

Lititz Borough
Stormwater Small Project Guidance Document

Revised: 2/17/21

Small Project Guidance Document and Worksheets

Introduction

If you are considering a relatively small construction project on your property that creates new impervious area and you need to manage the stormwater that is generated, this document will guide you through the appropriate process required by the Borough. Some general background information is provided below, prior to reviewing the necessary requirements for the Borough.

What is Stormwater?

Stormwater **runoff** is precipitation (rain or snowmelt) that flows across the land. Stormwater may be absorbed by the ground, flow directly into streams, bodies of water and drainage inlets, or evaporate back into the atmosphere. In nature, most precipitation is absorbed by trees and plants, or infiltrates into the ground, which results in consistent stream flow and good water quality. However, in the built environment, runoff is redirected. Precipitation that falls on a roof, driveway, patio (impervious areas) or lawn, runs off the surface more rapidly. This water runoff picks up pollutants as it moves along.

Stormwater Can Be a Problem!

If runoff is not managed or controlled, it can be a problem. These potential problems include:

- *Flooding*-When runoff moves more rapidly over the surface of the built environment, large volumes of water quickly reach streams causing them to rise faster than normal. When more impervious areas exist, flooding can occur more rapidly and more severely, sometimes resulting in damage to both property and people.
- *Pollution*-When runoff moves over the surface of the built environment, it picks up pollutants such as oil, fertilizers, pesticides, bare soil/sediment, trash, and animal waste. When these pollutants are carried by the runoff to local streams without having any treatment, they pollute our waters.
- *Streambank Erosion*-When runoff flows into streams at a higher volume and speed due to the built environment, it can cause severe stream bank erosion. Erosion can reduce the amount of streamside property, create dangerous situations, and damage natural habitat for fish and other aquatic life. Erosion also causes water pollution.
- *Threats to Human Health*-When runoff picks up pollutants from the built environment, it can carry toxic elements from metals, organic compounds, bacteria and viruses. Polluted stormwater can contaminate drinking water, impact recreational activities, as well as threaten fish and other aquatic life.

A homeowner can help to avoid the problems associated with runoff by managing or controlling runoff as follows:

- Reduce impervious area to allow more precipitation to soak into the ground
- Install plantings which help to infiltrate stormwater, and increase evaporation and transpiration.
- Install stormwater management controls such as rain barrels, rain gardens, etc.

Completing the Worksheets and Developing a Small Project Application

Pages 3-6 of this document include the worksheets, tables, and checklists that shall be completed to support the Exemption/Small Project Application. The rest of the document includes more detailed instructions for each step, examples, BMP sizing charts, and related supporting information. The steps required for completing the Exemption/Small Project Application include:

- Step 1:** Prepare a site plan
- Step 2:** Determine the amount of proposed impervious area for your project
- Step 3:** Determine the amount of new and **cumulative** impervious area. This step entails adding any previously added impervious areas after April 29, 2014, whether an Exemption was previously granted or not.
- Step 4:** Determine the review/approval process required for your project. Exemption? Small Project? Or, is a SWM Site Plan required?
- If the total new and cumulative impervious area is less than 500 square feet, you may qualify for an Exemption. If the total new and cumulative impervious area is greater than 2,000 square feet, you do not qualify for an Exemption or a Small Project.
- Step 5:** Determine the total stormwater runoff to be managed for your project.
- Step 6:** Determine any stormwater credits (rain barrels or planting new trees) you may claim or applies to your project.
- Step 7:** Determine the remaining stormwater runoff to be managed (if any) after applying any stormwater credits.
- Step 8:** Consider and select stormwater management BMPs for your project.
- Step 9:** Organize Small Project Application and submit to the Borough
- * NOTE:** **Once the worksheet pages (pages 3-6) are completed, the worksheet pages should be attached (Review Step 9 for Checklist of items to include along with any other attachments that may be called for or required as a result of each step) to the Exemption/Small Project Application (Appendix 4 of the Stormwater Management Ordinance).**

Step 1: Prepare a Site Plan (see Page 7)

- ☐ Minimum 8.5 x 11 inch site plan that depicts the information required in the checklist and under the instructions and examples section for Step 1 on Page 7.

Step 2: Determine the amount of proposed impervious area for your project (see Page 8)

Enter the total proposed new impervious area for your project into the following table:

| PROPOSED IMPERVIOUS AREA | | | | | |
|---|-------------|---|------------|---|------------------------------------|
| Surface | Length (ft) | x | Width (ft) | = | Impervious Area (ft ²) |
| Buildings/Structures | | x | | = | |
| Driveway/Patios/ Walkways/Other | | x | | = | |
| Total Proposed Impervious Surface Area (Sum of all impervious areas) | | | | | |

Step 3: Determine the amount of new and cumulative impervious area (see Page 9)

Enter the proposed impervious area from Step 2 above **AND** previously installed impervious area added after April 29, 2014, whether an Exemption was granted previously or not.

| PROPOSED AND CUMULATIVE IMPERVIOUS AREA | | | | |
|---|---|---|---|--|
| Proposed Impervious Area (ft ²) (from Step 2) | + | Previous Impervious Area (ft ²) | = | Total Impervious Area (ft ²) |
| | + | | = | |

Step 4: Determine the review/approval process required for your project (see Page 9)

Select the appropriate option based on the calculated under Step 3 for total impervious surface area.

| <input type="checkbox"/> <i>Option 1</i> | <input type="checkbox"/> <i>Option 2</i> | <input type="checkbox"/> <i>Option 3</i> |
|--|---|--|
| Total new and cumulative impervious surface area is less than or equal to 500 ft ² | Total new and cumulative impervious area is more than 500 ft ² and less than 2,000 ft ² | Total new and cumulative impervious surface area is greater than 2,000 ft ² |
| STOP! | Continue on to Step 5 | STOP! |
| Complete the Exemption/Small Project Application (Appendix 4 of the Stormwater Management Ordinance), sign the Acknowledgement, attach this document and site plan, and return to the Borough. | Your project is considered a Small Project. | Your project does not qualify for an exemption or is not considered a Small Project. A Stormwater Management (SWM) Site Plan will be required. |

Step 5: Determine the total stormwater runoff to be managed for your project (see Page 10)

| TOTAL VOLUME OF RUNOFF TO BE MANAGED | | | | |
|--|---|-------------------|---|---------------------------------|
| Total Impervious Area (ft ²) (from Step 3) | x | Conversion Factor | = | Total Runoff (ft ³) |
| | x | 0.0833 | = | |

Step 6: Determine any credits you may claim or applies to your project (see Page 10)

Select one or more of the following options and follow the instructions under selected options.

| | |
|--|--|
| <input type="checkbox"/> <i>Option 1</i> | <input type="checkbox"/> <i>Option 2</i> |
| Tree Planting Credit | Rain Barrel Credit |
| Enter the number of new trees to be planted in Row 2 in the table below to calculate the total credit. | If a rain barrel is selected and installed, enter 5 ft ³ in Row 3 under "Runoff Credit" in the table below. |

Based on the option(s) selected for stormwater credits in the table above, complete the following **Step 6 Summary Table** to determine the total stormwater credits that may be applied to your project/property:

| STORMWATER CREDITS | | | | | | |
|---------------------------------|----------------------|---|---|--------|---|---------------------|
| Row # | Option | # | X | Units | = | Runoff Credit (ft³) |
| 1 | Tree Planting Credit | | X | 10 ft³ | = | |
| 2 | Rain Barrel Credit | | | | | |
| Total Stormwater Credits in ft³ | | | | | | |

Step 7: Determine the remaining stormwater runoff to be managed (see Page 14)

| VOLUME OF RUNOFF REMAINING TO BE MANAGED | | | | |
|---|---|----------------------------------|---|-------------------------------------|
| Total Runoff (ft ³) (from Step 5) | - | Stormwater Credits (from Step 6) | = | Remaining Runoff (ft ³) |
| | - | | = | |

- ☐ Remaining runoff > 0 ft³, continue to Step 8.
- ☐ Remaining runoff = 0 ft³, skip Step 8 and go to Step 9.

