2501 Stanbridge Street
East Norriton, PA 19401

610-275-2800 tel
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www.eastnorritontwp.org

East Norriton Township
Grading Permit Application

I. LOCATION
Address

II. PROPERTY OWNER	
Name	Address
Phone #	City, State, Zip

III. CONTRACTOR	PA Contractor Registration #:
Name	Address
Phone #	City, State, Zip

IV. APPLICANT	
Name	Relationship to Owner
Address	Phone #
City, State, Zip	Fax #

V. PROPOSED WORK	
Indicate purpose and proposed work	
Applicant must submit an erosion control plan and a topographical plan that have been prepared by a professional engineer showing original and proposed grades. A minimum of $1000 shall be escrowed with the Township to offset review fees incurred by the Township.	**Total Estimated Cost: $**

Applicant Signature: _____ Date: _____/_____/_____

VI. PERMIT FEE & REVIEW **(fees calculated based on the current fee schedule)**		
Permit Fee:	Total Fee:	Approved By:

GRADING

SIMPLIFIED DRAINAGE PLAN GUIDANCE

166 Attachment XX

East Norriton Township

The East Norriton Township Stormwater Management Ordinance provides simplified drainage plan requirements for projects with less than 2,000 square feet of new impervious area or earth disturbance. This guidance document provides applicants with information necessary to prepare a simplified drainage plan, following simplified calculations for meeting Volume Control requirements. Applicants may prepare and submit the simplified drainage plan without the professional services of an engineer.

What does a Simplified Drainage Plan include?

A simplified drainage plan consists of general property information, a clear description of the proposed improvements, pertinent calculations and plans. Other items required on the Simplified Drainage Plan include:

1. Property Owner, Property Address, Total Property Area, Current Zoning Information;
2. Approximate property lines and adjacent roads;
3. North Arrow;
4. Existing streams, lakes, ponds or other waters of the Commonwealth:
5. Location of existing and proposed structures;
6. Dimensions (length and width) of all existing and proposed structures on the property along with areas (square feet) calculated for each feature;
7. Location of any existing or proposed on-site septic systems and/or potable water wells. The plan must indicate the approximate distance between these features and any proposed infiltration type Stormwater BMPs (Best Management Practices);
8. Location and construction details for all permanent Stormwater BMPs (including materials, dimensions, etc);
9. Proposed grading, including overland drainage patterns and swales;
10. Erosion and sediment controls;
11. Soil Type. The USDA provides free access to soil survey information through the Web Soil Survey website (http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm).
    a. After clicking the green button to start the Web Soil Survey, search for the project location by street address and then draw an approximate boundary around the Area of Interest (i.e. the project area).
    b. Click on the "Soil Map" tab to view soil survey information for the Area of Interest. Clicking on the full soil name will show detailed information about the soil type.
12. All calculations (see below).

The simplified drainage plan must include the following calculations:

1. Existing Impervious Surface Area;
2. Proposed Impervious Surface Area (including all new and existing impervious surfaces);
3. Earth Disturbance Area;
4. Volume Control Calculations;

For a complete listing of all simplified drainage plan requirements, please refer to the East Norriton Township Stormwater Management Ordinance.

Sample Calculations
The following calculations are based on the Simplified Method (CG-2 in the PA BMP Manual) and a sample project depicted in Figure 1 of this guidance document.

STEP 1 – Existing Impervious Area

The areas of all existing impervious surfaces must be added together. An impervious surface is any surface that prevents the infiltration of water into the ground, including, but not limited to, the following: roofs, pools, driveway areas (paved or gravel), sidewalks, patios and decks.

Roof (House):	40' x 25'	=	1,000 square feet (sf)
Driveway:	75' x 15'	=	1,125 sf
Sidewalk:	25' x 4'	=	100 sf
Total Existing Impervious Surface Area		=	2,225 sf

STEP 2 – Proposed Impervious Surface Area

Determine the total area of impervious surface after the project is completed, including new impervious surface and all remaining existing impervious surface.

Total Existing Impervious Surface Area		=	2,225 sf
New Patio:	20' x 15'	=	300 sf
Total Proposed Impervious Surface Area		=	2,525 sf

STEP 3 – Earth Disturbance Area

Determine the total area of all earth disturbance associated with the project. The earth disturbance area includes, but is not limited to, the following: clearing and grubbing, grading, excavations, stockpiling earth materials. In general, the earth disturbance area will include the area of the new improvement (a patio for example), the area of any associated grading next to the patio, area for stockpiling excavated materials, and the area where a stormwater BMP might be installed.

STEP 4 – Volume Control Calculations

Stormwater management facilities should be sized to capture at least the first two inches (2") of runoff from all contributing impervious surfaces.

At least one inch (1") from new impervious surfaces shall be permanently removed from the runoff flow. Removal options include reuse evaporation, transpiration, and infiltration.

Wherever possible, infiltration facilities should be designed to accommodate infiltration of the entire permanently removed runoff. However, in all cases at least the first one-half inch (1/2") of the permanently removed runoff should be infiltrated.

The applicant can utilize a wide range of Stormwater BMPs to meet these requirements. In many situations, a subsurface infiltration bed or seepage pit will be suitable. A complete listing of available Stormwater BMPs can be found in the PA BMP Manual, published by the PA DEP.

Example:
An applicant plans to install a new patio and infiltration bed, as shown in Figure 1. An infiltration bed is a subsurface storage facility that temporarily stores and infiltrates stormwater runoff. In general, infiltration bed construction includes an excavated pit filled with uniformly graded aggregate and lined with a geotextile fabric. In this example, the infiltration bed is configured to receive runoff from the new patio.

New Patio: 20' x 15' = 300 sf

Required Volume to Capture 2" of Runoff:
300 sf x 2" (or 0.17') = 51 cubic feet (cf)

Required Volume to Permanently Remove 1" of Runoff:
300 sf x 1" (or .08') = 24 cf

Required Volume to Infiltrate 1/2" of Runoff:
300 sf x 1/2" (or .04') = 12 cf

To simplify compliance with these requirements, the applicant has decided to construct a single infiltration bed to accommodate the largest of these required volumes (capturing 2" of runoff). To size the infiltration bed, the applicant must divide the required volume by the Void Ratio of the aggregate inside the infiltration bed. The Void Ratio for uniformly graded aggregate is 0.40.

