

Appendix

D.1

**Testing Requirements for Infiltration,
Bioretention and Sand Filter Subsoils**

General Notes Pertinent to All Testing

1. For infiltration trench (I-1) and basin (I-2) practices, a minimum field infiltration rate (f_c) of 0.52 inches per hour is required; lower rates preclude the use of these practices. For surface sand filter (F-1) and bioretention (F-6) practices, no minimum infiltration rate is required if these facilities are designed with a “day-lighting” underdrain system; otherwise these facilities require a 0.52 inch per hour rate.
2. Number of required borings is based on the size of the proposed facility. Testing is done in two phases, (1) Initial Feasibility, and (2) Concept Design.
3. Testing is to be conducted by a qualified professional. This professional shall either be a registered professional engineer, soils scientist or geologist and must be licensed in the State of Maryland.

Initial Feasibility Testing

Feasibility testing is conducted to determine whether full-scale testing is necessary, screen unsuitable sites, and reduce testing costs. A soil boring is not required at this stage. However, a designer or landowner may opt to engage Concept Design Borings per Table D.1.1 at his or her discretion, without feasibility testing.

Initial testing involves either one field test per facility, regardless of type or size, or previous testing data, such as the following:

- * on-site septic percolation testing, within 200 feet of the proposed BMP location, and on the same contour which can establish initial rate, water table and/or depth to bedrock,
- * geotechnical report on the site prepared by a qualified geotechnical consultant, or
- * Natural Resources Conservation Service (NRCS) County Soil Mapping showing an unsuitable soil group such as a hydrologic group “D” soil in a low-lying area or a Marlboro Clay.

If the results of initial feasibility testing as determined by a qualified professional show that an infiltration rate of greater than 0.52 inches per hour is probable, then the number of concept design test pits shall be per the following table. An encased soil boring may be substituted for a test pit, if desired.

Table D.1.1 Infiltration Testing Summary Table

Type of Facility	Initial Feasibility Testing	Concept Design Testing (initial testing yields a rate greater than 0.52"/hr)	Concept Design Testing (initial testing yields a rate lower than 0.52"/hr)
I-1 (trench)	1 field percolation test, test pit not required	1 infiltration test and 1 test pit per 50' of trench	not acceptable practice
I-2 (basin)	1 field percolation test, test pit not required	1 infiltration test and 1 test pit per 200 square feet of basin area	not acceptable practice
F-1 (surface sand filter)	1 field percolation test, test pit not required	1 infiltration test and 1 test pit per 200 square feet of filter area (no underdrains required*)	underdrains required
F-6 (bioretention)	1 field percolation test, test pit not required	1 infiltration test and 1 test pit per 200 square feet of filter area (no underdrains required*)	underdrains required

* underdrain installation is still strongly recommended

Documentation

Infiltration testing data shall be documented, and include a description of the infiltration testing method. This is to ensure that the tester understands the procedure.

Test Pit/Boring Requirements

- a. Excavate a test pit or dig a standard soil boring to a depth of 4 feet below the proposed facility bottom;
- b. Determine depth to groundwater table (if within 4 feet of proposed bottom) upon initial digging or drilling, and again 24 hours later;
- c. Conduct Standard Penetration Testing (SPT) every 2' to a depth of 4 feet below the facility bottom;