Step 8: Consider and select stormwater management BMPs for your project (see Page 15)

| SELECTED STORMWATER MANAGEMENT BMPs | | | | |
|-------------------------------------|---------------------|-------------|------------|------------|
| Option Selected | BMP | Length (ft) | Width (ft) | Depth (ft) |
| <input type="checkbox"/> | Rain Garden | | | |
| <input type="checkbox"/> | Infiltration Trench | | | |
| <input type="checkbox"/> | Dry Well | | | |
| <input type="checkbox"/> | Pervious Pavers | | | |
| <input type="checkbox"/> | Stone/Seepage Bed | | | |
| <input type="checkbox"/> | Other: | | | |
| <input type="checkbox"/> | Other: | | | |

Additional steps after stormwater management BMPs are selected:

- ☐ BMP(s) located and shown on site plan
- ☐ Flow paths to BMP(s) shown on site plan (if multiple BMPs are selected, flow paths shown from new impervious areas to be managed by which BMPs)
- ☐ Planting plan and/or plant list created if using a rain garden and/or vegetated swale
- ☐ Organize and develop an Operation and Maintenance (O&M) Plan for the BMPs

Step 9: Organize Small Project Application and submit to the Borough (see Page 27)

- ☐ Complete the Exemption/Small Project Application (Appendix 4 of the Stormwater Management Ordinance) and sign the Acknowledgement.
- ☐ Attach a completed Small Project Guidance Document and Worksheets document (this document) to the completed Exemption/Small Project Application.
- ☐ Attach a minimum 8.5 x 11 inch site plan that depicts the information required in the checklist and under the instructions and examples section for Step 1 to the completed Exemption/Small Project Application.
- ☐ Include a detail of the specific BMP to be installed using the example details included in this package (pages 16-25). The detail shall show length, width and depth dimensions of the proposed BMP. Also, provide the distance from the BMP to existing and/or proposed

buildings. For example, if a Dry Well will be installed, include pages 20-21 and provide the dimensions on the detail.

- ☐ Attach a planting plan and/or plant list (if applicable – see Step 7) to the completed Exemption/Small Project Application.
- ☐ Complete a Zoning Permit Application.
- ☐ Determine the Application filing fee.
- ☐ Submit a complete package (Exemption/Small Project Application and attachments, Zoning Permit Application, and filing fee).

What happens next?

After submitting your permit application for review, either your application will be approved and a permit will be issued or your application will require revisions to meet ordinance standards. Following are the steps to follow after submitting your permit application.

Permit Application Revisions Required

- Revise permit application information as required by comments provided by Borough staff.
- Resubmit permit application for review.

Permit Application Approved

- Complete and submit to the Borough the Small Projects Operation and Maintenance (O&M) Agreement, including Notarization. The applicant shall record O&M agreement with attached site plan and BMP information, at the Lancaster County Recorder of Deeds office. Documentation of recording shall be provided to the Borough.
- Borough then provides a copy of approved permit to applicant.
- Contact the Borough to perform a final inspection following BMP installation and prior to receipt of a Certificate of Use and Occupancy.
- Following BMP installation, perform periodic maintenance. See Appendix A for BMP maintenance requirements.

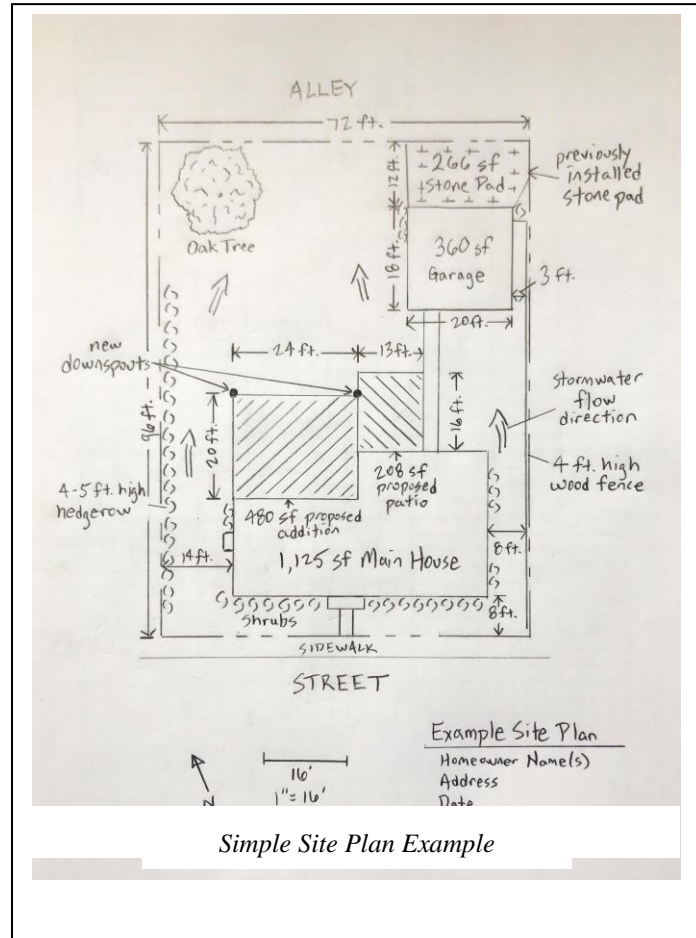
INSTRUCTIONS AND EXAMPLES

Step 1: Prepare a Site Plan

A Site Plan illustrates the existing and proposed features of a property including both pervious and impervious areas. Depicting the relationship between the proposed improvements and existing features such as property lines, bodies of water and vegetated areas will help determine if the stormwater runoff created by the proposed project can be managed naturally within the property itself, or if additional stormwater best management practices (manmade BMPs) are needed to accommodate the proposed runoff.

You may be able to find useful mapping information on your property tax assessment, deed of your house, or by utilizing Bing Maps. A Site Plan organized on 8.5 x 11 inch (minimum) paper will illustrate key feature of the site; shall be drawn by hand or computer, and prepared to scale showing:

- The date of the plan
- North arrow
- Property boundary
- Location of all existing and proposed structures (house, shed, home addition etc.) and any proposed downspouts. The size of the proposed features shall be shown by providing dimensions.
- Site conditions (grassed areas, agricultural fields, direction of slope and stormwater flow/runoff on the property).
- Existing and proposed driveways, pathways and other impervious areas (stone and gravel driveways and walkways are considered impervious).
- Natural features such as streams, wetlands, tree lines and other vegetation on the property and within 50 feet of the property line.
- Location, orientation and size of wells and on-site septic systems



Property boundaries can be determined several ways:

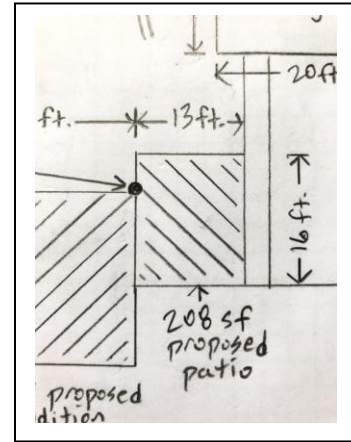
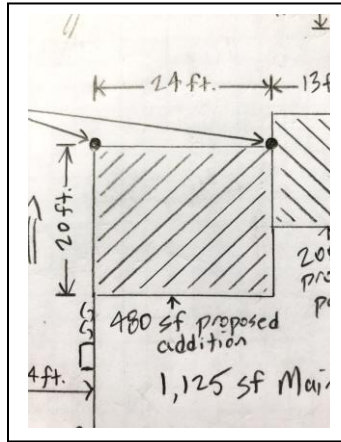
- Check for existing markers or monuments at the corners of your property.
- Access records and data from the Lancaster County Recorder of Deeds (<http://lancasterdeeds.com/>) and the **LanCo View Application** from the Lancaster County GIS Division (<https://co.lancaster.pa.us/143/GIS-Division>).
- Engage with a professional surveyor.

Step 2: Determine the amount of proposed impervious area for your proposed project.

The amount of stormwater runoff that will be generated from your proposed project is the **additional** amount of rain or snowmelt that will flow across your land after the proposed project is constructed. In order to do so, you will need to determine how much impervious area is being created by your project. Impervious areas are hard surfaces that prevent stormwater from soaking into the ground. They include buildings/structures, parking areas, walkways, decks, patios or other hard surfaces.

Using the *Simple Site Plan Example* shown under Step 1, there are two areas of proposed additions to existing conditions:

- A 480 square foot (sf) building addition to the main house (left picture)
- A new patio covering 208 sf between the garage area and main house (right picture).



