

C.2 Construction Specifications for Infiltration Practices**Infiltration Trench General Notes and Specifications**

The infiltration trench systems may not receive run-off until the entire contributing drainage area to the infiltration system has received final stabilization.

1. Heavy equipment and traffic shall be restricted from traveling over the infiltration trench to minimize compaction of the soil.
2. Excavate the infiltration trench to the design dimensions. Excavated materials shall be placed away from the trench sides to enhance trench wall stability. Large tree roots must be trimmed flush with the trench sides in order to prevent fabric puncturing or tearing of the filter fabric during subsequent installation procedures. The side walls of the trench shall be roughened where sheared and sealed by heavy equipment.
3. A Class "C" geotextile or better shall interface between the trench side walls and between the stone reservoir and gravel filter layers. A partial list of non-woven filter fabrics that meet the Class "C" criteria is contained below. Any alternative filter fabric must be approved by the local municipality prior to installation.

Mirafi 180-N
Amoco 4552
WEBTEC N70
GEOLON N70
Carthage FX-80S

The width of the geotextile must include sufficient material to conform to trench perimeter irregularities and for a 6-inch minimum top overlap. The filter fabric shall be tucked under the sand layer on the bottom of the infiltration trench for a distance of 6 to 12 inches. Stones or other anchoring objects should be placed on the fabric at the edge of the trench to keep the trench open during windy periods. When overlaps are required between rolls, the uphill roll should lap a minimum of 2 feet over the downhill roll in order to provide a shingled effect.

4. A 6 inch sand layer may be placed on the bottom of the infiltration trench in lieu of filter fabric, and shall be compacted using plate compactors. The sand for the infiltration trench shall be washed and meet AASHTO Std. M-43, Size No. 9 or No. 10. Any alternative sand gradation must be approved by the Engineer or the local municipality.
5. The stone aggregate should be placed in lifts and compacted using plate compactors. A maximum loose lift thickness of 12 inches is recommended. Gravel filling (rounded bank run gravel is preferred) for the infiltration trench shall be washed and meet one of the following: AASHTO Std. M-43; Size No. 2 or No. 3.
6. Following the stone aggregate placement, the filter fabric shall be folded over the stone aggregate to form a 6-inch minimum longitudinal lap. The desired fill soil or stone aggregate shall be placed over the lap at sufficient intervals to maintain the lap during subsequent backfilling.
7. Care shall be exercised to prevent natural or fill soils from intermixing with the stone aggregate. All contaminated stone aggregate shall be removed and replaced with uncontaminated stone aggregate.

8. Voids can be created between the fabric and the excavation sides and shall be avoided. Removing boulders or other obstacles from the trench walls is one source of such voids, therefore, natural soils should be placed in these voids at the most convenient time during construction to ensure fabric conformity to the excavation sides.
9. Vertically excavated walls may be difficult to maintain in areas where soil moisture is high or where soft cohesive or cohesionless soils are predominate. These conditions may require laying back of the side slopes to maintain stability.
10. PVC distribution pipes shall be Schedule 40 and meet ASTM Std. D 1784. All fittings and perforations (1/2 inch in diameter) shall meet ASTM Std. D 2729. A perforated pipe shall be provided only within the infiltration trench and shall terminate 1 foot short of the infiltration trench wall. The end of the PVC pipe shall be capped.
11. Corrugated metal distribution pipes shall conform to AASHTO Std. M-36, and shall be aluminized in accordance with AASHTO Std. M-274. Coat aluminized pipe in contact with concrete with an inert compound capable of effecting isolation of the deleterious effect of the aluminum on the concrete. Perforated distribution pipe shall be provided only within the infiltration trench and shall terminate 1 foot short of the infiltration trench wall. An aluminized metal plate shall be welded to the end of the pipe.
12. The observation well is to consist of 6-inch diameter PVC Schedule 40 pipe (ASTM Std. D 1784) with a cap set 6 inches above ground level and is to be located near the longitudinal center of the infiltration trench. Preferably the observation well will not be located in vehicular traffic areas. The pipe shall have a plastic collar with ribs to prevent rotation when removing cap. The screw top lid shall be a "Panella" type cleanout with a locking mechanism or special bolt to discourage vandalism. A perforated (1/2 inch in diameter) PVC Schedule 40 pipe shall be provided and placed vertically within the gravel portion of the infiltration trench and a cap provided at the bottom of the pipe. The bottom of the cap shall rest on the infiltration trench bottom.
13. If a distribution structure with a wet well is used, a 4-inch PVC drain pipe shall be provided at opposite ends of the infiltration trench distribution structure. Two (2) cubic feet of porous backfill meeting AASHTO Std. M-43 Size No. 57 shall be provided at each drain.
14. If a distribution structure is used, the manhole cover shall be bolted to the frame.

