



Extension FactSheet

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Soil Evaluation for Home Septic Systems

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Soil is an excellent medium for treating wastewater, and it is the most important part of a septic system. A detailed assessment of a proposed site and its soil resources is essential for design of a wastewater treatment system that will treat wastewater for decades.

Role of Soil in Effluent Renovation

Wastewater delivered to soil from a septic tank contains a number of contaminants that need to be removed before the wastewater joins with surface or groundwater. Wastewater typically contains organic matter, soluble nutrients (especially nitrogen in the form of ammonia, and phosphorus) and a variety of microorganisms. These contaminants pose risks to human and environmental health. The role of soil is to remove contaminants by natural physical, chemical and biological processes that are active in healthy soil.

Required Soil Conditions

Since many of the natural processes required to treat wastewater depend on adequate aeration, unsaturated soil is essential for wastewater renovation. Hence the soil must be sufficiently permeable for water to move through and beyond the soil profile. Adequate depth of soil ensures the wastewater is in contact with soil material for a sufficient period of time for treatment to take place. Information on the depth of soil and the ability of the soil to accept and transmit water (permeability) provides the basis for assessment of suitability of a soil for wastewater treatment. Together with information on the amount of wastewater

produced, soil depth and permeability are used to design the form and size of the soil adsorption system.

Limiting Layers

The depth of permeable, unsaturated soil is limited in Ohio where the ability of the soil or geologic layers to transmit water is too low or excessive, or where saturated soil conditions are present in the soil for a significant period, due to the presence of the water table. These conditions are termed “limiting layers” and include the following:

- Zones of seasonal, perched or long-term saturation (water table)
- Hard bedrock with few connected pores or fractures
- Dense glacial till
- Dense pans or cemented layers, including fragipans
- Coarse sand or gravel layers
- Fractured bedrock

Soil Depth

In Ohio a minimum of 4 feet of unsaturated soil present beneath the wastewater distribution system is needed to treat wastewater before contact with a limiting layer. Only about 6% of the area of Ohio has soils that meet this criterion. Where at least 2 feet of suitable soil material occurs before a limiting layer, a mound system may be designed to adequately treat wastewater. Irrigation of treated effluent can be considered where at least 1 foot of suitable soil is available.

Evaluation of Permeability

The ability of soil to transmit water has traditionally been described as its permeability. Permeability is often estimated from other soil properties including texture, structure, consistence and color.

Hydraulic conductivity is a quantitative parameter (a number) that indicates water transmission. Hydraulic conductivity varies with the soil moisture content, but is frequently measured by first saturating the soil. It is important that measurements be made on the distinct layers in the soil, called horizons.

Percolation tests have traditionally been used to assess the rate of water movement in the soil, and they can supplement soil structural indicators in providing an estimate of soil permeability at a site.

Process of Site Assessment

Soil and site assessment involves the following series of steps:

- Studying local soil information from the county soil survey
- Conducting a visual assessment of the site to identify landscape features
- Probing the soil to delineate soil resources on the lot
- Excavating soil borings and pits to prepare profile descriptions of major soils on the lot
- Matching the soil resource to appropriate treatment technology through a suitability assessment

Soil surveys are available for all Ohio counties. These surveys provide an excellent source of information for a preliminary assessment of soil conditions likely to be found at a site. While useful for indicating general conditions expected in an area, and the relationship of soil series in soil landscapes, soil survey maps cannot capture all the local variability of soil conditions.

Site-specific observations made by qualified, experienced practitioners are necessary for understanding the fine-scale variability of soil properties and local conditions at a site.

Dozens of soil probes refine the visual assessment to delineate the soil resources on the lot so that possible locations of a wastewater treatment system can be proposed.

A number of auger borings or other exposures, such as soil pits, are needed to examine the soil variability on the site. A soil pit is the best form of exposure for description and evaluation of the soil that is proposed as a treatment medium. When digging or boring soils, care should always be exercised to avoid contact with underground service lines. Soil should be exposed and described to a depth of at least 4 feet below the proposed wastewater distribution system.

Soil Profile

Physical and chemical properties of the soil materials related to water and air movement and storage, root growth, and biological activity need to be investigated to gain an understanding of the quality of the available soil materials for wastewater treatment. In particular, the location, nature and depth of layers of soil, and the depth and nature of the limiting conditions must be measured and described.

In lieu of actual measurements of water movement and storage in the soil over an extended period, soil characteristics are used to indicate drainage conditions within the profile. Soil color and the presence of mottles of contrasting color, called redoximorphic features, indicate the soil history of formation and mineralogy, as well as drainage conditions and aeration.

Soil Evaluation Assistance

Trained professionals can conduct soil evaluations. The Association of Ohio Pedologists publishes a list of consulting soil scientists. It is posted as a pdf file at the following web address: <http://www.ohiopedologist.org/Information/ConsultantBrochure.pdf>

OSU Extension offers training in site and soil evaluation for septic system designers. A list of people who have completed the design school is posted at the following web site: www.ag.ohio-state.edu/~setll

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