From the *Simple Site Plan Example* completed under Step 1, the length and width of the different types of new additions/imperious surfaces are entered into the Step 2 table:

| PROPOSED IMPERVIOUS AREA | | | | | |
|---|-------------|---|------------|---|------------------------------------|
| Surface | Length (ft) | x | Width (ft) | = | Impervious Area (ft ²) |
| Buildings | 20 | x | 24 | = | 480 |
| Driveway | | x | | = | |
| Patios/ walkways | 16 | x | 13 | = | 208 |
| Other | | x | | = | |
| Total Proposed Impervious Surface Area (Sum of all impervious areas) | | | | | 688 |

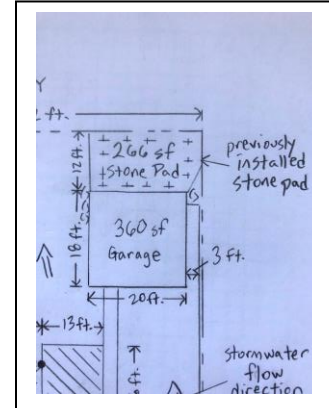
See Explanation of Cumulative Impervious Surface Area for previously added impervious areas to determine total runoff to be considered and managed.

Step 3: Determine the amount of new and cumulative impervious area

Cumulative impervious surface area is the total increase in added impervious surface areas to the property since April 29, 2014.

Using the *Simple Site Plan Example*:

- Previously, a 266 sf stone pad was added after April 29, 2014 and is called out on the *Simple Site Plan Example*. An Exemption was previously granted for the stone pad (since the added stone pad was less than 500 sf).
- Together, the proposed building and patio additions along with the previous 266 sf stone pad would be the total cumulative impervious area for the property.
- The proposed and previous impervious areas are listed in the Step 3 table to calculate the total impervious area:



| PROPOSED AND CUMULATIVE IMPERVIOUS AREA | | | | |
|---|---|---|---|--|
| Proposed Impervious Area (ft ²) (from Step 2) | + | Previous Impervious Area (ft ²) | = | Total Impervious Area (ft ²) |
| 688 | + | 266 | = | 954 |

Step 4: Determine the review/approval process required for your project.

Utilize the total impervious surface area to be managed from Step 3 to determine which approval category below your proposed project falls under:

- I. If the total new and cumulative impervious surface area is **less than or equal to 500 ft²**, the project is exempt from the requirement to prepare a Small Project Application or Site Plan. Stop and sign the Acknowledgement and complete the PROPOSED IMPERVIOUS AREA chart on the Exemption/Small Project Application (Appendix 4 of the Stormwater Management Ordinance).

OR

- II. If the additional new and cumulative impervious area is more than **500 ft²** and less than **2,000 ft²**, the project is eligible to qualify as a Small Project. Continue to Step 5 to find out how to make an application to the Borough for a Small Project.

OR

- III. If total new and cumulative impervious surface area is **greater than 2,000 ft²**, then a Stormwater Management Plan shall be submitted in accordance with the *Lititz Borough Stormwater Management Ordinance*.

Step 5: Determine the total stormwater runoff to be managed for your project

Estimate how much stormwater will be generated on your property as a result of the proposed project. Estimate the volume of stormwater runoff created by impervious surfaces by using the following equations to obtain stormwater *runoff in cubic feet (ft³)*.

Cubic Feet of Runoff to be Managed:

(ft² of impervious area) x 0.0833 = ft³ of runoff

_____ SF Impervious Area = _____ Cubic Feet to be managed

Using the *Simple Site Plan Example* and the **Total Impervious Surface Area (Sum of all impervious areas)** calculated under Step 3, the worksheet will provide the total volume of runoff to be managed:

| TOTAL VOLUME OF RUNOFF TO BE MANAGED | | | | |
|---|---|-------------------|---|---------------------------------|
| Total Impervious Area (ft ²) (from Step 3) | x | Conversion Factor | = | Total Runoff (ft ³) |
| 954 | x | 0.0833 | = | 79.5 |

Enter the impervious area for your project calculated under Step 2 into the table for Step 4 on Page 4.

Step 6: Determine any credits you may claim or applies to your project

Description:

All or parts of new and cumulative impervious surfaces may qualify for stormwater credits if the property owner chooses to utilize one of the methods listed below. The volume of stormwater that needs to be managed could be reduced through either of the following credits, thereby reducing the required stormwater controls that need to be constructed.

There are two (2) primary DIA credit categories that may be utilized:

- Tree Planting Credit
- Rain Barrel Credit

Both credit categories may be claimed for one project.

Tree Planting Credit

Description:

Trees soak up rain water through their root system. Planting trees can reduce surface water and ground water can be increased.

Recommended Resource

A recommend resource for tree planting and care is *Planting and After Care of Community Trees*, published by the Penn State Cooperative Extension, 2008.
<http://pubs.cas.psu.edu/freepubs/pdfs/uh143.pdf>

Criteria and Calculations:

Planting of new trees may be used to manage a portion of the proposed stormwater volume. First, calculate the cubic feet of stormwater that can be managed by planting new trees. If the criteria below can be met, planting of new trees can be used to manage a portion of the proposed stormwater volume:

Deciduous Trees or Evergreen Trees = 10 ft³ per tree

Criteria:

- Trees must be PA native species. A good resource to assist you in selecting the appropriate tree is the Pennsylvania Native Plant Society <http://www.panativeplantsociety.org/plant-information-and-landscaping.html>
- Trees shall be a minimum 1 inch caliper deciduous tree or a minimum 5 foot tall evergreen tree.
- Trees shall be adequately protected during construction
- No more than 25% of the total required capture volume can be mitigated through the use of trees
- Dead trees shall be replaced by the property owner within 6 months
- Trees have a better chance of survival and require less water if planted between September 15th and May 15th.
- Consider the growing parameters for each tree species when determining location and spacing

Rain Barrel Credit

Description:

Rain barrels are large containers that are typically used to collect drainage from roof gutters or roof leaders and temporarily store non-potable water. The water is then used to irrigate gardens, lawns and landscaped areas, used for car washing, etc. after the rain fall has ended. Rain barrels typically come in sizes ranging from 50 to 100 gallons.

Whenever rain barrels are used, they must make provisions for the following:

- There must be a means to release the stored water in the containers between rain events in order to maintain storage volume at all times.
- Stormwater must be kept from entering other potable systems. Pipes and storage systems must be clearly identified "Do Not Drink".
- An overflow outlet is required a few inches below the top of the storage container with an overflow pipe to divert excess flow away from adjacent structures once the storage container is full.
- Screens and covered lids shall be used at the top opening of the container to filter or block debris and insects from entering the storage chamber.

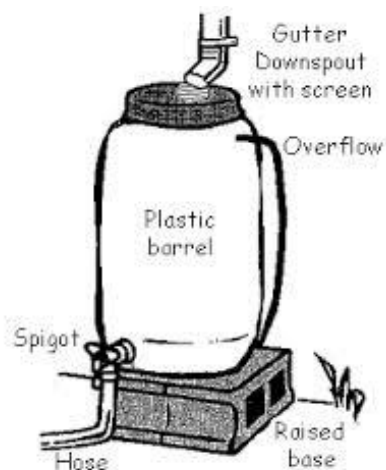
Recommended Resource:

A recommended resource for rain barrels is *Rain Barrel Installation Instructions* published by the Rutgers Cooperative Extension. http://water.rutgers.edu/Stormwater_Management/rainbarrelbrochure.pdf

A recommended resource for both rain barrels and cisterns is *Rainwater Harvesting: Guidance for Homeowners* published by the North Carolina Cooperative Extension.

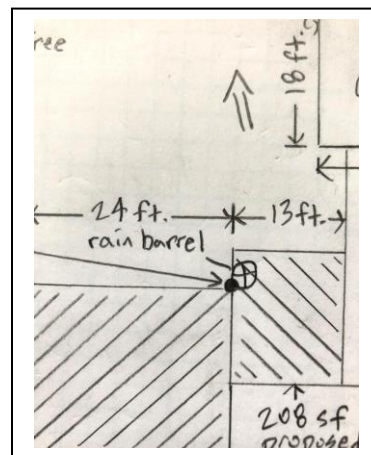
<https://content.ces.ncsu.edu/rainwater-harvesting-guidance-for-homeowners>

If installed properly, a rain barrel can be used to manage a portion of the proposed stormwater volume:



One 50 Gallon Rain Barrel = 5 ft³ credit (maximum of 5 ft³ credit per project)

Using the *Simple Site Plan Example*, we decide to add one (1) 50 gallon rain barrel. The proposed rain barrel is also added to the site plan, and Option 3 is selected and the 5 ft³ credit can be claimed in the tables for Step 6.