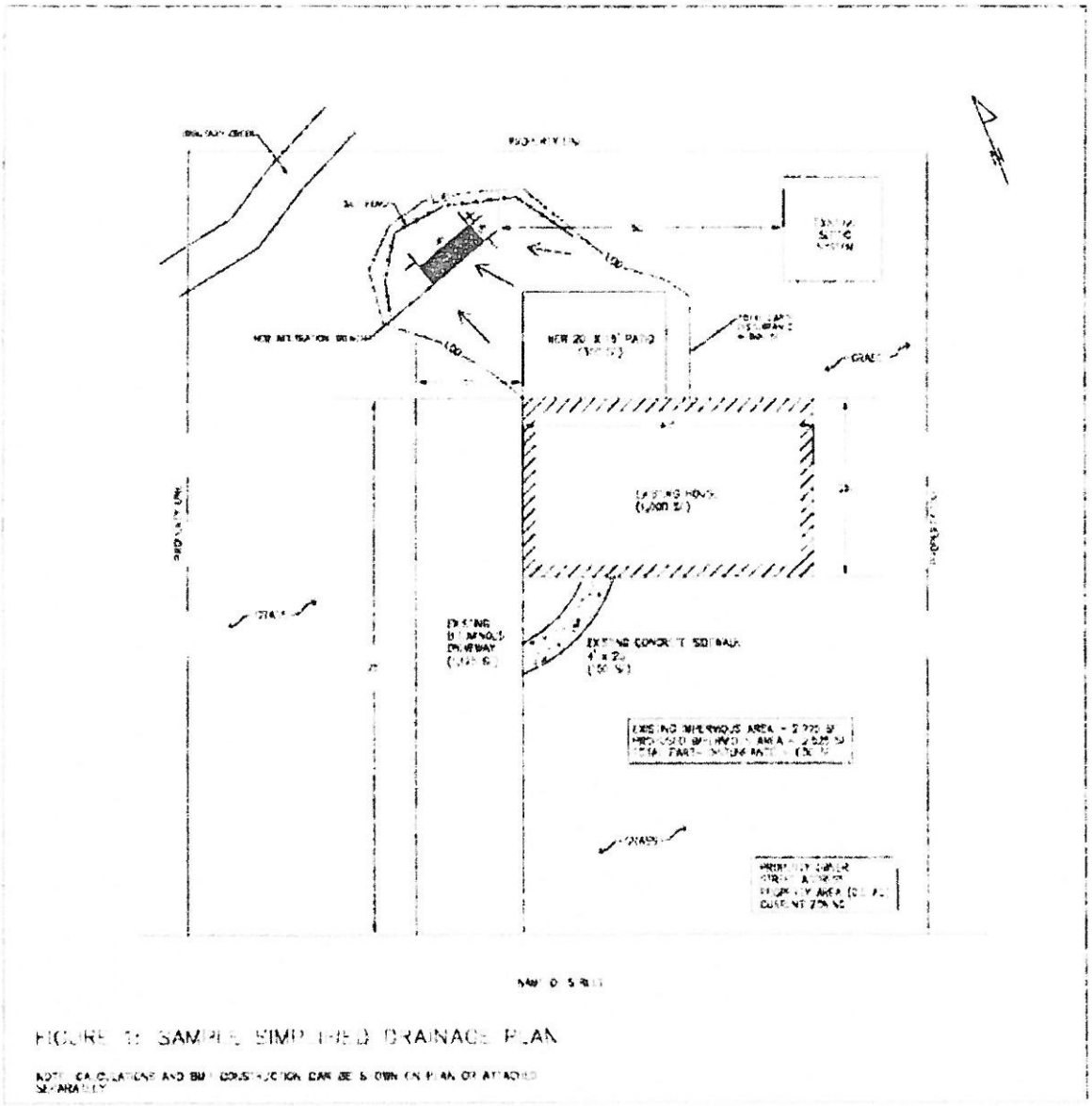
Required Infiltration Bed Volume:
51 cf / 0.40 = 128 cf

If the depth of the infiltration bed is designed to be 3', then the surface area of the infiltration bed can be calculated. In general, the designed depth for an infiltration bed should range between 1' to 3' and the width of the facility should be about twice its depth.

Infiltration Bed Area:
128 cf / 3' depth = 26 sf

Final Infiltration Bed Sizing (3' depth):
9' x 3' (27 sf), 7' x 4' (28 sf)

Figure 1: Sample Simplified Drainage Plan

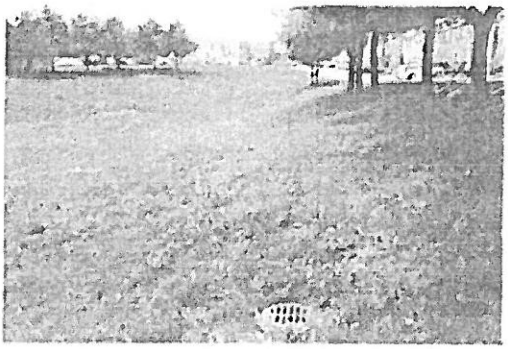


Note that a simplified drainage plan shall include:

(1) Location of proposed structures, driveways, or other paved areas with approximate sizes in square feet.

(2) Location of any existing or proposed site septic system and/or potable wells.

BMP 6.4.4: Infiltration Trench



An Infiltration Trench is a "leaky" pipe in a stone filled trench with a level bottom. An Infiltration Trench may be used as part of a larger storm sewer system, such as a relatively flat section of storm sewer, or it may serve as a portion of a stormwater system for a small area, such as a portion of a roof or a single catch basin. In all cases, an Infiltration Trench should be designed with a positive overflow.

Key Design Elements

- Continuously perforated pipe set at a minimum slope in a stone filled, level-bottomed trench
- Limited in width (3 to 8 feet) and depth of stone (6 feet max. recommended)
- Trench is wrapped in nonwoven geotextile (top, sides, and bottom)
- Placed on uncompacted soils
- Minimum cover over pipe is as per manufacturer.
- A minimum of 6" of topsoil is placed over trench and vegetated
- Positive Overflow always provided

Deed restrictions recommended
Not for use in hot spot areas without pretreatment

Potential Applications

Residential: Yes
Commercial: Yes
Ultra Urban: Yes
Industrial: Yes
Retrofit: Yes
Highway/Road: Yes

Stormwater Functions

Volume Reduction: Medium
Recharge: High
Peak Rate Control: Medium
Water Quality: High

Water Quality Functions

TSS: 85%
TP: 85%
NO3: 30%

Other Considerations

- **Protocol 1. Site Evaluation and Soil Infiltration Testing** and **Protocol 2. Infiltration Systems Guidelines** should be followed, see Appendix C

Description

An Infiltration Trench is a linear stormwater BMP consisting of a continuously perforated pipe at a minimum slope in a stone-filled trench (Figure 6.4-1). Usually an Infiltration Trench is part of a **conveyance system** and is designed so that large storm events are conveyed through the pipe with some runoff volume reduction. During small storm events, volume reduction may be significant and there may be little or no discharge. All Infiltration Trenches are designed with a **positive overflow** (Figure 6.4-2).

An Infiltration Trench differs from an Infiltration Bed in that it may be constructed without heavy equipment entering the trench. It is also intended to convey some portion of runoff in many storm events.

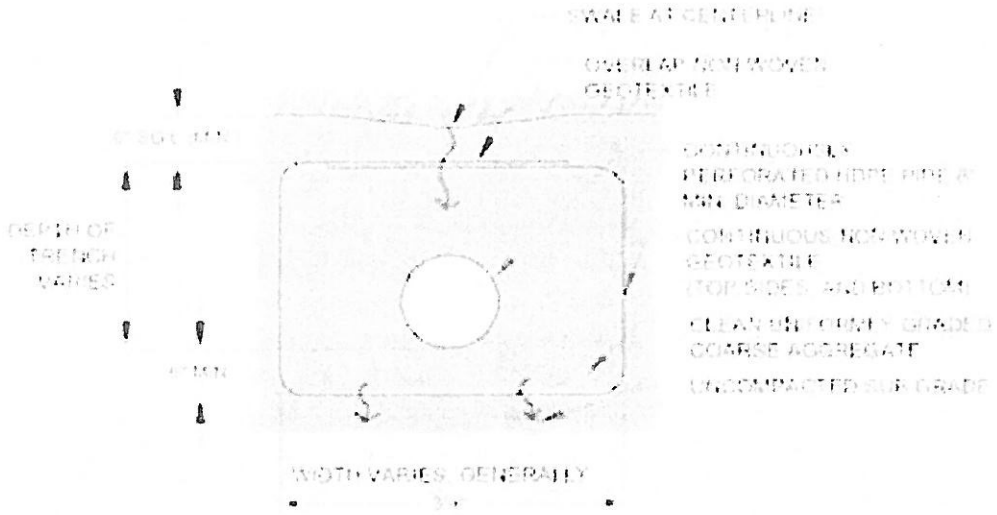


Figure 6.4-1

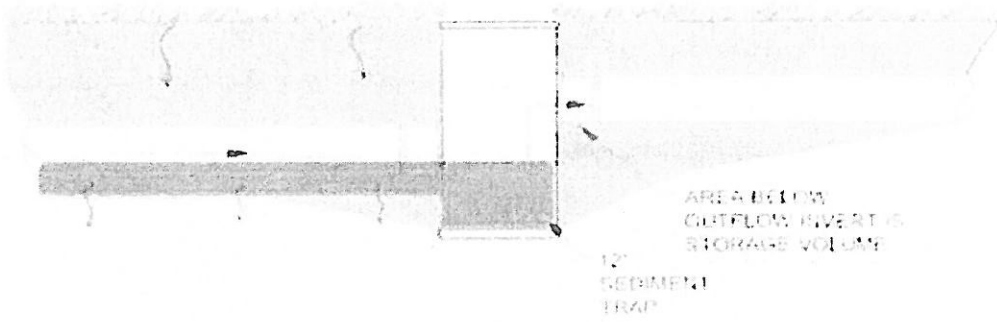


Figure 6.4-2

All Infiltration Trenches should be designed in accordance with Appendix C. Although the width and depth can vary, it is recommended that Infiltration Trenches be limited in depth to not more than six (6)

feet of stone. This is due to both construction issues and Loading Rate issues (as described in the Guidelines for Infiltration Systems). The designer should consider the appropriate depth.