NOTE: PVC pipe with a wall thickness classification of SDR-35 meeting ASTM standard D3034 is an acceptable substitution for PVC Schedule 40 pipe.

Required Elements for Infiltration Trenches

Feasibility

Required Elements

- To be suitable for infiltration, underlying soils shall have an infiltration rate (f_c) of at least 0.5 inches per hour, as initially determined from NRCS soil textural classification, and subsequently confirmed by field geotechnical tests (see Appendix D). The minimum geotechnical testing is one test hole per 5000 sf, with a minimum of two borings per facility (taken within the proposed limits of the facility).
- Soils shall also have a clay content of less than 20% and a silt/clay content of less than 40%.
- Infiltration practices cannot be located on areas with natural slopes greater than 15%.
- Infiltration practices cannot be located in fill soils, except the top quarter of an infiltration trench or dry well.
- To protect groundwater from possible contamination, runoff from designated hotspot land uses or activities must not be directed to a formal infiltration facility. In cases where this goal is impossible (e.g., where the storm drain system leads to a large recharge facility designed for flood control), redundant pretreatment must be provided by applying two of the practices listed in Table 5.1 in series, both of which are sized to treat the entire W_{Qv} .
- The bottom of the infiltration facility shall be separated by at least three feet vertically from the seasonally high water table or bedrock layer, as documented by on-site soil testing. (Four feet in sole source aquifers).
- Infiltration facilities shall be located at least 100 feet horizontally from any water supply well.
- Infiltration practices cannot be placed in locations that cause water problems to downgradient properties. Infiltration trenches and basins shall be setback 25 feet downgradient from structures and septic systems. Dry wells shall be separated a minimum of 10 feet from structures.

Conveyance

Required Elements

- The overland flow path of surface runoff exceeding the capacity of the infiltration system shall be evaluated to preclude erosive concentrated flow during the overbank events. If computed flow velocities exceed erosive velocities (3.5 to 5.0 fps), an overflow channel shall be provided to a stabilized watercourse. (See Appendix L for erosive velocities of grass and soil).
- All infiltration systems shall be designed to fully de-water the entire W_{Qv} within 48 hours after the storm event.
- If runoff is delivered by a storm drain pipe or along the main conveyance system, the infiltration practice must be designed as an off-line practice (see Appendix K for a detail), except when used as a regional flood control practice.

Pretreatment

Required Elements

- A minimum pretreatment volume of 25% of the W_{Qv} must be provided prior to entry to an infiltration facility, and can be provided in the form of a sedimentation basin, sump pit, grass channel, plunge pool or other measure.
- If the f_c for the underlying soils is greater than 2.00 inches per hour, a minimum pretreatment volume of 50% of the W_{Qv} must be provided.
- If the f_c for the underlying soils is greater than 5.00 inches per hour, 100% of the W_{Qv} shall be pretreated prior to entry into an infiltration facility.

- Exit velocities from pretreatment chambers shall be non-erosive (3.5 to 5.0 fps during the two-year design storm). (See Appendix L for erosive velocities of grass and soil).

