APPENDIX D

WATER MOVEMENT THROUGH SOILS

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A basic understanding of water movement through soils is needed to appreciate the necessity of determining a soil's permeability and its relationship to the design of a disposal field.

Water Movement Water moves through the voids between soil particles as a result of gravity. The rate of movement is governed by the size and shape of the voids through which water is pulled by gravity.

The basic factors which govern the quantity of water that can move through the soil on a lot are as follows:

> **Permeability** The rate at which water will move through a soil. Soil permeability is determined by the size, continuity and tortuosity of the pores. Soils such as sand have large continuous pores which conduct more water than a clay which have small disconnected pores.
>
> **Porosity** The percentage of a soil that is void of material. Porosity decreases with an increase of compaction, and/or grain size distribution. Particle shape also influences porosity. A soils porosity does not directly convert to a permeability value.
>
> **Hygroscopic Water** The water which clings to a soil particle due to surface tension. The finer the grain size the greater the surface area is. As the surface area increases, more of the water in the pores attach to the soil particles through surface tension.
>
> **Hydraulic Gradient** The surface slope of a water table. For disposal fields it is usually assumed that the hydraulic gradient parallels the ground surface. A sharp change in grade (ravine) within 50 feet of a system will change this.
>
> **Darcy's Law** can be used to calculate the theoretical volume of water that will move through a soil under saturated soil conditions.

$Q = V * A$ — Q = Volume of water
V = Velocity
A = Cross Sectional Area

$V = k * i$

K = Permeability
I = Hydraulic Gradient

Soil Saturation

Water Flow Water flows through saturated soils at a faster rate than it does through an unsaturated soil. Sewage treatment is most effective when working in unsaturated conditions.

Zone of Saturation The zone where all the soil voids are filled with water.

Hydrostatic Water Level The level of water surface in a hole dug into a saturated soil.

Capillary Fringe A layer of saturated soil above the zone of saturation. Water is drawn up by capillary action. The finer the soils the higher this zone will be. The soil is saturated above the water table.

Unsaturated Soil In an unsaturated soil the larger voids are filled with air and water moves through the smaller voids. With a sewage effluent the removal of pathogens is increased because they become trapped.

Boundary Layer The boundary between layers of soil with different hydraulic conductivities interferes with water movement. The depth to which the water ponds is dependent on the difference in conductivity.

Infiltrative Surface The interface between the disposal field and the natural soil, where the effluent must enter the soil. The pores in the soil must be open for the sewage to pass through. If the pores become blocked during construction, the bed will not be able to operate at its full potential. The pores will also become partially blocked by the clogging mat. Steps can be taken to avoid or minimize damage to this vital component. Contractors should not work when the soil is saturated, the area should be hand raked, sand and gravel should be placed carefully.