Variations

Infiltration Trenches generally have a vegetated (grassed) or gravel surface. Infiltration Trenches also may be located alongside or adjacent to roadways or impervious paved areas with proper design. The subsurface drainage direction should be to the downhill side (away from subbase of pavement), or located lower than the impervious subbase layer. Proper measures should be taken to prevent water infiltrating into the subbase of impervious pavement.

Infiltration Trenches may also be located down a mild slope by "stepping" the sections between control structures as shown in Figure 6.4-3. A level or nearly level bottom is recommended for even distribution.

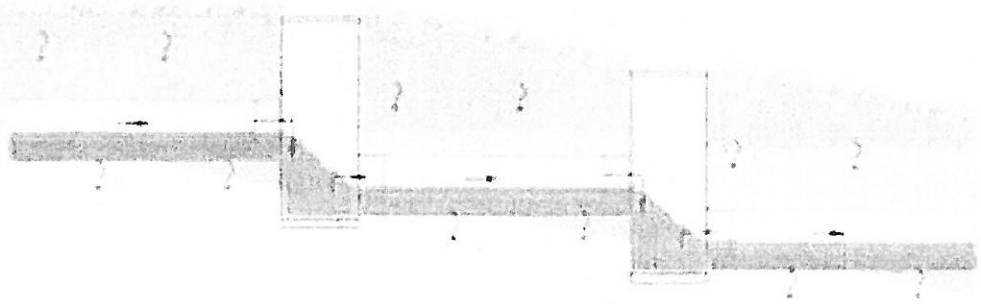
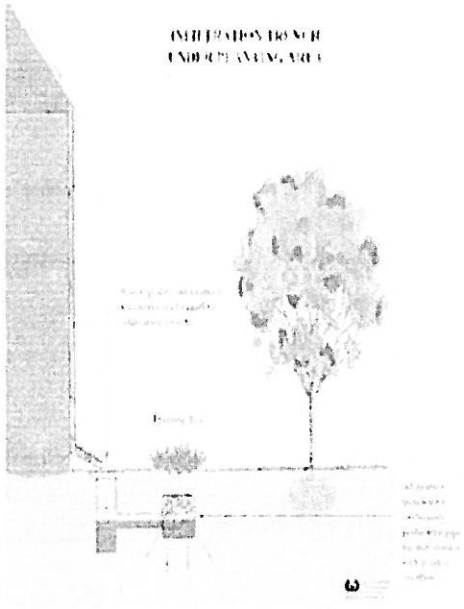


Figure 6.4-3

Applications



- **Connection of Roof Leaders**

Roof leaders may be connected to Infiltration Trenches. Roof runoff generally has lower sediment levels and often is ideally suited for discharge through an Infiltration Trench. A cleanout with sediment sump should be provided between the building and Infiltration Trench.

- **Connection of Inlets**

Catch Basins, inlets and area drains may be connected to Infiltration Trenches, however sediment and debris removal should be addressed. Structures should include a sediment trap area below the invert of the pipe for solids and debris. In areas of high traffic or areas where excessive sediment, litter, and other similar materials may be generated, a water quality insert or other pretreatment device is needed.

- **In Combination with Vegetative Filters**

An Infiltration Trench may be preceded by or used in combination with a Vegetative Filter, Grassed Swale, or other vegetative element used to reduce sediment levels

from areas such as high traffic roadways. Design should ensure proper functioning of vegetative system.

- **Other Applications**

Other applications of Infiltration Trenches may be determined by the design professional as appropriate.

Design Considerations

1. Soil Investigation and Percolation Testing is required (see Appendix C, Protocol 2)
2. Guidelines for Infiltration Systems should be met (i.e., depth to water table, setbacks, Loading Rates, etc. See Appendix C, Protocol 1)
3. Water Quality Inlet or Catch Basin with Sump (see Section 6.6.4) recommended for all surface inlets, designed to avoid standing water for periods greater than the criteria in Chapter 3.
4. A continuously perforated pipe should extend the length of the trench and have a positive flow connection designed to allow high flows to be conveyed through the Infiltration Trench.
5. The slope of the Infiltration Trench bottom should be level or with a slope no greater than 1%. The Trench may be constructed as a series of "steps" if necessary. A level bottom assures even water distribution and infiltration.
6. Cleanouts or inlets should be installed at both ends of the Infiltration Trench and at appropriate intervals to allow access to the perforated pipe.
7. The discharge or overflow from the Infiltration Trench should be properly designed for anticipated flows.

Detailed Stormwater Functions

Infiltration Area

The Infiltration Area is the bottom area of the Trench*, defined as:

Length of Trench x Width of Trench = Infiltration Area (Bottom Area)

This is the area to be considered when evaluating the Loading Rate to the Infiltration Trench.
* Some credit can be taken for the side area that is frequently inundated as appropriate.

Volume Reduction Calculations

Volume = Depth* (ft) x Area (sf) x Void Space

*Depth is the depth of the water surface during a storm event, depending on the drainage area and conveyance to the bed.

Infiltration Volume = Bed Bottom Area (sf) x Infiltration design rate (in/hr)
x Infiltration period* (hr) x (1/12)

*Infiltration Period is the time when bed is receiving runoff and capable of infiltration. Not to exceed 72 hours.

The void ratio in stone is approximately 40% for AASTO No 3. If the conveyance pipe is within the Storage Volume area, the volume of the pipe may also be included. All Infiltration Trenches should be designed to infiltrate or empty within 72 hours.

Peak Rate Mitigation Calculations

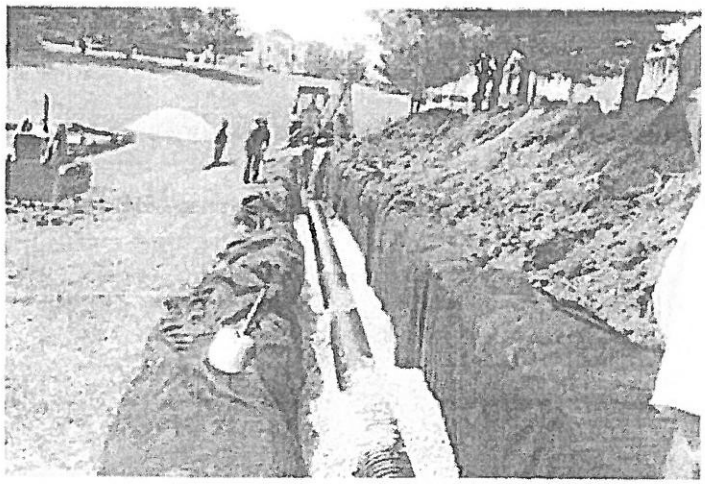
See Chapter 8 for Peak Rate Mitigation methodology which addresses link between volume reduction and peak rate control.