Pretreatment Techniques to Prevent Clogging

Infiltration basins or trenches can have redundant methods to ensure the long-term integrity of the infiltration rate. The following techniques are pretreatment options for infiltration practices:

- Grass channel (Maximum velocity of 1 fps for water quality flow. See the Fact Sheet on page 5-10 for more detailed design information.)
- Grass filter strip (minimum 20 feet and only if sheet flow is established and maintained)
- Bottom sand layer (for I-1)
- Upper sand layer (for I-1; 6" minimum with filter fabric at sand/gravel interface)
- Use of washed bank run gravel as aggregate
- Alternatively, a pre-treatment settling chamber may be provided and sized to capture the pretreatment volume. Use the method prescribed in section 6.4.3 (i.e., the Camp-Hazen equation) to size the chamber.
- Plunge Pool
- An underground trap with a permanent pool between the downspout and the dry well (I-3)

Treatment

Required Elements

- Infiltration practices shall be designed to exfiltrate the entire W_{Qv} through the floor of each practice (sides are not considered in sizing).
- The construction sequence and specifications for each infiltration practice shall be precisely followed. Experience has shown that the longevity of infiltration practices is strongly influenced by the care taken during construction
- Calculate the surface area of infiltration trenches as:

$$A_p = V_w / (nd_t)$$

Where:

- A_p = surface area (sf)
- V_w = design volume (e.g., WQ_v) (ft³)
- n = porosity (assume 0.4)
- d_t = trench depth (maximum of four feet, and separated at least three feet from seasonally high groundwater) (ft)

- Calculate the approximate bottom area of infiltration basins using the following equation:

$$A = v_w/d_b$$

Where:

- A = surface area of the basin (ft²)
- d_b = depth of the basin (ft)

Note that in trapezoidal basins, this area should first be used to approximate the area at the bottom of the basin, but can later be modified to account for additional storage provided above side slopes.

Landscaping

Required Elements

- Upstream construction shall be completed and stabilized before connection to a downstream infiltration facility. A dense and vigorous vegetative cover shall be established over the contributing pervious drainage areas before runoff can be accepted into the facility.
- Infiltration trenches shall not be constructed until all of the contributing drainage area has been completely stabilized.

Maintenance

Required Elements

- Infiltration practices shall never serve as a sediment control device during site construction phase. In addition, the Erosion and Sediment Control plan for the site shall clearly indicate how sediment will be prevented from entering an infiltration facility. Normally, the use of diversion berms around the perimeter of the infiltration practice, along with immediate vegetative stabilization and/or mulching can achieve this goal.
- An observation well shall be installed in every infiltration trench and dry well, consisting of an anchored six- inch diameter perforated PVC pipe with a lockable cap installed flush with the ground surface.
- Direct access shall be provided to infiltration practices for maintenance and rehabilitation. If a stone reservoir or perforated pipe is used to temporarily store runoff prior to infiltration, the practice shall not be covered by an impermeable surface.

General Notes Pertinent to All Testing

1. For infiltration practices, a minimum field infiltration rate (f_c) of 0.5 inches per hour is required; areas yielding a lower rate preclude these practices. If the minimum f_c exceeds two inches per hour, half of the WQ_v must be treated by an upstream SMP that does allow infiltration. For F-1 and 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 0.5 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 Testing.
3. Testing is to be conducted by a qualified professional. This professional shall either be a registered professional engineer in the State of New York, a soils scientist or geologist also licensed in the State of New York.

Initial Feasibility Testing

Feasibility testing is conducted to determine whether full-scale testing is necessary, and is meant to 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 H-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:

- * septic percolation testing on-site, within 200 feet of the proposed SMP location, and on the same contour [can establish initial rate, water table and/or depth to bedrock]
- * previous written geotechnical reporting on the site location as prepared by a qualified geotechnical consultant
- * 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 0.5 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 Infiltration Testing Summary Table

Type of Facility	Initial Feasibility Testing	Concept Design Testing (initial testing yields a rate greater than 0.5"/hr)	Concept Design Testing (initial testing yields a rate lower than 0.5"/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 sf of basin area	not acceptable practice
F-1 (sand filter)	1 field percolation test, test pit not required	1 infiltration test and 1 test pit per 200 sf 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 sf of filter area (no underdrains required**)	underdrains required

