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TENNESSEE

FARM•A•SYST

Assessing Your Farmstead Site

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The goal of this *Farm•A•Syst* factsheet is to help you protect and improve the groundwater that supplies your drinking water as well as the ponds, lakes, rivers, and streams that make Tennessee beautiful.

The following questions are designed to help you pinpoint potential problem areas on your farmstead. These problem areas may contribute to the contamination of your drinking water if they are not managed properly.

If your answer to any of these questions is *YES*, or if you don't know the answer, you may have a high-risk situation in your home or on your farmstead. Refer to the fact section with the same number as that question (under the heading, "What you should know about . . .") for more information.

Don't be alarmed if you answer *YES* to many or even all of these questions. That does not automatically mean you have a water-quality problem. It may, however, tell you that change is needed to avoid potential problems. In the same way, answering *NO* to every question does not mean you are *not* at risk.

YES	NO	
❑	❑	1. Does the topsoil on your farmstead contain a lot of sand or gravel?
❑	❑	2. Does the subsoil on your farmstead contain a lot of sand or gravel?
❑	❑	3. Is your soil less than three feet deep, or do you see numerous bedrock outcrops on your farmstead?
❑	❑	4. Is the soil on your farmstead poorly drained?
❑	❑	5. Do the soils on your farm lack **fragipans** (dense brittle hardpans), high clay layers, or other drainage-restricting layers that protect groundwater?
❑	❑	6. Is the depth to groundwater less than 20 feet?
❑	❑	7. Is your farmstead underlain by limestone or chert (East or Middle Tennessee) or coastal-plain sand and gravel (West Tennessee)?
❑	❑	8. Does runoff from your farmstead drain to a **sinkhole** (a depression that drains directly to groundwater through holes in underlying limestone bedrock)?

Why should you care?

Groundwater is the underground water that supplies wells and springs and recharges surface water bodies. It is the source of drinking water for many Tennesseans. Up to 20 million gallons of groundwater may be stored under the typical farmstead—stored within 100 feet below fertilizer and pesticide storage areas, fuel tanks, livestock pens, and septic systems, all potentially major sources of pollution. The management decisions you make on your farmstead can significantly affect the quality of your drinking water and your family's health. These decisions can also affect your potential legal liability and the value of your property.

Surface water includes bodies such as ponds, lakes, rivers, and streams. Besides their aesthetic and recreational value, they are often an important source of drinking water for livestock.

How farmstead practices affect surface and groundwater depends on the soil, geology, and groundwater depth of your farmstead site. Evaluating the soils and geologic characteristics of your farmstead is an important step in protecting the water you drink.

The type of soil you have is the most critical factor in determining whether a contaminant breaks down harmlessly or **leaches** (moves *with water* down through the soil) into groundwater. This is because most of the chemical breakdown of contaminants occurs in the soil. Groundwater contamination is most likely in areas where contaminants can move quickly through the soil. By assessing the soils on your site, you can estimate potential risks for groundwater pollution.

This site assessment will help you identify practices that can protect your water resources. Protecting water from pollution is much easier than trying to correct pollution once it occurs.

Farm•A•Syst is only for your own use and benefit. It is a voluntary program intended to provide general information about protecting and improving water quality. Information from a *Farm•A•Syst* assessment will not be collected by any outside agency and should remain in your private records.

What you should know about . . .

1. Topsoil texture

Sandy soils drain rapidly through large pores and have few clay particles to absorb contaminants. Large amounts of rainfall can drain quickly through these soils and cause dissolved contaminants to move rapidly through the soil and into groundwater. Clay soils, on the other hand, are made up of extremely small particles that slow the movement of water and dissolved contaminants through the soil. Many contaminants also stick tightly to organic matter or clay surfaces.

While held to soil particles, contaminants are broken down by bacteria, other organisms, and chemicals in the soil. Most chemical and biological breakdown takes place in the surface layers, where the soil tends to be warm, moist, well-aerated, and high in **organic** matter (living matter, or matter that contains carbon compounds). Organic matter attracts and holds many contaminants. Soils high in organic matter provide an excellent environment for the chemical and biological breakdown of potential pollutants.

The soil's natural purification capability is limited. Under certain circumstances, such as heavy rainfall or chemical spills, the soil may be filled beyond its capacity, allowing the chemical to move through the soil relatively quickly. In such cases, the area's subsurface geologic material and the distance the contaminant must travel to groundwater are important factors in determining whether pollution actually reaches groundwater.

2. Subsoil texture

If the subsoil on your farm contains a lot of coarse fragments like sands or gravels, contaminants that are not broken down in the topsoil will probably move into groundwater. Coarse-textured subsoils on your site limit its potential to protect groundwater from spills.

Water moves much more slowly through clay layers than through sandy layers, which allows a longer period for the biological treatment of contaminants. Many pesticides, for example, are made up of charged particles that will attach to clay and organic matter, allowing time for biological breakdown.