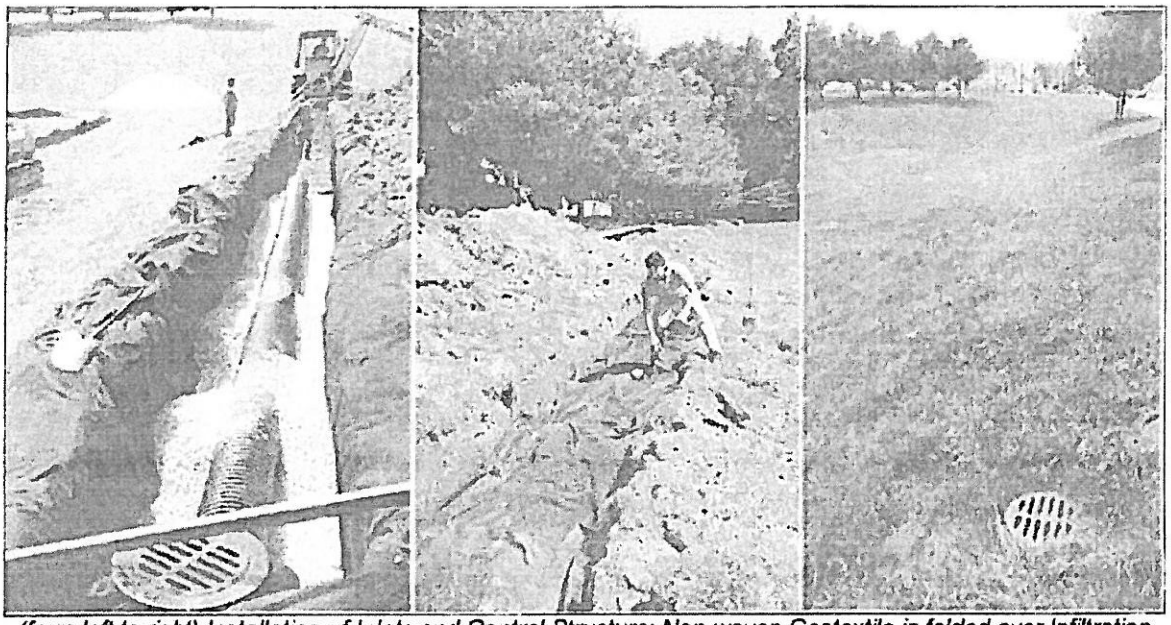
Water Quality Improvement

See Chapter 8 for Water Quality Improvement methodology which addresses pollutant removal effectiveness of this BMP.

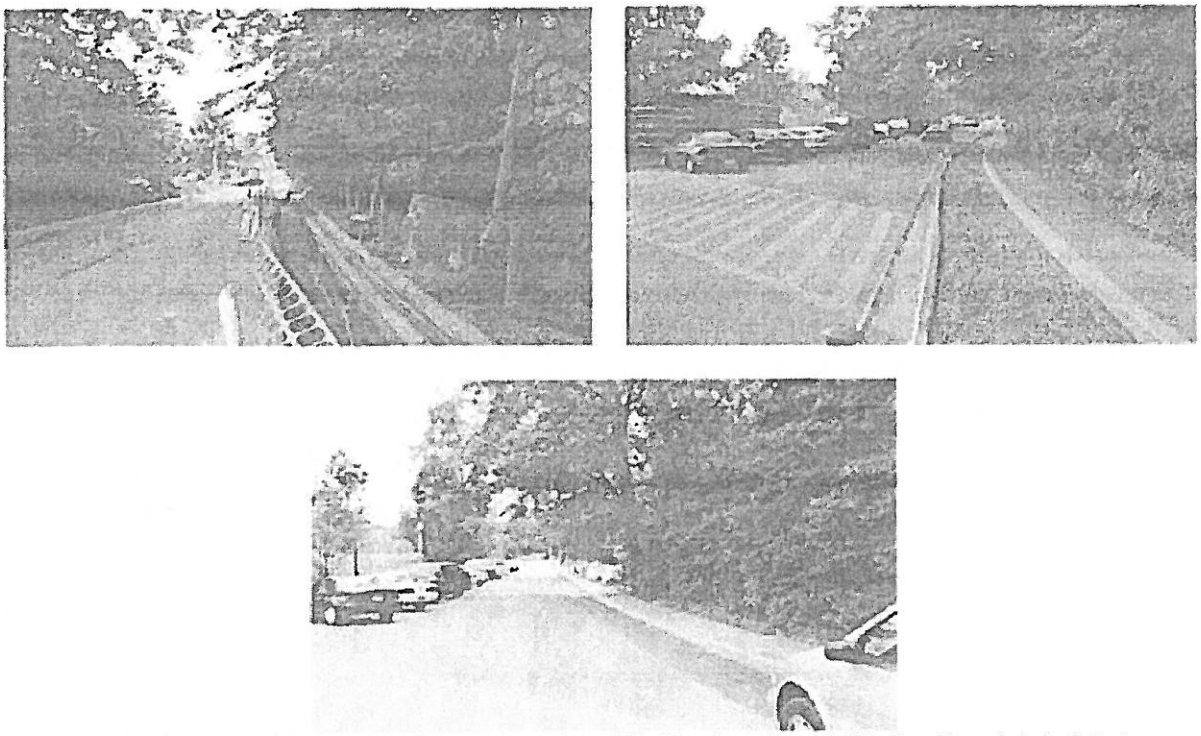
Construction Sequence

1. Protect Infiltration Trench area from compaction prior to installation.
2. If possible, install Infiltration Trench during later phases of site construction to prevent sedimentation and/or damage from construction activity. After installation, prevent sediment laden water from entering inlets and pipes.
3. Install and maintain proper Erosion and Sediment Control Measures during construction.
4. Excavate Infiltration Trench bottom to a uniform, level uncompacted subgrade free from rocks and debris. Do NOT compact subgrade.
5. Place nonwoven geotextile along bottom and sides of trench*. Nonwoven geotextile rolls should overlap by a minimum of 16 inches within the trench. Fold back and secure excess geotextile during stone placement.
6. Install upstream and downstream Control Structures, cleanouts, etc.
7. Place uniformly graded, clean-washed aggregate in 8-inch lifts, lightly compacting between lifts.
8. Install Continuously Perforated Pipe as indicated on plans. Backfill with uniformly graded, clean-washed aggregate in 8-inch lifts, lightly compacting between lifts.
9. Fold and secure nonwoven geotextile over Infiltration Trench, with minimum overlap of 16-inches.
10. Place 6-inch lift of approved Topsoil over Infiltration Trench, as indicated on plans.
11. Seed and stabilize topsoil.
12. Do not remove Inlet Protection or other Erosion and Sediment Control measures until site is fully stabilized.
13. Any sediment that enters inlets during construction is to be removed within 24 hours.





(from left to right) Installation of Inlets and Control Structure; Non-woven Geotextile is folded over Infiltration Trench; Stabilized Site



(Clockwise from top left) Infiltration Trench is on downhill side of roadway; Infiltration Trench is installed; Infiltration Trench is paved with standard pavement material

Maintenance and Inspection Issues

- Catch Basins and Inlets should be inspected and cleaned at least 2 times per year.
- The vegetation along the surface of the Infiltration Trench should be maintained in good condition, and any bare spots revegetated as soon as possible.
- Vehicles should not be parked or driven on a vegetated Infiltration Trench, and care should be taken to avoid excessive compaction by mowers.

Cost Issues

The construction cost of infiltration trenches can vary greatly depending on the configuration, location, site-specific conditions, etc. Typical construction costs in 2003 dollars range from $4 - $9 per cubic foot of storage provided (SWRPC, 1991; Brown and Schueler, 1997). Annual maintenance costs have been reported to be approximately 5 to 10 percent of the capital costs (Schueler, 1987).