The option selection table and Step 6 Summary Table would be completed as follows based on the example:

| | |
|---|---|
| <input type="checkbox"/> Option 1 | <input checked="" type="checkbox"/> Option 2 |
| Tree Planting Credit | Rain Barrel Credit |
| Enter the number of new trees to be planted in Row 2 in the Step 6 Summary Table to calculate the total credit. | If a rain barrel is selected and installed, enter 5 ft ³ in Row 3 under "Runoff Credit" in the Step 6 Summary Table. |

| STORMWATER CREDITS | | | | | | |
|---------------------------------|----------------------|---|---|--------|---|---------------------|
| Row # | Option | # | X | Units | = | Runoff Credit (ft³) |
| 1 | Tree Planting Credit | | X | 10 ft³ | = | |
| 2 | Rain Barrel Credit | | | | | 5 |
| Total Stormwater Credits in ft³ | | | | | | 5 |

Step 7: Determine the remaining stormwater runoff to be managed

After calculating credits, a determination is needed for the volume of runoff remaining to be managed. Using the *Simple Site Plan Example* and examples completed for Step 5 and Step 6, we have the following information entered into the Step 7 table as an example:

| VOLUME OF RUNOFF REMAINING TO BE MANAGED | | | | |
|--|---|-------------------------------------|---|-------------------------------------|
| Total Runoff (ft ³) (from Step 4) | - | Stormwater Credits (from Step 5) | = | Remaining Runoff (ft ³) |
| 79.5 | - | 5 | = | 74.5 |

If the remaining runoff is greater than zero cubic feet (> 0 ft³), then continue to Step 8. If you were able to claim enough credits that the remaining runoff is equal to zero, then skip Step 8 and go to Step 9.

Step 8: Consider and select stormwater management BMPs for your project

Stormwater Management Alternatives/Best Management Practices (BMPs)

Now that you know what areas of your proposed project generate stormwater runoff, and how much runoff each area will generate, you can evaluate stormwater management alternatives and select an alternative(s) that would be most suitable to your project.

Below is a guide to various alternatives for your consideration. Note that each BMP worksheet will contain additional information and criteria for further consideration in selecting a particular type of BMP.

- Tree planting
- Rain Barrel
- Cistern
- Rain Garden

- Vegetated Swale
- Infiltration Trenches
- Drywells
- Pervious Pavers

Additional consideration should be given as to determine the best location to install the best management practice on your property. Below are some general considerations to assist in selecting the appropriate BMP. Contact the Borough if you need help with sizing BMPs.

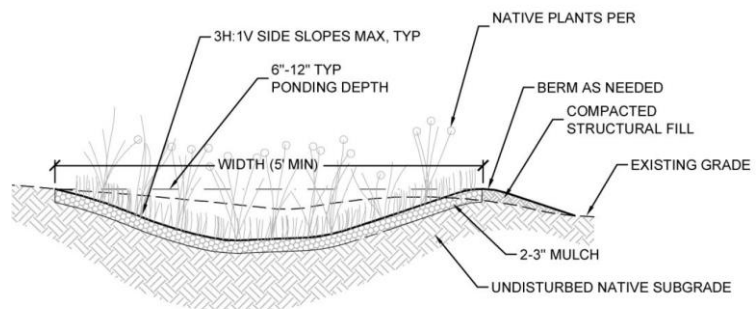
General Considerations in Locating BMPs

- Ponding Water.** Many stormwater BMPs encourage water to infiltrate into the soil. (such as rain gardens, infiltration trenches, pervious pavers). Where water ponds on your property, water is unable to infiltrate. Areas that are often saturated are not appropriate places to put these practices.
- Proximity to foundations.** You should also avoid constructing infiltration practices within 10 feet of building foundations.
- Location of underground utilities.** Do not construct infiltration practices near septic systems or drinking water wells. Also avoid any utilities like electric, cable, water, sewer, and gas lines. (Use the PAONE-CALL system to locate underground utilities prior to planning and constructing your BMP.)
- Slope.** Depending on the practice, a steeper slope may prohibit the location of the BMP, or it may be something that needs to be taken into account during the design stage. Refer to BMP Worksheets.

Rain Garden (Bioretention)

Description:

A **rain garden** is an excavated depression area on the surface of the ground that is planted with native vegetation. This vegetation filters and soaks up the runoff that is directed to the depression. Special soil within the rain garden helps the plants to grow and enables the excess water to be absorbed in the ground.



Rain Garden detail

Key considerations of a rain garden include:

- Maximum recommended depth of one foot
- Native vegetation that tolerates dry and wet conditions – See Appendix B for planting list.

- An adjacent overflow area, where if the rain garden would overflow, the excess runoff would flow over a pervious surface and not cause harm to a nearby property.
- An overflow control device, such as a domed riser, to allow excess flow from large rain events to flow to an overflow area or another BMP, stormwater control device, or pipe.
- Fill layer shall be a minimum of 0.5 feet deep and consist of a blended mixture of approximately 50% topsoil, 30% sand, and 20% compost or mulch

Recommended Resources:

General Information: A recommend resource for rain gardens is, *Rain Gardens: A How-To Manual for Homeowners* published by the University of Wisconsin Cooperative Extension, 2003.

<https://doee.dc.gov/sites/default/files/dc/sites/ddoe/publication/attachments/RaingardenHow2HomeownerUWExtension.pdf>

Maintenance and Care Considerations: A recommend resource for rain gardens is the *Homeowner's Guide for Best Management Practices Operations and Maintenance* by the Lancaster County Clean Water Consortium, 2018.

https://www.lititzborough.org/sites/lititzpa/files/uploads/homeowners_bmp_om_guide_-_draft_10_6_17_reduced.pdf

Sizing Rain Gardens:

The rain garden would be required to be sized to accommodate the net cubic feet to be managed. The following sizing chart assumes a 6 inch ponding depth rain garden. Round up your volume to be managed to match the chart.

| Rain Garden Sizing Chart | | | | | | | | | |
|--|------|----|----|----|-----|-----|-----|-----|-----|
| Stormwater Volume to be Managed (ft ³) | 12.5 | 25 | 50 | 75 | 100 | 125 | 150 | 175 | 200 |
| Rain Garden Required Size (ft ²) | 6 | 14 | 36 | 59 | 82 | 106 | 130 | 154 | 178 |

Elements of a Rain Garden Checklist:

| | |
|------------------|--|
| Location | <input type="checkbox"/> Rain gardens should be located in areas with less than a 12% slope (i.e. a 12 foot drop over a horizontal distance of 100 feet or a 6 foot drop over a distance of 50 feet). <input type="checkbox"/> Rain gardens should be located at least 10 ft from foundations to avoid basement seepage. <input type="checkbox"/> Rain gardens should be located at least 15 ft from onsite wastewater treatment systems and at least 25 ft from private drinking water wells. |
| Treatment | <input type="checkbox"/> The bottom of a rain garden should be level to encourage the even distribution of stormwater and increase infiltration capacity. <input type="checkbox"/> Rain gardens should be approximately 6 – 8 inches deep with a 3 – 4 inch amended soil layer and a 2 – 3 inch layer of non-dyed aged shredded hardwood mulch. <input type="checkbox"/> The amended soil layer of a rain garden should be a 50/50 mixture of the excavated native soils and mature organic compost. |

| | |
|------------------------------|---|
| Vegetation | <ul style="list-style-type: none"> □ Select native plants and/or grasses with deep roots. A rain garden native planting list is located at the end of this guide. |
| Construction | <ul style="list-style-type: none"> □ A crushed stone entrance can be installed at the inflow to prevent channeling. □ A berm to detain stormwater should be constructed along the downhill side of the rain garden, perpendicular to the slope of the lawn. □ Be sure that the soil within the rain garden area does not become compacted by construction activities (i.e. heavy machinery). If soil becomes severely compacted it may need to be tilled and amended to maintain proper drainage. |
| Maintenance (minimum) | <ul style="list-style-type: none"> □ Rain gardens shall be inspected following at least the first two precipitation events of at least 1.0 inch to ensure that the system is functioning properly. Thereafter, the rain garden shall be monitored and maintained to assure proper functioning, plant growth and survival. Plants shall be replaced on an as-needed basis during the growing season. □ Silt/sediment shall be removed from the rain garden when the accumulation exceeds one inch, or when water ponds on the surface of the rain garden for more than 48 hours). The top few inches of material shall be removed and shall be replaced with fresh soil mixture and mulch. □ Pruning or replacement of woody vegetation shall occur when dead or dying vegetation is observed. □ Soil erosion gullies shall be repaired when they occur. □ Fertilizer or pesticides shall not be applied to plants within rain gardens. □ Perennial plants and ground covers shall be replaced as necessary to maintain an adequate vegetated ground cover. Annual plants may also be used to maintain ground cover. |