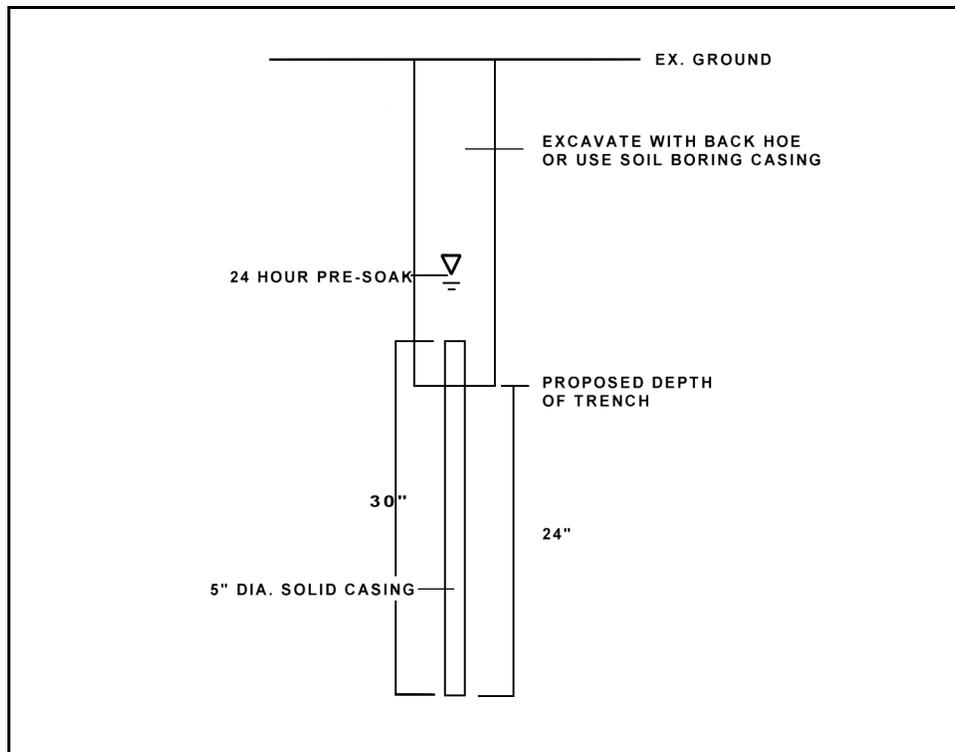
Appendix D.1 Testing Requirements for Infiltration Bioretention and Sand Filter Subsoils

- d. Determine United States Department of Agriculture (USDA) or Unified Soil Classification (USC) System textures at the proposed bottom and 4 feet below the bottom of the best management practice (BMP);
- e. Determine depth to bedrock (if within 4 feet of proposed bottom);
- f. The soil description should include all soil horizons; and
- g. The location of the test pit or boring shall correspond to the BMP location; test pit/soil boring stakes are to be left in the field for inspection purposes and shall be clearly labeled as such.

Infiltration Testing Requirements (field testing required)

- a. Install casing (solid 5 inch diameter, 30” length) to 24” below proposed BMP bottom (see Figure D.1.1).
- b. Remove any smeared soiled surfaces and provide a natural soil interface into which water may percolate. Remove all loose material from the casing. Upon the tester’s discretion, a two (2) inch layer of coarse sand or fine gravel may be placed to protect the bottom from scouring and sediment. Fill casing with *clean* water to a depth of 24” and allow to pre-soak for twenty-four hours.
- c. Twenty-four hours later, refill casing with another 24” of clean water and monitor water level (measured drop from the top of the casing) for 1 hour. Repeat this procedure (filling the casing each time) three additional times, for a total of four observations. Upon the tester’s discretion, the final field rate may either be the average of the four observations, or the value of the last observation. The final rate shall be reported in inches per hour.
- d. May be done through a boring or open excavation.
- e. The location of the test shall correspond to the BMP location.
- f. Upon completion of the testing, the casings shall be immediately pulled, and the test pit shall be back-filled.

Figure D.1.1 Infiltration Testing Requirements



Laboratory Testing

Use grain-size sieve analysis and hydrometer tests (where appropriate) to determine USDA soils classification and textural analysis. Visual field inspection by a qualified professional may also be used, provided it is documented. The use of lab testing to establish infiltration rates is prohibited.

Bioretention Testing

All areas tested for application of F-6 facilities shall be back-filled with a suitable sandy loam planting media. The borrow source of this media, which may be the same or different from the bioretention area location itself, must be tested as follows:

If the borrow area is undisturbed soil one test is required per 200 square feet of borrow area. The test consists of "grab" samples at one foot depth intervals to the bottom of the borrow area. All samples at the testing location are then mixed, and the resulting sample is then lab-tested to meet the following criteria:

- a) USDA minimum textural analysis requirements: A textural analysis is required from the site stockpiled topsoil. If topsoil is imported, then a texture analysis shall be performed for each location where the topsoil was excavated.

Minimum requirements:

sand 35 - 60%
 silt 30 - 55%
 clay 10 - 25%

- b) The soil shall be a uniform mix, free of stones, stumps, roots or other similar objects larger than one inch.
- c) Consult the bioretention construction specifications (Appendix B.3.8) for further guidance on preparing the soil for a bioretention area.

Table D.1.2 Minimum Depth to Seasonably High Water Table

Region	Depth to water table for infiltration	Depth to water table for encased or lined facilities such as an underground concrete sand filter
Lower Eastern Shore	2	0*
Remainder of State	4	0*

*may need professional structural design