*feasibility test information already counts for one test location

** underdrain installation still strongly suggested

Documentation

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

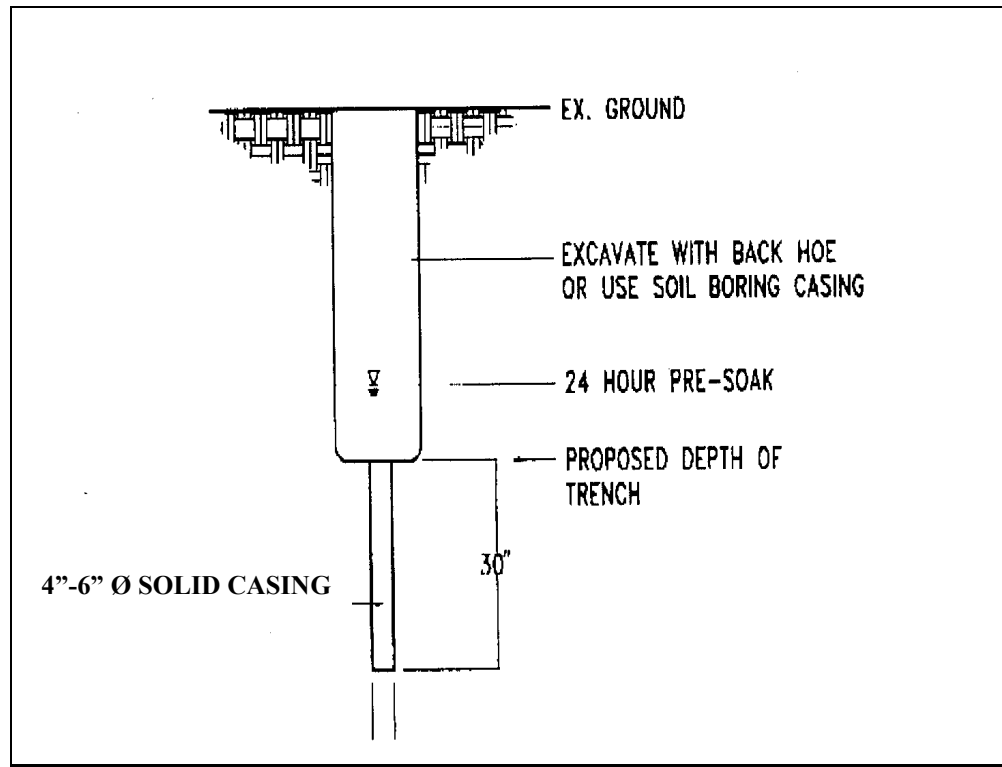
Test Pit/Boring Requirements

- a. excavate a test pit or dig a standard soil boring to a minimum depth of 4 feet below the proposed facility bottom elevation
- 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
- d. determine USDA or Unified Soil Classification System textures at the proposed bottom and 4 feet below the bottom of the SMP
- e. determine depth to bedrock (if within 4 feet of proposed bottom)
- f. The soil description should include all soil horizons.
- g. The location of the test pit or boring shall correspond to the SMP 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