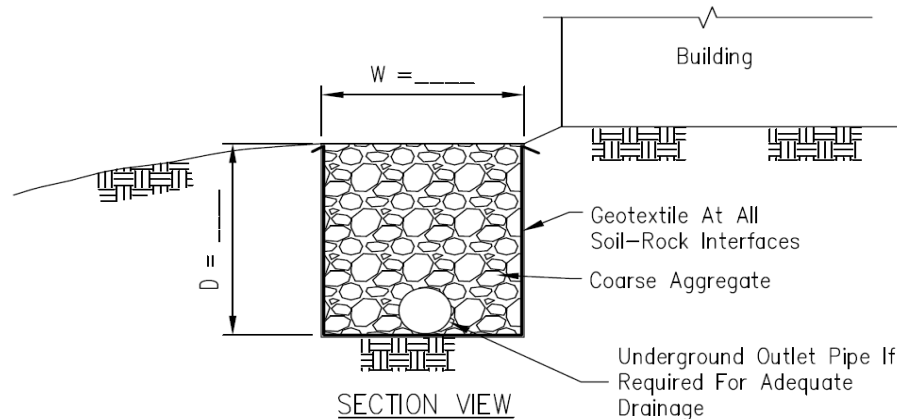
Infiltration Trench

Description:

An infiltration trench is long, narrow, rock-filled trench that receives stormwater runoff. It allows the water to be stored in the open space between the stones and also permits the water to soak into the ground. Sometimes the trench includes a perforated pipe within the rock area to distribute the water evenly along the trench. Key elements of an infiltration trench include:

- These facilities should be located a minimum of ten (10) feet (or as otherwise required by the Borough) from the building foundation to avoid foundation seepage problems.
- Trench stone shall be wrapped in nonwoven geotextile (top, sides and bottom).
- A positive flow or slope shall be maintained to permit excess runoff which cannot be stored or infiltrated to drain into a nearby vegetated area.
- Roof downspouts can be connected to infiltration trenches, but shall contain a cleanout to collect sediment and debris before entering the infiltration area.

- They should have over overflow pipes to allow high volumes of runoff to overflow the facility and flow into an infiltration area, pervious area, or other connected storm sewer designed to receive the excess runoff.
- Protect infiltration areas from compaction by heavy equipment during and after construction. They shall be constructed generally after all earth disturbance associated with the construction site is stabilized to avoid clogging.



Infiltration Trench detail

Recommended Resource:

General Information: *Fact Sheet #5, Infiltration Trenches and Dry Wells*, Massachusetts Low Impact Development Toolkit, a production of the Metropolitan Area Planning Council,
http://www.mapc.org/wp-content/uploads/2017/11/LID_Fact_Sheet_-_Infiltration_Trenches_and_Dry_Wells.pdf

Maintenance and Care Considerations: A recommend resource for infiltration trenches is the *Homeowner's Guide for Best Management Practices Operations and Maintenance* by the Lancaster County Clean Water Consortium, 2018.

https://www.lititzborough.org/sites/lititzpa/files/uploads/homeowners_bmp_om_guide_-_draft_10_6_17_reduced.pdf

Sizing Infiltration Trenches:

The infiltration trench would be required to be sized to accommodate the net cubic feet to be managed. The following sizing chart assumes a 2 foot wide trench with a depth of 2 feet.

| Infiltration Trench Sizing Chart | | | | | | | | | |
|--|------|----|----|----|-----|-----|-----|-----|-----|
| Stormwater Volume to be Managed (ft ³) | 12.5 | 25 | 50 | 75 | 100 | 125 | 150 | 175 | 200 |
| Infiltration Trench Required Length (ft) | 8 | 16 | 31 | 47 | 63 | 78 | 94 | 109 | 125 |

Elements of an Infiltration Trench:

| | |
|-----------------|--|
| Location | <input type="checkbox"/> Trenches and dry wells must be located at least 10 feet minimum away from the foundation. |
|-----------------|--|

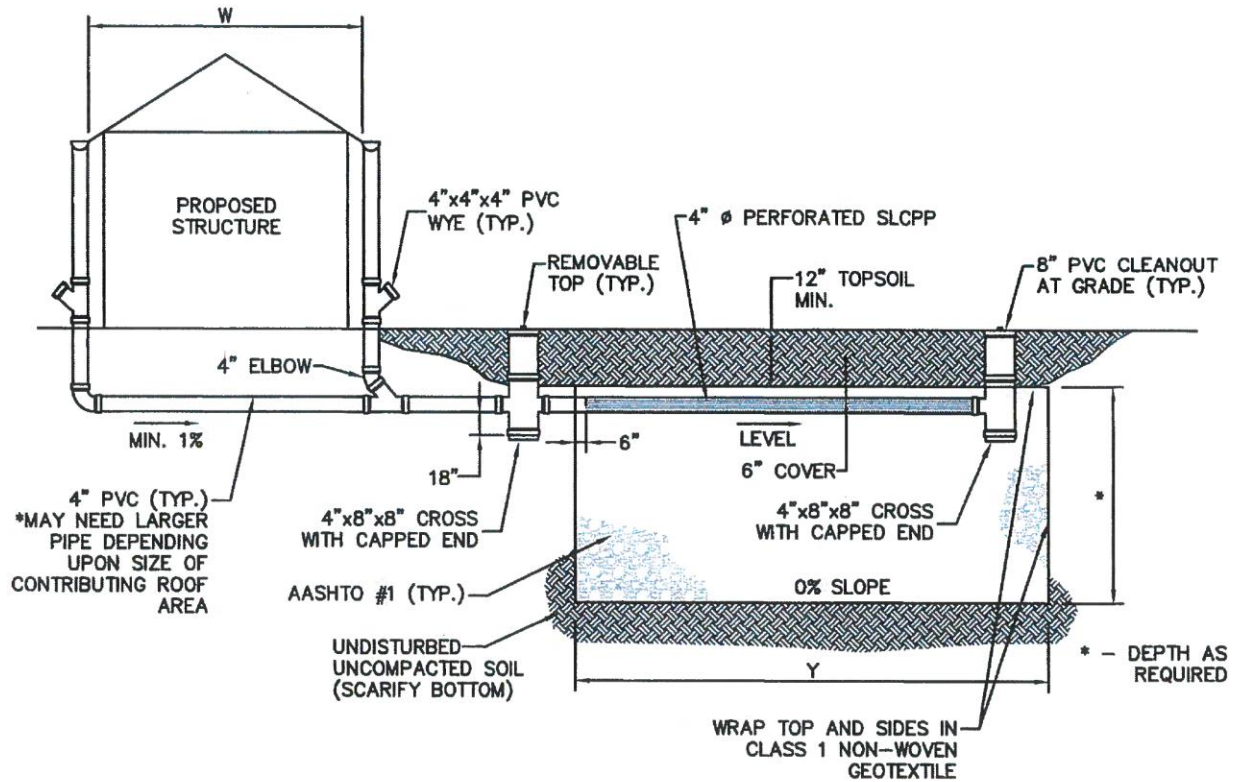
| | |
|------------------------------|---|
| | <input type="checkbox"/> Trenches and dry wells cannot be placed in locations that cause water problems (such as seepage which may cause slope failure) to downgrade properties. |
| Treatment | <input type="checkbox"/> The bottom of the stone reservoir should be completely flat or nearly so in order that infiltrated runoff will be able to infiltrate through the entire bottom surface area. <input type="checkbox"/> The bottom of infiltration practices must be separated by at least two feet vertically from the seasonal high groundwater table (SHGWT). Depth to the SHGWT should be determined by a licensed soil evaluator, registered professional engineer or certified soil scientist. <input type="checkbox"/> The bottom of infiltration practices must be located in the soil profile. |
| Construction | <input type="checkbox"/> Great care must be taken to prevent the infiltration area from compaction by marking off the location before the start of construction at the site and constructing the infiltration practice last. <input type="checkbox"/> An observation well shall be installed in every infiltration trench or dry well, consisting of an anchored 4- to 6-inch diameter perforated PVC pipe with a screw-top cap installed flush with the ground surface. |
| Maintenance (minimum) | <input type="checkbox"/> Infiltration practices shall be inspected annually and repaired if necessary to ensure proper drainage. <input type="checkbox"/> Accumulated sediment and debris shall be removed from the surface of the infiltration practice annually. |

Dry Well

Description:

A **dry well** (or seepage pit) is an underground structure that captures and disposes stormwater runoff by allowing water to slowly soak (or percolate) into the ground. Dry wells are very similar to infiltration trenches, and the well is generally and mostly filled with stone. Key elements of a dry well include:

- These facilities should be located a minimum of ten (10) feet (or as otherwise required by the Borough) from the building foundation to avoid foundation seepage problems.
- Stone in the well shall be wrapped in nonwoven geotextile (top, sides and bottom).
- Roof downspouts are usually connected to a dry well, but shall contain a cleanout to collect sediment and debris before entering the well area.



