

## **APPENDIX J: CYLINDER INFILTRMETER TEST METHOD**

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### **MARYLAND DEPARTMENT OF THE ENVIRONMENT CYLINDER INFILTRMETER PERCOLATION TEST PROCEDURE**

#### **DESCRIPTION**

A single ring infiltrometer, falling head percolation test measures the time required for a unit depth of clear water to infiltrate into the soil from a standard size infiltrometer. Tests should be conducted only after soil descriptions, limiting zones and water level data indicate that required treatment zones are present and that the soils may be suitable. Representative tests are conducted in the least permeable horizon in the upper 24 inches of the soil and can be used to rank the relative permeabilities of different soil horizons.

The results of the infiltrometer tests are interpreted empirically to confirm soil suitability and select appropriate wastewater hydraulic loading rates for system design. The test, as currently conducted, does not provide an accurate measure of saturated vertical hydraulic conductivity and the results can be highly variable within a site.

#### **MATERIALS AND EQUIPMENT**

- 1) 12 inch diameter cylinder infiltrometer
- 2) Sledge hammer
- 3) Posthole digger and round point shovel
- 4) Pointing trowel
- 5) Minimum 5 gallons of clear water per test
- 6) Diffuser or coarse sand
- 7) Tape measure or folding rule
- 8) Watch
- 9) Data forms

#### **LOCATION AND DEPTH OF TESTS**

Information from the soil profile descriptions are used to select representative locations and depths for testing. Tests should be performed in the least permeable horizon in the upper 24 inches. If a plow pan exists at depths greater than 12 inches below the surface, representative tests should be conducted in this layer and any least permeable horizons in the upper 24 inches.

## NUMBER OF TESTS

A minimum of three tests should be conducted within the proposed sewage disposal area. If soil textures, structure and consistence are relatively uniform within the soil horizons or layers selected for testing, the tests can be spaced evenly throughout the area. If soil textures, structure or consistence vary or indicate restrictions to water flow, at least two tests should be conducted in each layer to help assess variability and select representative rates.

## PREPARATION OF THE TEST HOLE

Dig a hole at least 14 to 18 inches in diameter to the depth of the limiting or most restrictive horizon within the upper 24 inches of the soil profile. If working with a backhoe, the backhoe excavation should stop at least 6 to 12 inches above the test depth. If the test pit meets OSHA and MOSH regulations then a test can be conducted by entering the test pit and excavating the remaining soil with a shovel. Carefully drive the cylinder at least 5 inches into the soil. The cylinder should be kept as plumb as possible. Especially avoid rocking the cylinder as it is driven. After having driven the cylinder, press the soil against the inside wall of the cylinder casing. Remove any smeared or compacted surface and expose as much of the natural soil structure as possible. Cover the soil surface with an inch of coarse sand or pea gravel or a diffuser shield. Slowly, fill the cylinder with clear water to at least 6 inches above the soil surface within the infiltrometer. Avoid scouring the bottom and stirring up the fines while adding the water. Remove the diffuser and carefully adjust the water level as necessary to 6 inches.

## MEASUREMENTS

Immediately record the depth to the water surface from the top of the cylinder at the seam. A steel tape can slowly be lowered along the seam until it just breaks the surface of the water. This should be repeated to assure an accurate measurement. A hook gage can be used as an alternative to the tape method. Measurements should be read to the nearest 1/16th of an inch. Measurements are taken at regular intervals. Intervals can be 10, 15, 20, 30 and 60 minutes but should be selected so that the water level does not fall more than 1 inch during any interval. If after any interval the water level in the infiltrometer drops to a depth of less than five inches above the soil surface, the level should be adjusted back up to six inches. Highly permeable soils will require a shorter interval. As the test progresses the time interval may be adjusted. The goal is a measurement that is an approximation of vertical permeability under saturated or near saturated conditions. For the purposes of this test a constant rate is considered acceptable. The percolation rate is calculated by dividing the time interval in minutes by the water level drop in inches. This calculation yields a percolation rate in units of minutes per inch (MPI). The test is run until the computed percolation rates for successive intervals vary by less than 10 percent. Measurements must be made over a minimum of three intervals. Before measuring the last interval, the water level in the infiltrometer should be adjusted to six inches. The last interval is used to calculate the percolation rate. Two examples of single ring infiltrometer test results follow.

**EXAMPLE**

| TEST NO.                                            | DEPTH FROM<br>TOP OF<br>CYLINDER<br>(in.) | ELAPSED<br>TIME (min.) | MEASURED<br>DROP (in.) | RATE<br>(min./in.) | %<br>DIFFERENCE<br>IN RATE |
|-----------------------------------------------------|-------------------------------------------|------------------------|------------------------|--------------------|----------------------------|
| 1                                                   | 2 8/16                                    | N/A                    | N/A                    | N/A                | N/A                        |
|                                                     | 13                                        | 10                     | 0.500                  | 20                 | N/A                        |
|                                                     | 3 6/16                                    | 10                     | 0.375                  | 27                 | 35%                        |
|                                                     | 2 8/16                                    | N/A                    | N/A                    | N/A                | N/A-Repour                 |
|                                                     | 12 14/16                                  | 10                     | 0.375                  | 27                 | 0%                         |
| <i>Percolation Rate = 27 minutes per inch (MPI)</i> |                                           |                        |                        |                    |                            |
| 2                                                   | 2 3/16                                    | N/A                    | N/A                    | N/A                | N/A                        |
|                                                     | 12 13/16                                  | 20                     | 0.625                  | 32                 | N/A                        |
|                                                     | 3 5/16                                    | 20                     | 0.500                  | 40                 | 25%                        |
|                                                     | 2 3/16                                    | N/A                    | N/A                    | N/A                | N/A -Repour                |
|                                                     | 2 9/16                                    | 20                     | 0.375                  | 53                 | 32%                        |
|                                                     | 12 14/16                                  | 20                     | 0.312                  | 64                 | 21%                        |
|                                                     | 3 2/16                                    | 20                     | 0.250                  | 80                 | 25%                        |
|                                                     | 2 3/16                                    | N/A                    | N/A                    | N/A                | N/A-Repour                 |
|                                                     | 2 9/16                                    | 30                     | 0.375                  | 80                 | 0%                         |
| <i>Percolation Rate = 80 minutes per inch (MPI)</i> |                                           |                        |                        |                    |                            |

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