

Table 1. Profile description for Subsystem 1 installed in Blairton silt loam located in Frederick Co., VA.

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Ap (0-23 cm) dark brown (10YR 4/3) silt loam; moderate fine and medium granular structure; friable, nonsticky, and non plastic.

Bt1 (23-58 cm) yellowish brown (10YR 5/6) silty clay; few, fine light olive gray mottles; weak medium subangular blocky structure; friable, sticky, and non-plastic.

Bt2 (58-84 cm) strong brown (7.5YR 5/6) clay; common medium distinct light olive gray (5YR 6/2) mottles; moderate fine subangular blocky structure; friable; slightly sticky; slightly plastic.

Bt3 (84-107 cm) yellowish red (5YR 4/6) and light olive gray (5YR 6/2) clay; moderate medium subangular blocky structure; friable; slightly sticky; slightly plastic; coarse fragments present.

C (107-140 cm) yellowish red (5YR 4/6) and light olive gray (5YR 6/2) silty clay; weak thin platy structure; firm; sticky; plastic; many shale fragments.

Cr (140 cm) shale bedrock; shale has light gray (5YR 7/1) clay coatings.

The depth to hard bedrock varied ranging from 68 cm above the system to 140 cm below the system. Coarse fragments were also quite variable with the largest quantities present above the system. The profile below the system tends to have a greater abundance of mottles and in some places a thin indurated layer.

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Table 2. Profile description for Subsystem 2 installed in Blairton silt loam located in Frederick Co., VA.

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Ap (0-17 cm) dark brown (10YR 4/3) silt loam; moderate fine and medium granular structure; friable, nonsticky and nonplastic; some shale fragments.

Bt1 (17-33 cm) yellowish brown (10YR 5/6) silty clay loam; few fine light yellowish brown (2.5YR 6/4) mottles; weak medium subangular blocky structures, friable, sticky and nonplastic; small percent of shale fragments present.

Bt2 (33-58 cm) light yellowish brown (10YR 6/4) silty clay; common medium distinct olive gray (5YR 5/2) mottles; moderate fine subangular blocky structure; friable, slightly sticky and slightly plastic; numerous coarse fragments.

Bt3 (58-74 cm) strong brown (7.5YR 5/6) silty clay; many distinct light olive gray (5YR 6/2) mottles; moderate medium subangular blocky structure; friable, slightly sticky and slightly plastic; numerous coarse fragments.

C (74-89 cm) yellowish brown (10YR 5/6) silty clay; many light olive gray (5YR 6/2) mottles; weak thin plastic structure; firm, sticky and plastic; many shale fragments.

Cr (89 cm) shale bedrock; fractured shale has light gray (5YR 7/1) to light olive gray (5YR 6/2) clay coatings.

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overcome site restrictions of low hydraulic conductivity, a shallow groundwater table (grey mottles at 45.7 cm), and an estimated percolation rate of greater than 47.2 min/cm (Table 3).

The design flow of 1135.6 Lpd (based on two bedrooms, four person maximum occupancy) generated by the household passed through a septic tank and into a pump chamber. The clarified effluent was pumped into two subsystems with different loading rates. The first subsystem operated under one-half the standard Virginia loading rate, or 5.1 Lpd/m<sup>2</sup>, and the second one under the normal Virginia regulation, or 10.2 Lpd/m<sup>2</sup> (Table 4). Actual flow rates were monitored during the entire study period (Table 5).

In shallow-placed trench OSWTDS, the trench is constructed higher in the profile and then backfilled with the original soil and additional fill materials to protect the drainlines from freezing during cold weather (Figure 2). This placement increases the amount of suitable soil between trench bottom and any soil restrictions lower in the profile. Based on this technique and due to the shallow depth to groundwater in the Blairton silt loam, soil infiltrators were placed directly on the freshly tilled soil surface, following surface contours. Seven infiltrators were joined end to end to suspend one 11.43 m long LPD drainline, or lateral, 30.5 cm above the tilled soil surface. Each subsystem contained seven 3.2 cm polyvinyl chloride (PVC) laterals for a total of 14 drainlines in the soil infiltrator LPD OSWTDS. A survey diagram of the property is included as Figure 3. A diagram of the absorption field containing subsystems 1 and 2 can as Figure 4.

The two subsystems were placed end to end with a minimum distance between them. A 30.5 cm separation distance was maintained between laterals. A 22.9 cm layer of topsoil was mounded over the plastic infiltrators and a grass cover was established over the drainfield system. Total height of the absorption field did not exceed 61.0 cm.

Table 3. Site description for Frederick Co., VA.

| Soil Series        | Soil Restrictions          | Restriction Description       |
|--------------------|----------------------------|-------------------------------|
| Blairton silt loam | Low hydraulic conductivity | 47.2 min/cm percolation rate* |
|                    | Shallow ground-water table | 45.0 cm grey mottles          |

\*In some parts of the soil profile, the percolation rate is estimated at even slower than 47.2 min/cm due to the presence of the indurated layer mentioned in Table 1.

Table 4. The design loading rates and the actual loading rates for the two infiltrator subsystems in the Blairton silt loam.

| Design Flow (Lpd) | Actual Flow (Lpd) | Dosing Interval (d) | Dosing Volume (Lpd) | Subsystem | Design Loading Rate (Lpd/m <sup>2</sup> ) | Actual Loading Rate (Lpd/m <sup>2</sup> ) |
|-------------------|-------------------|---------------------|---------------------|-----------|---|---|
| 1135.6            | 709.1             | 1.98                | 851.7               | 1(1/2 VA) | 5.1                                       | 2.4                                       |
|                   |                   |                     |                     | 2(VA)     | 10.2                                      | 4.9                                       |