Dry Well detail

Recommended Resource:

General Information: *Fact Sheet #5, Infiltration Trenches and Dry Wells*, Massachusetts Low Impact Development Toolkit, a production of the Metropolitan Area Planning Council,

http://www.mapc.org/wp-content/uploads/2017/11/LID_Fact_Sheet_-_Infiltration_Trenches_and_Dry_Wells.pdf

Sizing Dry Wells:

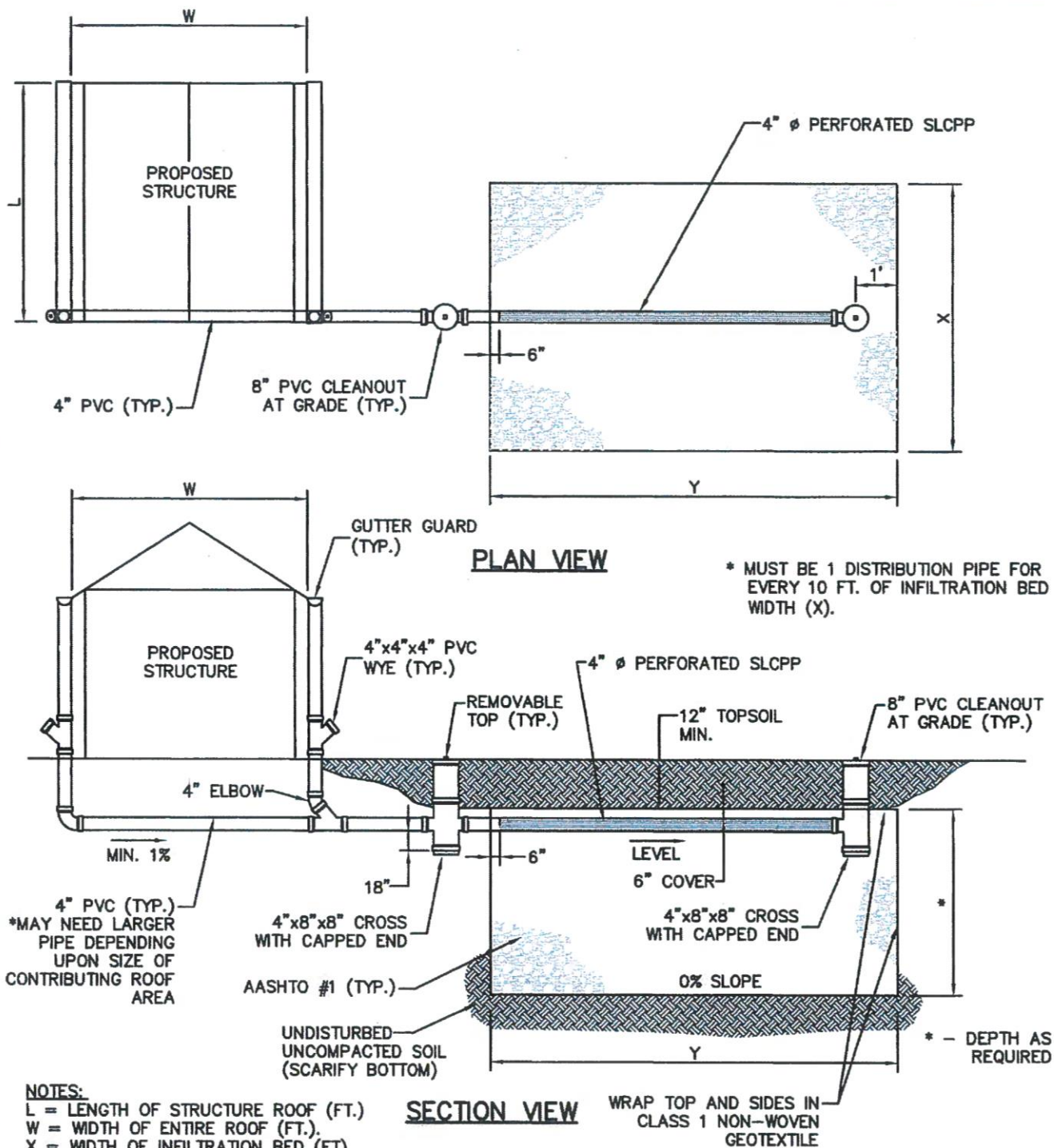
The dry well would be required to be sized to accommodate the net cubic feet to be managed.

The following sizing chart assumes a depth of 2 feet.

| Dry Well Sizing Chart | | | | | | | | | |
|--|------|----|----|----|-----|-----|-----|-----|-----|
| Stormwater Volume to be Managed (ft ³) | 12.5 | 25 | 50 | 75 | 100 | 125 | 150 | 175 | 200 |
| Dry Well Required Area (sq. ft.) | 16 | 32 | 63 | 94 | 125 | 158 | 188 | 220 | 250 |

Elements of an Infiltration Trench or Dry Well:

| | |
|------------------------------|---|
| Location | <ul style="list-style-type: none"> <input type="checkbox"/> Trenches and dry wells must be located at least 10 feet minimum away from the foundation. <input type="checkbox"/> Trenches and dry wells cannot be placed in locations that cause water problems (such as seepage which may cause slope failure) to downgrade properties. |
| Treatment | <ul style="list-style-type: none"> <input type="checkbox"/> The bottom of the stone reservoir should be completely flat or nearly so in order that infiltrated runoff will be able to infiltrate through the entire bottom surface area. <input type="checkbox"/> The bottom of infiltration practices must be separated by at least two feet vertically from the seasonal high groundwater table (SHGWT). Depth to the SHGWT should be determined by a licensed soil evaluator, registered professional engineer or certified soil scientist. <input type="checkbox"/> The bottom of infiltration practices must be located in the soil profile. |
| Construction | <ul style="list-style-type: none"> <input type="checkbox"/> Great care must be taken to prevent the infiltration area from compaction by marking off the location before the start of construction at the site and constructing the infiltration practice last. <input type="checkbox"/> An observation well shall be installed in every infiltration trench or dry well, consisting of an anchored 4- to 6-inch diameter perforated PVC pipe with a screw-top cap installed flush with the ground surface. |
| Maintenance (minimum) | <ul style="list-style-type: none"> <input type="checkbox"/> Infiltration practices shall be inspected annually and repaired if necessary to ensure proper drainage. <input type="checkbox"/> Accumulated sediment and debris shall be removed from the surface of the infiltration practice annually. |



NOTES:

L = LENGTH OF STRUCTURE ROOF (FT.)
W = WIDTH OF ENTIRE ROOF (FT.)
X = WIDTH OF INFILTRATION BED (FT.)
Y = LENGTH OF INFILTRATION BED (FT.)

REQUIRED VOLUME (RV) FROM WORKSHEET
STORAGE VOLUME OF BED = $X \cdot Y \cdot D \cdot 0.4$
IS SV > RV _____

NOTES:

1. BED BOTTOM AREA CAN BE NO LESS THAN 20% OF IMPERVIOUS AREA CONTRIBUTING TO IT.
2. PIPING AND CLEANOUTS TO BE CENTERED WITHIN INFILTRATION BED.
3. BED TO BE CHECKED REGULARLY TO MAINTAIN PROPER OPERATION.
4. IDENTIFY OVERFLOW LOCATIONS.