In East and Middle Tennessee, clay subsoils with **chert** (light-colored gravel) are common. As long as the chert content is one-third of the soil or less, leaching is not rapid and the potential for groundwater contamination is low. If the soil is loamy or sandy with chert, the risk increases.

3. Soil depth

Shallow soils limit the treatment capacity of your soil. If the soil on your farm is shallow and a spill occurs, there is a significant risk of groundwater contamination.

The bedrock depth on your site is an important indicator of the groundwater pollution risk you face. If you can see bedrock at the surface, or if there is only a thin layer of soil above bedrock, the chances are greater that contamination will occur than if the soil is deep. Water will percolate down through the soil, reach the bedrock, and flow on top of it until it becomes surface water or until there is a crack where the water can move downward to groundwater. If bedrock is close to the soil surface, the ability of the soil to retain and break down any spilled contaminants is minimal. Therefore, sites with shallow soils are poorly suited for septic tank drainfields or animal waste storage.

One easy way to assess the depth to bedrock in your area is to look at roadcuts near your farmstead. In areas with shallow bedrock, blasting is often necessary during road construction or excavation.

4. Soil drainage class

Typically, about half the volume of a soil is filled with solids, and the other half is **pore space** (voids between soil particles). This pore space is filled with either water or air.

In a poorly drained soil, most of the pore space is filled with water much of the time. The void space in a well-drained soil, on the other hand, is filled with water and air. Following a rainfall, the large pores of a well-drained soil drain quickly. As the water leaves the pores, air enters, creating an **aerobic**, or oxygen-containing, environment. In an aerobic environment, soil organisms break down contaminants quickly; without oxygen, the process is much slower or does not occur at all.

A farmstead that is situated low in the landscape—at the bottom of hills or in a floodplain—usually has a higher risk of contaminating groundwater. Soils lower on the landscape are wetter than those higher up, and groundwater is closer to the surface. The closer groundwater is to the surface of the soil, the less chance there is for aerobic breakdown to occur before contaminants reach groundwater.

5. Fragipans or limiting layers

Under some soils, there is a layer of soil that restricts the movement of roots and water. In Tennessee, root-limiting layers are either fragipans or layers with high clay contents.

Fragipans are common in Highland Rim and West Tennessee soils formed from loess. Fragipans limit the depth that roots can penetrate and slow water movement significantly. Other soils may have a layer that is high in clay, which also slows water movement. Water moves slowly through the small pores typical of clay soils.

Although fragipans and other root-limiting layers may decrease soil productivity, these features common in some Tennessee soils protect groundwater by slowing the movement of contaminants.

6. Groundwater depth

The closer groundwater is to the soil surface, the smaller the chance that pollutants will be broken down by organisms in the soil. Spills are more likely to contaminate groundwater on a site with a shallow water table.

7. Bedrock type

Bedrock underlies all land at some depth below the surface. Some types of bedrock are very stable and resist breakdown. Other types of bedrock, like limestone, slowly dissolve as groundwater moves through cracks in the bedrock. Areas with limestone bedrock are often referred to as **karst areas**.

In karst areas, sinkholes are formed when limestone bedrock dissolves and cannot support the weight of the overlying soil and rock. These depressions are unique because there are no streams or similar surface outlets for water. Water at the bottom of the sinkhole drains directly to groundwater. In some areas, a very large sinkhole may even have a small stream feeding directly into it. Streams that empty into sinkholes are called **disappearing streams**. Because sinkholes and disappearing streams drain directly to groundwater, it is important that trash never be dumped in these areas.

A farmstead located in areas underlain by limestone is at risk of polluting groundwater if good management practices are not routinely followed.

8. Surface water runoff

Surface water runoff from a farmstead always contains some contaminants. If your farmstead is located in an area where the surface water drains either to a sinkhole or to a creek that drains into a sinkhole, there is a serious risk of polluting groundwater.

If you answered *YES* to any of the questions on the first page, the soils and geology of your farmstead may create a high-risk environment that promotes the contamination of surface and groundwater. Keep this in mind as you complete the other *Farm•A•Syst* factsheets and make decisions concerning activities and conditions on your farmstead.

If you want more information . . .

Contact:

- Your county Extension office

- Your local Soil Conservation District office (soils information, county soil survey)

Read:

- Soil survey for your county

- *Soil Erosion and Water Quality*. PB 1424.

This publication is available from your University of Tennessee Agricultural Extension Service county office.

Download:

These sites on the World Wide Web (WWW) are good places to start when browsing the Internet for information about water quality:

- http://funnelweb.utcc.utk.edu/~utext
  (University of Tennessee Agricultural Extension Service)

- http://www.epa.gov
  (U.S. Environmental Protection Agency)

- http://www.usda.gov
  (U.S. Department of Agriculture)

- http://h2o.usgs.gov
  (U.S. Geological Survey)

- http://wwwdtnnsh.er.usgs.gov
  (Tennessee division of USGS)

- http://hermes.ecn.purdue.edu:8001/server/water/water.html
  (National Extension Water Quality Database Website, Purdue University)

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