Specifications

The following specifications are provided for information purposes only. These specifications include information on acceptable materials for typical applications, but are by no means exclusive or limiting. The designer is responsible for developing detailed specifications for individual design projects in accordance with the project conditions.

1. **Stone** for infiltration trenches shall be 2-inch to 1-inch uniformly graded coarse aggregate, with a wash loss of no more than 0.5%, AASHTO size number 3 per AASHTO Specifications, Part I, 19th Ed., 1998, or later and shall have voids 40% as measured by ASTM-C29.

2. **Non-Woven Geotextile** shall consist of needled nonwoven polypropylene fibers and meet the following properties:
   a. Grab Tensile Strength (ASTM-D4632)
   b. Mullen Burst Strength (ASTM-D3786)
   c. Flow Rate (ASTM-D4491)
   d. UV Resistance after 500 hrs (ASTM-D4355) 70%
   e. Heat-set or heat-calendared fabrics are not permitted
      Acceptable types include Mirafi 140N, Amoco 4547, and Geotex 451.

3. **Pipe** shall be continuously perforated, smooth interior, with a minimum inside diameter of 8-inches. High-density polyethylene (HDPE) pipe shall meet AASHTO M252, Type S or AASHTO M294, Type S.

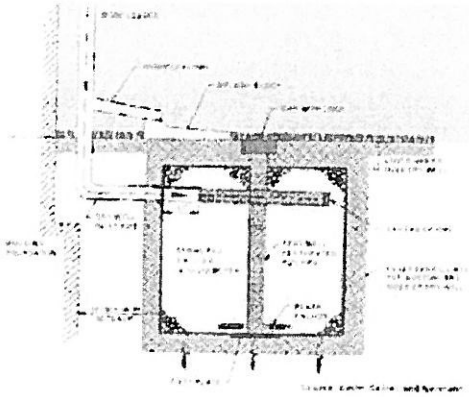
References

Brown and Schueler, *Stormwater Management Fact Sheet: Infiltration Trench*. 1997.

Schueler, T., 1987. *Controlling urban runoff: a practical manual for planning and designing urban BMPs*, Metropolitan Washington Council of Governments, Washington, DC

SWRPC, The Use of of Best Management Practices (BMPs) in Urban Watersheds, US Environmental Protection Agency,1991.

BMP 6.4.6: Dry Well / Seepage Pit



A Dry Well, or Seepage Pit, is a variation on an Infiltration system that is designed to temporarily store and infiltrate rooftop runoff.

Key Design Elements

- Fllow Infiltration System Guidelines in Appendix C
- Maintain minimum distance from building foundation (typically 10 feet)
- Provide adequate overflow outlet for large storms
- Depth of Dry Well aggregate should be between 18 and 48 inches
- At least one observation well; clean out is recommended
- Wrap aggregate with nonwoven geotextile
- Maintenance will require periodic removal of sediment and leaves from sumps and cleanouts
- Provide pretreatment for some situations

Potential Applications

Residential: Yes
Commercial: Yes
Ultra Urban: Yes
Industrial: Limited
Retrofit: Yes
Highway/Road: No

Stormwater Functions

Volume Reduction: Medium
Recharge: High
Peak Rate Control: Medium
Water Quality: Medium

Water Quality Functions

TSS: TP: 85% 85%
NO3: 30%

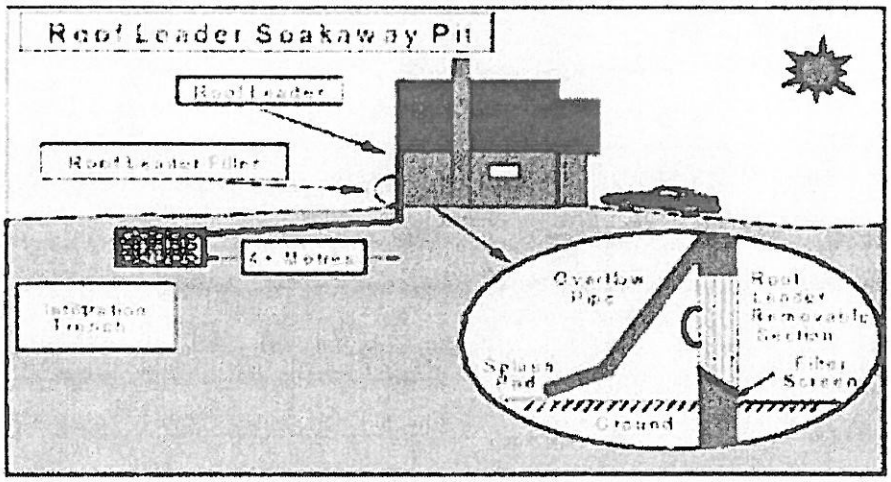
Other Considerations

- **Protocol 1. Site Evaluation and Soil Infiltration Testing** and **Protocol 2. Infiltration Systems Guidelines** should be followed, see Appendix C

Description

A Dry Well, sometimes called a Seepage Pit, is a subsurface storage facility that temporarily stores and infiltrates stormwater runoff from the roofs of structures. Roof leaders connect directly into the Dry Well, which may be either an excavated pit filled with uniformly graded aggregate wrapped in geotextile or a prefabricated storage chamber or pipe segment. Dry Wells discharge the stored runoff via infiltration into the surrounding soils. In the event that the Dry Well is overwhelmed in an intense storm event, an overflow mechanism (surcharge pipe, connection to larger infiltration area, etc.) will ensure that additional runoff is safely conveyed downstream.

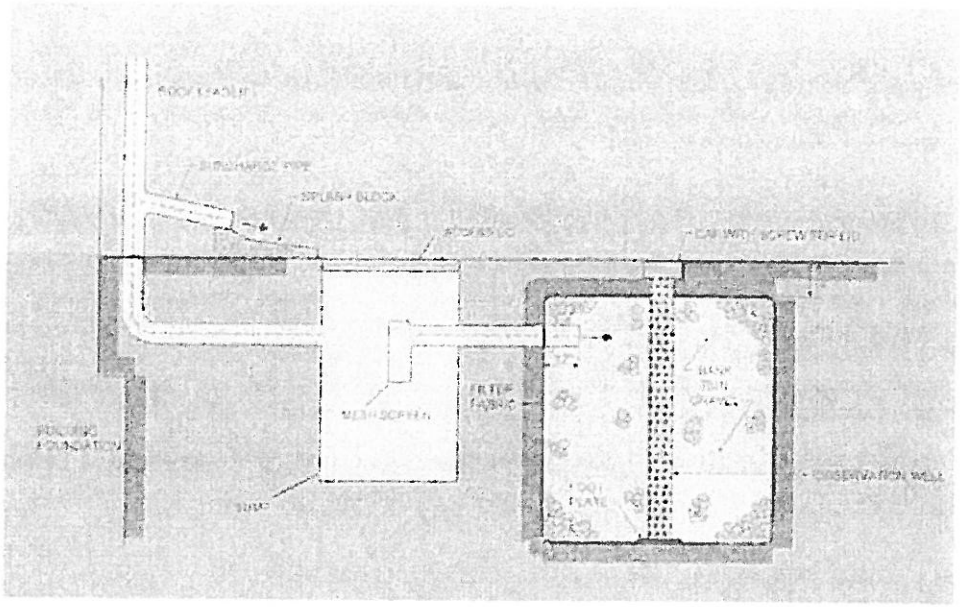
By capturing runoff at the source, Dry Wells can dramatically reduce the increased volume of stormwater generated by the roofs of structures. Though roofs are generally not a significant source of runoff pollution, they are still one of the most important sources of new or increased runoff volume from developed areas. By decreasing the volume of stormwater runoff, Dry Wells can also reduce runoff rate and improve water quality. As with other infiltration practices, Dry Wells may not be appropriate for "hot spots" or other areas where high pollutant or sediment loading is expected without additional design considerations. Dry Wells are not recommended within a specified distance to structures or subsurface sewage disposal systems. (see Appendix C, Protocol 2)

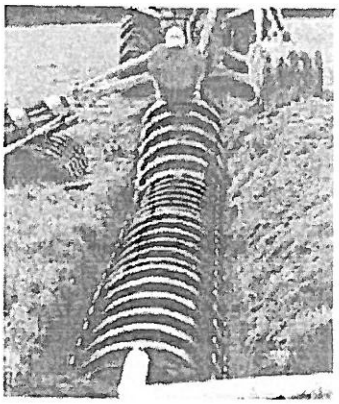


Variations

Intermediate "Sump" Box – Water can flow through an intermediate box with an outflow higher to allow the sediments to settle out. Water would then flow through a mesh screen and into the dry well.