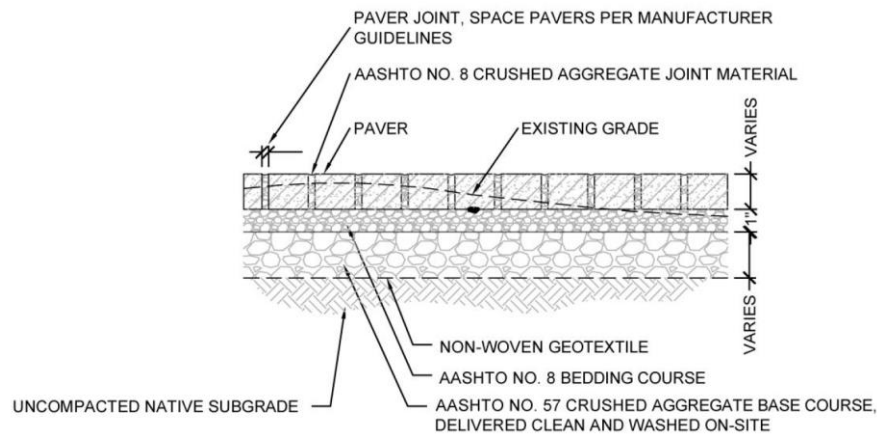
DRY WELL

NTS

Pervious Pavers

Description:

A **pervious paver system** consists of impervious building materials such as stone, concrete or brick, laid with space in between. This space is filled with gravel, sand or vegetation creating a pervious area for runoff to infiltrate into the ground. Pervious paving is commonly used for patios, walkways, driveways and parking areas.



Pervious Pavers detail

Recommended Resources:

General Information: A recommended resource for paver installation is: *Permeable Hard-scapes* (Section 4 of the Chesapeake Stormwater Network Homeowner Guide for a More Bay- Friendly Property), <http://chesapeakestormwater.net/training-library/stormwater-bmps/permeable-pavers/>

Maintenance and Care Considerations: A recommend resource for pervious pavers (porous paving) is the *Homeowner's Guide for Best Management Practices Operations and Maintenance* by the Lancaster County Clean Water Consortium, 2018. https://www.lititzborough.org/sites/lititzpa/files/uploads/homeowners_bmp_om_guide_-_draft_10_6_17_reduced.pdf

The installation of a pervious paver system per the manufactures specifications will satisfy the stormwater management requirements for that surface, and no additional controls are required for the surface.

PERMEABLE PAVER INSTALLATION

Setting bed and stone base shall be per manufacture recommendation. Stone bed shall be a minimum of 6-inches deep.

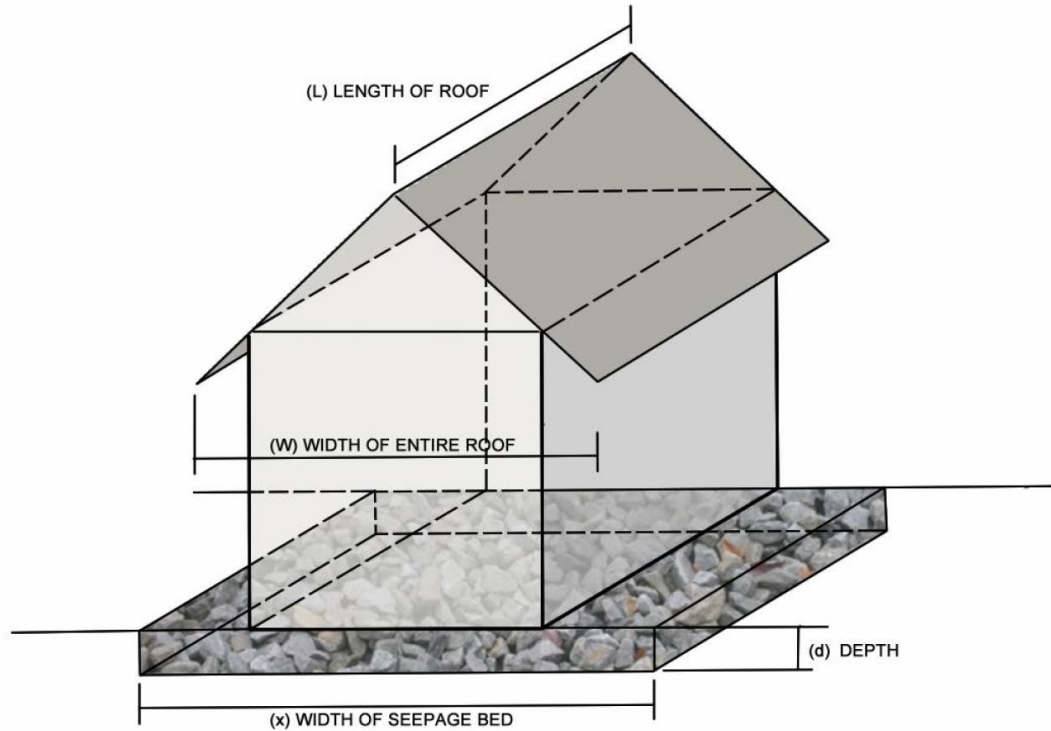
Elements of Pervious/Permeable Paver Systems:

| | |
|------------------------------|---|
| Feasibility | <ul style="list-style-type: none"> <input type="checkbox"/> Soil infiltration rate must be at least 0.5 inches per hour <input type="checkbox"/> Separation from groundwater table and bedrock must be at least 2 feet. |
| Location | <ul style="list-style-type: none"> <input type="checkbox"/> Permeable paving should be located in areas with less than 5% slope. <input type="checkbox"/> Permeable paving systems should not be located over drinking well or on-site wastewater structures or features. |
| Treatment | <ul style="list-style-type: none"> <input type="checkbox"/> The water quality volume must exfiltrate through the floor of the practice in the soil horizon. <input type="checkbox"/> Permeable paving systems shall be designed to fully de-water the entire water quality volume within 24 hours after the storm event. <input type="checkbox"/> The bottom of the stone reservoir should be completely flat, or nearly so, to allow runoff to infiltrate through the entire bottom surface area. |
| Vegetation | <ul style="list-style-type: none"> <input type="checkbox"/> The site shall be completely stabilized before any flow is directed to the practice. <input type="checkbox"/> Pavers that are planted with grass require species with deep root systems. |
| Construction | <ul style="list-style-type: none"> <input type="checkbox"/> Permeable blocks must have a minimum void ratio of 15%, contain open cell grids filled with clean washed aggregate, and set on prepared base course materials consisting of a minimum of 1.5 inches of No. 8 washed aggregate, over a minimum of 4 inches of No. 57 washed stone. <input type="checkbox"/> Solid blocks with open-cell joints must contain permeable void areas (between the impermeable blocks) exceeding 15% of the surface area of the paving system. Permeable void areas are to be filled with clean washed aggregate and compacted with a minimum 5,000 lbf plate compactor. Pavers are set on prepared base course materials consisting of a minimum of 1.5 inches of No. 8 washed aggregate, over a minimum of 4 inches of No. 57 washed stone. |
| Maintenance (minimum) | <ul style="list-style-type: none"> <input type="checkbox"/> The surface of permeable paving or pavers shall be monitored after storms to ensure it drains properly. The surface shall be inspected annually for deterioration and repaired as needed. <input type="checkbox"/> Maintenance shall be performed according to the manufacturer's specifications for paver systems. <input type="checkbox"/> Paver grids planted with grass shall be mowed on a regular basis and reseeded as necessary. <input type="checkbox"/> Use of sand and salt on permeable paving and pavers shall be minimized. <input type="checkbox"/> Porous asphalt or concrete driveways shall not be repaved or resealed with impermeable products. |

Stone Bed Under a Shed

Description:

A stone bed under a shed can be used to manage the runoff from the structure.



KEY

L = LENGTH OF STRUCTURE ROOF = LENGTH OF SEEPAGE BED (FT.)
W = WIDTH OF ENTIRE ROOF (FT)
x = WIDTH OF SEEPAGE BED (FT)
 $x = W + 2 \text{ FT}$
d = DEPTH OF SEEPAGE BED (FT)
 $d = 8"$

NOTES

- 1.) SIDE AND BOTTOM OF BED TO BE WRAPPED IN CLASS 1 GEOTEXTILE.
- 2.) BED TO BE FILLED WITH CLEAN STONE (3/4" MIN. SIZE).
- 3.) BED TO BE CONSTRUCTED AT 0% SLOPE ON UNDISTURBED SOIL.
- 4.) BED TO BE CHECKED REGULARLY TO MAINTAIN PROPER OPERATION.