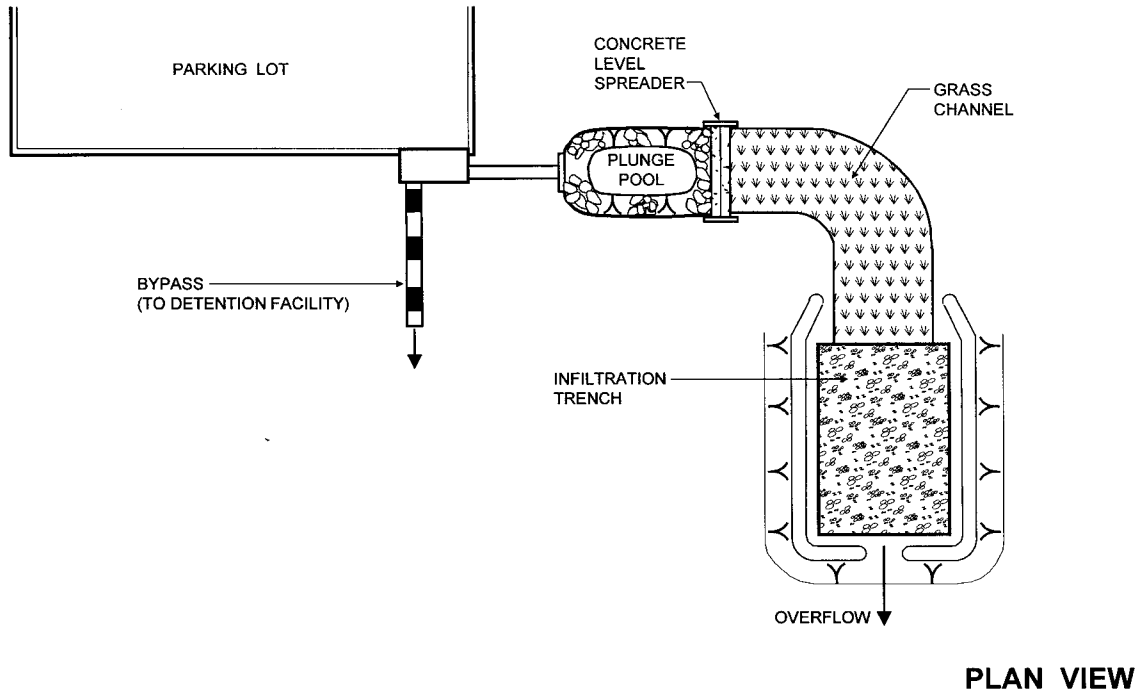
- a. Install casing (solid 4-6 inch diameter, 30" length) to 24" below proposed SMP bottom (see Figure D-1).

- 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 SMP location.
- f. Upon completion of the testing, the casings shall be immediately pulled, and the test pit shall be back-filled.

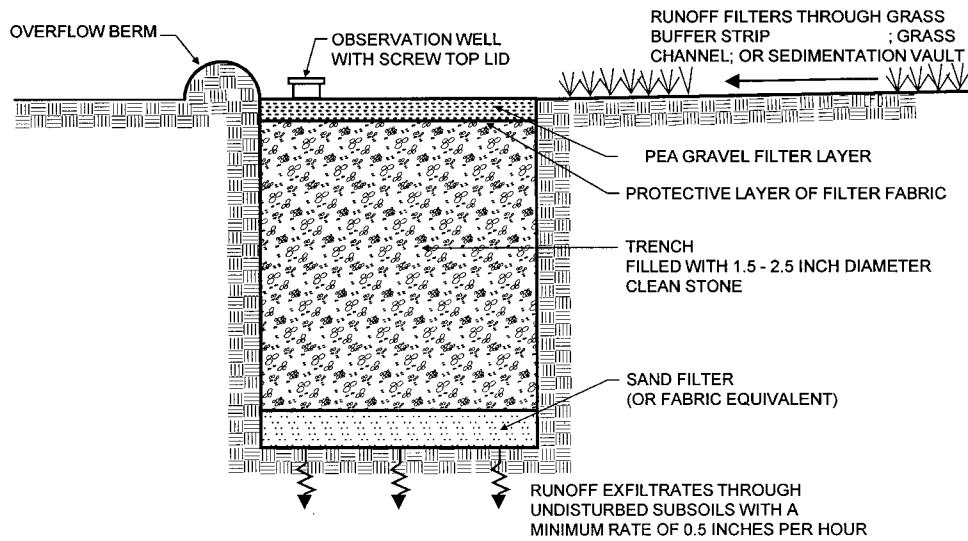
Figure D.1 Infiltration Testing Requirements**Laboratory Testing**

- a. Grain-size sieve analysis and hydrometer tests where appropriate may be used 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.*

Figure 6.11 Infiltration Trench (I-1)



PLAN VIEW



SECTION