Drain Without Gutters – For structures without gutters or downspouts, runoff is designed to sheetflow off a pitched roof surface and onto a stabilized ground cover (surface aggregate, pavement, or other means). Runoff is then directed toward a Dry Well via stormwater pipes or swales.





Prefabricated Dry Well – There are a variety of prefabricated, predominantly plastic subsurface storage chambers on the market today that can replace aggregate Dry Wells. Since these systems have significantly greater storage capacity than aggregate, space requirements are reduced and associated costs may be defrayed. Provided the following design guidelines are followed and infiltration is still encouraged, prefabricated chambers can prove just as effective as standard aggregate Dry Wells.

Applications

Any roof or impervious area with relatively low sediment loading

Design Considerations

1. Dry Wells are sized to temporarily retain and infiltrate stormwater runoff from roofs of structures. A dry well usually provides stormwater management for a limited roof area. Care should be taken not to hydraulically overload a dry well based on bottom area and drainage area. (See Appendix C, Protocol 2 for guidance)

2. Dry Wells should drain-down within the guidelines set in Chapter 3. Longer drain-down times reduce Dry Well efficiency and can lead to anaerobic conditions, odor and other problems.

3. Dry Wells typically consist of 18 to 48 inches of clean washed, uniformly graded aggregate with 40% void capacity (AASHTO No. 3, or similar). Dry Well aggregate is wrapped in a nonwoven geotextile, which provides separation between the aggregate and the surrounding soil. At least 12 inches of soil is then placed over the Dry Well. An alternative form of Dry Well is a subsurface, prefabricated chamber. A variety of prefabricated Dry Wells are currently available on the market.

4. Dry Wells are not recommended when their installation would create a significant risk for basement seepage or flooding. In general, 10 feet of separation is recommended between Dry Wells and building foundations. However, this distance may be shortened at the discretion of the designer. Shorter separation distances may warrant an impermeable liner to be installed on the building side of the Dry Well.

5. All Dry Wells should be able to convey system overflows to downstream drainage systems. System overflows can be incorporated either as surcharge (or overflow) pipes extending from roof leaders or via connections to more substantial infiltration areas.

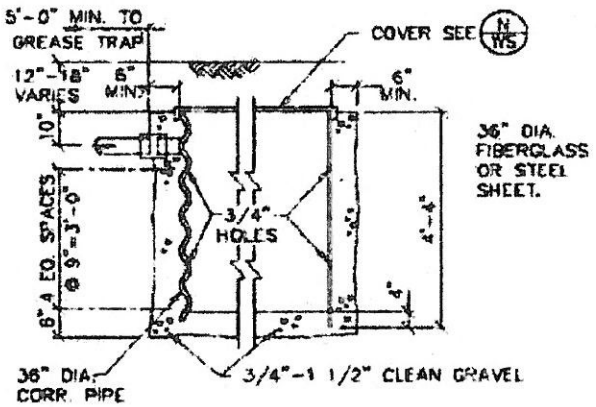
6. The design depth of a Dry Well should take into account frost depth to prevent frost heave.

7. A removable filter with a screened bottom should be installed in the roof leader below the surcharge pipe in order to screen out leaves and other debris.

8. Adequate inspection and maintenance access to the Well should be provided. Observation wells not only provide the necessary access to the Well, but they also provide a conduit through which pumping of stored runoff can be accomplished in case of slowed infiltration.

9. Though roofs are generally not a significant source of runoff pollution, they can still be a source of particulates and organic matter, as well as sediment and debris during construction. Measures such as roof gutter guards, roof leader clean-out with sump, or an intermediate sump box can provide pretreatment for Dry Wells by minimizing the amount of sediment and other particulates that may enter it.

NOTE:
1. FABRICATE FROM 12 GA. STEEL SHEET, 12 GA. CORR. PIPE (STEEL OR ALUM.) OR 1/4" FIBERGLASS
2. STEEL OPTIONS SHALL BE GALV. AFTER FABRICATION.
3. MIN. PERFORATIONS - 4 ROWS OF 3/4" HOLES, 8 HOLES PER ROW, ALL OPTIONS.



SEEPAGE PIT F/WS
SCALE: 1"=1'-0" S1-120 3-28-88

Detailed Stormwater Functions

Volume Reduction Calculations
The storage volume of a Dry Well is defined as the volume beneath the discharge invert. The following equation can be used to determine the approximate storage volume of an aggregate Dry Well:

Dry Well Volume = Dry well area (sf) x Dry well water depth (ft) x 40% (if stone filled)

Infiltration Area: A dry well may consider both bottom and side (lateral) infiltration according to design.

Peak Rate Mitigation Calculations
See Chapter 8 for corresponding peak rate reduction.

Water Quality Improvement
See Chapter 8

Construction Sequence

1. Protect infiltration area from compaction prior to installation.
2. If possible, install Dry Wells during later phases of site construction to prevent sedimentation and/or damage from construction activity.
3. Install and maintain proper Erosion and Sediment Control Measures during construction as per the Pennsylvania Erosion and Sediment Pollution Control Program Manual (March 2000, or latest edition).
4. Excavate Dry Well bottom to a uniform, level uncompacted subgrade free from rocks and debris. Do NOT compact subgrade. To the greatest extent possible, excavation should be performed with the lightest practical equipment. Excavation equipment should be placed outside the limits of the Dry Well.
5. Completely wrap Dry Well with nonwoven geotextile. (If sediment and/or debris have accumulated in Dry Well bottom, remove prior to geotextile placement.) Geotextile rolls should overlap by a minimum of 24 inches within the trench. Fold back and secure excess geotextile during stone placement.
6. Install continuously perforated pipe, observation wells, and all other Dry Well structures. Connect roof leaders to structures as indicated on plans.
7. Place uniformly graded, clean-washed aggregate in 6-inch lifts, lightly compacting between lifts.
8. Fold and secure nonwoven geotextile over trench, with minimum overlap of 12-inches.
9. Place 12-inch lift of approved Topsoil over trench, as indicated on plans.
10. Seed and stabilize topsoil.
11. Connect surcharge pipe to roof leader and position over splashboard.

12. Do not remove Erosion and Sediment Control measures until site is fully stabilized.

Maintenance Issues

As with all infiltration practices, Dry Wells require regular and effective maintenance to ensure prolonged functioning. The following represent minimum maintenance requirements for Dry Wells:

- Inspect Dry Wells at least four times a year, as well as after every storm exceeding 1 inch.
- Dispose of sediment, debris/trash, and any other waste material removed from a Dry Well at suitable disposal/recycling sites and in compliance with local, state, and federal waste regulations.
- Evaluate the drain-down time of the Dry Well to ensure the maximum time of 72 hours is not being exceeded. If drain-down times are exceeding the maximum, drain the Dry Well via pumping and clean out perforated piping, if included. If slow drainage persists, the system may need replacing.
- Regularly clean out gutters and ensure proper connections to facilitate the effectiveness of the dry well.
- Replace filter screen that intercepts roof runoff as necessary.
- If an intermediate sump box exists, clean it out at least once per year.

