lead to additional problems in the estuaries. Excessive nitrogen inputs can cause algal blooms, which in turn demand high amounts of oxygen. As algae take dissolved oxygen out of the water, the amount of oxygen left for fish and other species decreases. This can result in fish kills and other negative impacts to estuarine organisms.

Although a properly used and maintained septic system should remove adequate amounts of contaminants, groundwater can be negatively affected if systems are misused or fail. Since failures that occur below the land surface may not be visible, problems may go undetected for extended periods of time. Contaminants can enter groundwater supplies, and long-term nonpoint source pollution may occur. The contaminated groundwater, over time and considerable distances, can be drawn up through wells or come in contact with surface waters and cause adverse effects.



Red Flags: Avoid Septic System Failure



There are many things to watch for that can indicate septic system problems or failure. Keep in mind, however, that there can also be problems beneath the land surface that may not be visible. Proper maintenance and use of septic systems are essential to preventing problems.

Signs of Septic System Failure:

- * **Wet spots or standing water** - Areas that remain wet after rain events or appear without precipitation should be investigated, since effluent can seep up from a failing system and puddle on the ground surface.
- * **Odd growth patterns** - Green lines on the drainfield that follow the path of the pipes are normal; however, green blobs not in line with pipes, random patches of lush growth, and bulls-eye patterns (dead areas surrounded by green growth) all indicate problems in the drainfield.
- * **Slow drains or backups** - If wastewater is slow to drain and the plumbing is working properly, there may be a problem with backup in the septic tank.
- * **Septic odor** - Easy to detect, odor is one of the best problem indicators.

Proper Maintenance to Prevent Problems:

- * **Leaky fixtures** - One of the most common causes of septic failure, leaking fixtures can cause hydraulic overload. Toilets are particularly problematic and should be monitored for leaks.
- * **Gutters, downspouts or paved surfaces pointing or draining toward the drainfield** - Excess water on the drainfield saturates the soil and prevents wastewater from being disposed of and treated properly. All paved surfaces and water-diversion devices should point water away from the drainfield.
- * **Garbage disposal** - Food grinders can double the volume of solids in the wastewater. This causes septic tanks to fill faster and requires them to be pumped much more frequently. Disposals should not be used with septic systems.

Preventing problems with septic systems in your community depends on the actions of individual homeowners. To avoid these problems in your community, it is important to educate homeowners

about the responsibilities associated with septic system ownership and to encourage them to take the steps outlined in this document. This will benefit the homeowners, your community, and the environment. 🌱

Information Clearinghouse

A website with additional information about septic system health and other coastal environmental topics is available through the North Carolina Coastal Training Program at www.ncnerr.org

Figures in this publication are adapted from:

Hoover, M. T. 1997. "SoilFacts: Septic Systems and their Maintenance." North Carolina Cooperative Extension Service. <http://ces.soil.ncsu.edu/soilscience/publications/Soilfacts/AG-439-13/> Visited 11/9/01.

This document was funded in part by the National Oceanic and Atmospheric Administration and the North Carolina Division of Coastal Management.



For More Information, Contact:
NCNERR Education Office
135 Duke Marine Lab Road
Beaufort, NC 28516
(252) 728-2170
www.NCcoastalreserve.net