Cost Issues

The construction cost of a Dry Well/Seepage Pit can vary greatly depending on design variability, configuration, location, site-specific conditions, etc. Typical construction costs in 2003 dollars range from $4 - $9 per cubic foot of storage volume provided (SWRPC, 1991; Brown and Schueler, 1997). Annual maintenance costs have been reported to be approximately 5 to 10 percent of the capital costs (Schueler, 1987). The cost of gutters is typically included in the total structure cost, as opposed

Specifications

The following specifications are provided for information purposes only. These specifications include information on acceptable materials for typical applications, but are by no means exclusive or limiting. The designer is responsible for developing detailed specifications for individual design projects in accordance with the project conditions.

1. **Stone** for infiltration trenches shall be 2-inch to 1-inch uniformly graded coarse aggregate, with a wash loss of no more than 0.5%, AASHTO size No. 3 per AASHTO Specifications, Part I, 19th Ed., 1998, or later and shall have voids 40% as measured by ASTM-C29.

2. **Nonwoven Geotextile** shall consist of needled nonwoven polypropylene fibers and meet the following properties:
   a. Grab Tensile Strength (ASTM-D4632) ³ 120 lbs
   b. Mullen Burst Strength (ASTM-D3786) ³ 225 psi
   c. Flow Rate (ASTM-D4491) ³ 95 gal/min/ft^2
   d. UV Resistance after 500 hrs (ASTM-D4355) ³ 70%
   e. Heat-set or heat-calendared fabrics are not permitted
      Acceptable types include Mirafi 140N, Amoco 4547, and Geotex 451.

3. Topsoil See Appendix C

4. Pipe shall be continuously perforated, smooth interior, with a minimum inside diameter of 4-inches. High-density polyethylene (HDPE) pipe shall meet AASHTO M252, Type S or AASHTO M294, Type S. 12 gauge aluminum or corrugated steel pipe may be used in seepage pits.

5. Gutters and splashboards shall follow Manufacturer's specifications.

References

New Jersey Department of Environmental Protection. *New Jersey Stormwater Best Management Practices Manual.* 2004.

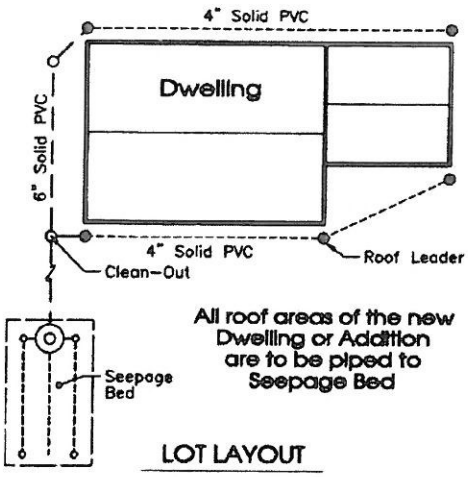
New York Department of Environmental Conservation. *New York State Stormwater Management Design Manual.* 2003.

French Drains. http://www.unexco.com/french.html . 2004.

SWRPC, The Use of of Best Management Practices(BMPs) in Urban Watersheds, US Environmental Protection Agency,1991.

Brown and Schueler, *Stormwater Management Fact Sheet: Infiltration Trench.* 1997.

Schueler, T., 1987. *Controlling urban runoff: a practical manual for planning and designing urban BMPs*, Metropolitan Washington Council of Governments, Washington, DC

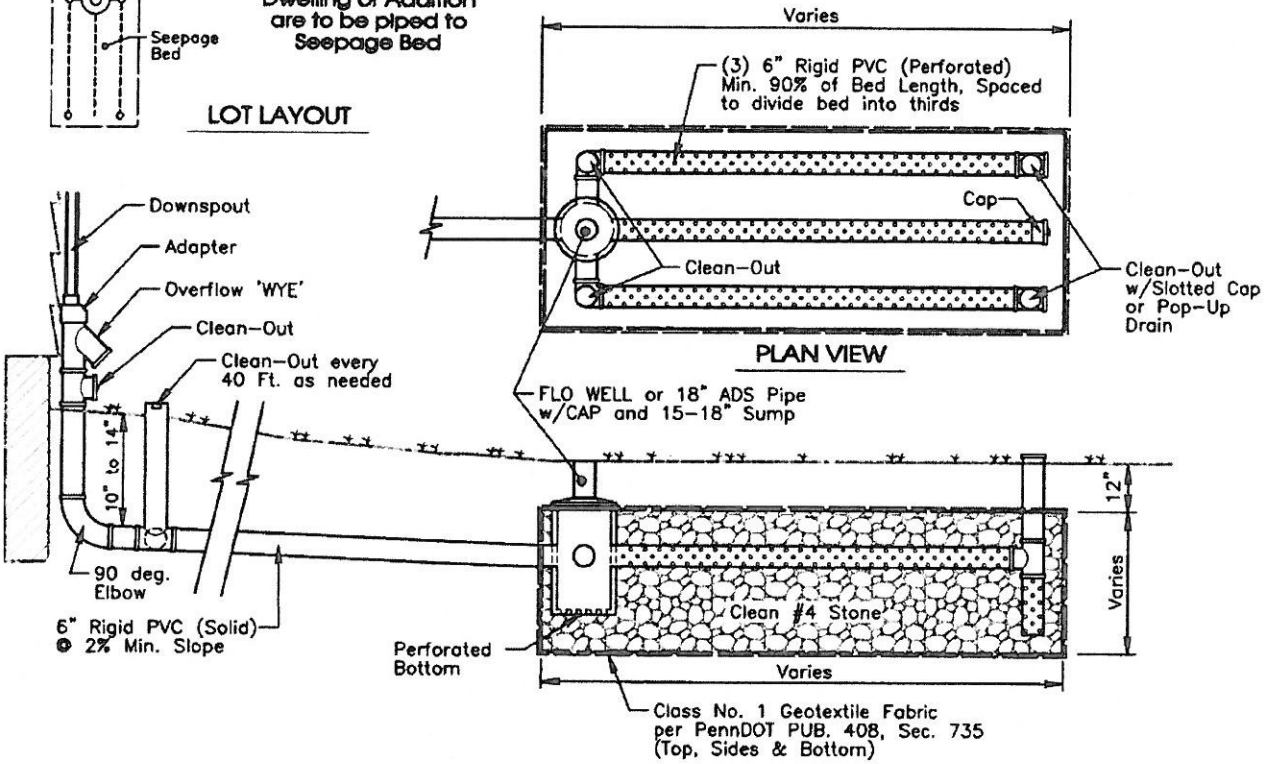


All roof areas of the new Dwelling or Addition are to be piped to Seepage Bed

LOT LAYOUT

Notes:

1. This is a suggested method to recharge groundwater and now assumes a percolation rate.
2. The designer is welcome to come up with other solutions.
3. Seepage Bed location(s) to be approved by the Township Engineer.
4. 1st Inspection – Hole with fabric installed (Min 24 hours notice). Final Inspection – Stone and Pipe Installed.



SECTION VIEW

Default Seepage Bed Sizing Standards (Table 72-10.A)					
For 2-year 24-hour storm event (3.2 inches)					
New Impervious Coverage (Sq. Ft.)	Required Storage Volume (Cu. Ft.)	Required Seepage Bed Volume (Cu. Ft.)	3' Deep Bed Size	4' Deep Bed Size	5' Deep Bed Size
≤ 300	80.00	200.00	10' x 7'	10' x 5'	10' x 4'
≤ 400	106.67	266.67	12' x 8'	10' x 7'	9' x 6'
≤ 500	133.33	333.33	12' x 10'	12' x 7'	10' x 7'
≤ 600	160.00	400.00	13' x 11'	10' x 10'	10' x 8'
≤ 700	186.67	466.67	16' x 10'	12' x 10'	12' x 8'
≤ 800	213.33	533.33	16' x 12'	14' x 10'	11' x 10'
≤ 900	240.00	600.00	20' x 10'	15' x 10'	12' x 10'
up to 1000	266.67	666.67	23' x 10'	17' x 10'	14' x 10'

DOWNSPOUT SEEPAGE BED DETAIL

Not To Scale

Stormwater Management Detail

Figure 72-10.A
Seepage Bed Design

Scale: N.T.S. | Date: 02/08/2010 | Detail ID: 72-10.A

EAST NORRITON TOWNSHIP
2501 Stanbridge Street
East Norriton - Pennsylvania 19401-1616
Phone: (610) 275-2800 Fax: (610) 277-1879

STORMWATER BEST MANAGEMENT PRACTICES (BMPs) AND CONVEYANCES OPERATIONS AND MAINTENANCE AGREEMENT

THIS AGREEMENT, made and entered into this _____ day of _____, 20___, by and between _____, (hereinafter the "Landowner"), and the Township of East Norriton, Montgomery County, Pennsylvania, (hereinafter "Municipality");

WITNESSETH

WHEREAS, the Landowner is the owner of certain real property as recorded by deed in the land records of Montgomery County, Pennsylvania, Deed Book _____ and Page _____, (hereinafter "Property").

WHEREAS, the Landowner is proceeding to build and develop the Property; and

WHEREAS, the Stormwater Controls and BMP Operations and Maintenance Plan approved by the Municipality (hereinafter referred to as the "O&M Plan") for the property identified herein, which is attached hereto as Appendix A and made part hereof, provides for management of stormwater within the confines of the Property through the use of Best Management Practices (BMPs) and conveyance(s); and

WHEREAS, the Municipality and the Landowner, for itself and its administrators, executors, successors, heirs, and assigns, agree that the health, safety, and welfare of the residents of the Municipality and the protection and maintenance of water quality require that on-site stormwater Best Management Practices (BMPs) and conveyance(s) be constructed and maintained on the Property; and

WHEREAS, for the purposes of this agreement, the following definitions shall apply:

> **BMP – "Best Management Practice"** - Those activities, facilities, designs, measures or procedures used to manage stormwater impacts from land development, to meet state water quality requirements, to promote groundwater recharge, and otherwise meet the purposes of the Municipality's Stormwater Management Ordinance. BMPs may include, but are not limited to, a wide variety of practices and devices, from large-scale retention ponds and constructed wetlands to small-scale underground treatment systems, infiltration facilities, filter strips, low impact design, bioretention, wet ponds, permeable paving, grassed swales, riparian or forested buffers, sand filters, detention basins, manufactured devices, and operational and/or behavior-related practices that attempt to minimize the contact of pollutants with stormwater runoff. The BMPs identified in the O&M Plan are permanent appurtenances to the Property; and
>
> **Conveyance** - As specifically identified in the O&M Plan, a man-made, existing or proposed facility, structure or channel used for the transportation or transmission of stormwater from one place to another, including pipes, drainage ditches, channels and swales (vegetated and other), gutters, stream channels, and like facilities or features. The conveyances identified in the O&M Plan are permanent appurtenances to the Property; and

WHEREAS, the Municipality requires, through the implementation of the O&M Plan, that stormwater management BMP(s) and conveyance(s), as required by said O&M Plan and the Municipal Stormwater Management Ordinance, be constructed and adequately inspected, operated and maintained by the Landowner, his successors in interest, heirs, and assigns.

NOW, THEREFORE, in consideration of the foregoing promises, the mutual covenants contained herein, and the following terms and conditions, the parties hereto, intending to be legally bound hereby, agree as follows:

1. The Landowner shall construct the BMP(s) and conveyance(s) in accordance with the plans and specifications identified in the O&M Plan, which is attached hereto as Appendix A

   Titled _____

   _____

   Dated _____ Last Revised _____

2. The Landowner shall inspect, operate and maintain the BMP(s) and conveyance(s) as shown on the O&M Plan in good working order acceptable to the Municipality and in accordance with the specific inspection and maintenance requirements noted on the O&M Plan.

3. The Landowner hereby grants permission to the Municipality, its authorized agents and employees, to enter upon the property, at reasonable times and upon presentation of proper identification, to inspect the BMP(s) and conveyance(s) whenever it deems necessary for compliance with this Agreement, the O&M Plan and the Municipality's Stormwater Management Ordinance. Whenever possible, the Municipality shall notify the Landowner prior to entering the property.

4. In the event the Landowner fails to operate and maintain the BMP(s) and conveyance(s) as shown on the O&M Plan in good working order acceptable to the Municipality, the Municipality or its representatives may enter upon the Property and take whatever action is deemed necessary to maintain said BMP(s) and conveyance(s). This provision shall not be construed to allow the Municipality to erect any permanent structure on the land of the Landowner. It is expressly understood and agreed that the Municipality is under no obligation to maintain or repair said facilities, and in no event shall this Agreement be construed to impose any such obligation on the Municipality.

5. In the event the Municipality, pursuant to this Agreement, performs work of any nature, or expends any funds in performance of said work for labor, use of equipment, supplies, materials, and the like, the Landowner shall reimburse the Municipality for all expenses (direct and indirect) incurred within thirty (30) days of receipt of invoice from the Municipality.

6. The intent and purpose of this Agreement is to ensure the proper maintenance of the BMP(s) and conveyance(s) by the Landowner; provided, however, that this Agreement shall not be deemed to create or effect any additional liability of any party for damage alleged to result from or be caused by stormwater runoff.

7. The Landowner, its executors, administrators, assigns, heirs, and other successors in interests, shall release the Municipality's employees and designated representatives from all damages, accidents, casualties, occurrences or claims which might arise or be asserted against said employees and representatives from the construction, presence, existence, or maintenance of the BMP(s) and conveyance(s) by the Landowner or Municipality. In the event that a claim is asserted or threatened against the Municipality, its designated representatives or employees, the Municipality shall promptly notify the Landowner, and the Landowner shall defend, at his own expense, any suit based on the claim. If any judgment or claims against the Municipality's employees or designated

representatives shall be allowed, the Landowner shall pay all costs and expenses regarding said judgment or claim.

8. The Municipality shall inspect the BMP(s) and conveyance(s) at a minimum of once every three (3) years to ensure their continued functioning.

9. Failure or delay in enforcing any provision of this Agreement shall not constitute a waiver by the Municipality of its rights of enforcement hereunder.

10. The Landowner shall inform future buyers of the Property about the function of, operation, inspection and maintenance requirements of the BMP(s) and conveyance(s) prior to the purchase of the Property by said future buyer, and upon purchase of the Property the future buyer assumes all responsibilities as Landowner and must comply with all components of this Agreement.

This Agreement shall be recorded at the Office of the Recorder of Deeds of Montgomery County, Pennsylvania, and shall constitute a covenant running with the Property and/or equitable servitude, and shall be binding on the Landowner, his administrators, executors, assigns, heirs and any other successors in interests, in perpetuity.

ATTEST:

WITNESS the following signatures and seals:

(SEAL) For the Municipality: _____

(SEAL) For the Landowner(s): _____

_____

ATTEST:

_____ (City, Borough, Township)

County of _____, Pennsylvania

I, _____, a Notary Public in and for the County and State aforesaid, whose commission expires on the _____ day of _____, 20__, do hereby certify that _____ whose name(s) is/are signed to the foregoing Agreement bearing date of the _____ day of _____, 20__, has acknowledged the same before me in my said County and State.

GIVEN UNDER MY HAND THIS _____ day of _____, 20__.

_____ _____

NOTARY PUBLIC (SEAL)