The installation of a stone bed under a shed will satisfy the stormwater management requirements for that shed, and no additional controls are required for the shed.

Using the *Simple Site Plan Example*, it is time to select our Stormwater Management BMPs. We do have open space towards the rear of the yard where we can place a BMP to manage 74.5 ft³ of runoff. Based on the available area, it is possible either a rain garden or infiltration trench could work in the rear yard location. The area needed for both types of BMPs are measured out:

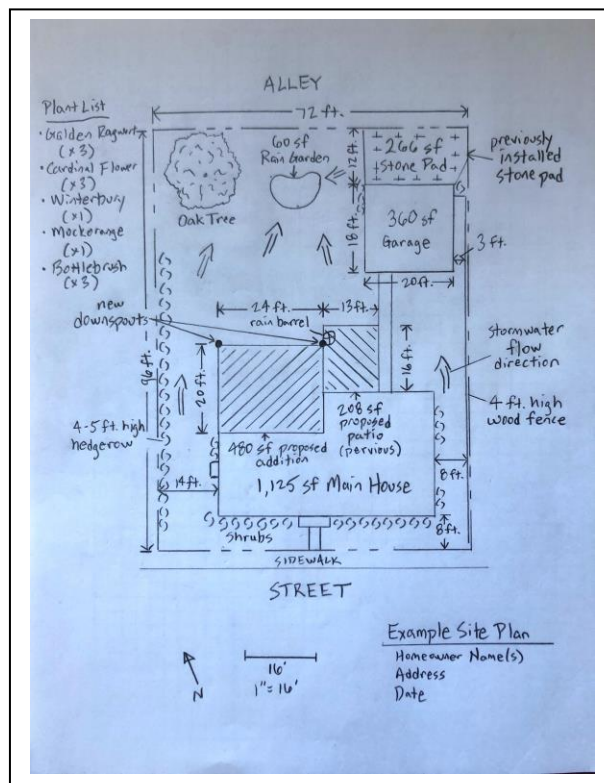
- Rain Garden
 - Based on the sizing chart, and with rounding the runoff to be managed up to 75 ft³, a rain garden covering 59 square feet with a 6" ponding depth would be needed.
 - A 10 foot long by 6 foot wide rain garden would fit.
- Infiltration Trench
 - Based on the sizing chart, and with rounding the runoff to be managed up to 75 ft³, a 47 foot long (2 feet wide by 2 feet deep) infiltration trench would be needed.
 - After reviewing the site plan, this would not work (too long).
- The width of the infiltration trench could be adjusted from 2 feet to 3 feet to fit the trench into the available space.
 - However, after reviewing materials needed for construction, maintenance requirements, and aesthetics, a Rain Garden was chosen.

A 10 foot long by 6 foot wide (60 square feet) Rain Garden is added to the site plan.

After reviewing the picture guide of native plants in the *Homeowner's Guide for Best Management Practices Operations and Maintenance* by the Lancaster County Clean Water Consortium and the list of plants in Appendix B of this guide, a plant list for the Rain Garden is added to the site plan (option: the plant list could be a placed on a separate sheet of paper).

The site plan is finalized (picture to the right). All the checklist items for Step 9 on Page 6 are organized, and a complete packet is submitted to the Borough.

NOTE: It may be helpful to complete a full Exemption/Small Project Application, and then request to meet with Borough staff to review to verify eligibility, approach, impacts to wetlands/other bodies of water, easements, and other known information that may be beneficial.



Meeting with Borough staff after a complete application is organized will also help communicate any other considerations such as completing an O&M Agreement, future requirements (annual submission of an O&M Verification Form), and so on.

Step 9: Organize Small Project Application and submit to the Borough

General overview of the entire process:

1. Assess the stormwater management need for your proposed project.
 - a. Prepare a Site Plan of existing and proposed property features.
 - b. Determine the amount of proposed impervious area for your proposed project.
 - c. Determine if any Stormwater Credit applies to your project.
 - d. Determine the total stormwater runoff to be managed.
2. Consider and select alternative stormwater management type(s) for your project.
3. Meet with Municipal Staff. All individuals planning on using the Small Project approach are encouraged to review the planned project with the Borough Staff to verify eligibility, approach, impacts to wetlands/other bodies of water, easements, and other known information that may be beneficial. Prior to meeting with the Borough Staff, the applicant should prepare a basemap sketch of applicant's existing property, measure existing and proposed impervious areas, and consider which stormwater management control(s) are desired. Borough Staff shall assist the property owner in determining the best stormwater alternatives for the specific property involving the Small Project.
4. The applicant shall complete the required Small Projects Worksheet(s) then submit these items with the Site Plan and permit fee to the Borough.
5. The Borough Staff shall review the submittal, conduct a site visit, and coordinate any recommended revisions to the proposed project with the applicant, and with the Borough Engineer if necessary.
6. The applicant shall address the review comments provided the Borough, and resubmit any necessary information back to the Borough for further processing.
7. Once the Borough's review comments have been addressed, the Owner shall sign and submit and record the Operations and Maintenance Agreement with the approved Site Plan at the County Recorder of Deeds office.
8. Then Borough shall sign the Permit and distribute a copy to the applicant. The Borough shall also establish an inspection schedule based on the proposed facilities.
9. The Borough shall inspect during and/or after construction based on the schedule.

SMALL PROJECTS OPERATIONS AND MAINTENANCE AGREEMENT

Lititz Borough

1. Development activities shall begin only after Lititz Borough approves the Small Project and plan has been recorded at the County Recorder of Deeds office.
2. The installed Stormwater BMPs will not adversely affect any property, septic systems, or drinking water wells on this or any other property.
3. The applicant acknowledges that the proposed Stormwater BMPs will be a permanent fixture of the property that cannot be altered or removed without approval by Lititz Borough.
4. If, after approval of the Small Project by Lititz Borough, the applicant wishes to pursue alternative stormwater management measures in support of the project, the applicant will submit revised Small Project information and worksheets to Lititz Borough for approval. If a site requires a more complex system or if problems arise, the applicant may need the assistance of a licensed professional engineer, landscape architect or surveyor.
5. The Best Management Practices (BMPs) shall be constructed by the Landowners in accordance with the plans and specifications.
6. The Landowner shall operate and maintain the BMPs in good working order acceptable to the Borough and in accordance with the specifications maintenance requirements and attached hereto as Exhibit A.
7. The Landowner hereby grants permission to the Borough, its authorized agents and employees to enter upon the property, at reasonable times and upon presentation of proper identification, to inspect the BMPs whenever it deems necessary. Whenever possible the Borough shall notify the Landowner prior to entering the property.
8. In the event the Landowner fails to operate and maintain the BMPs in good working order acceptable to the Borough, the Borough or its representatives may enter upon the Property and take whatever action is deemed necessary to maintain said BMPs. This provision shall not be construed to allow the Borough to erect any permanent structure on the land of the Landowner. It is expressly understood and agreed that the Borough 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 Borough.
9. In the event the Borough, pursuant to this Agreement, performs work of any nature, or expands any funds in performance of said work for labor, use of equipment, supplies, materials, and the like, the Landowner shall reimburse the Borough for all expenses (direct and indirect) incurred within 10 days of receipt of invoice from the Borough.

10. The intent and purpose of the Agreement is to ensure the proper maintenance of the onsite BMPs 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.
11. The Landowner, its executors, administrators, assigns, and other successors in interests, shall release the Borough'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 BMPs by the Landowner or the Borough. In the event that a claim is asserted against the Borough, its designated representatives or employees, the Borough 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 Borough's employees or designated representatives shall be allowed, the Landowner shall pay all costs and expenses regarding said judgment or claim.

I (we) _____, hereby certify and acknowledge that I (we) understand the above Operations and Maintenance provisions and agree to assume full responsibility for the implementation, construction, operation, and maintenance of the proposed stormwater management facilities. Furthermore, I (we) also acknowledge that the steps, assumptions, and guidelines provided in this submission, including but not limited to the Lititz Borough Small Project Guidance will be adhered to.

This Agreement shall be recorded at the Office of the Recorder of Deeds of Lancaster 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 Borough:

For the Landowner:

ATTEST:

_____ (Borough)

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)

APPENDIX A

MAINTENANCE OF BMPS FOR SMALL PROJECT PERMITS

Refer to the *Homeowner's Guide for Best Management Practices Operations and Maintenance* by the Lancaster County Clean Water Consortium (can be found on the Borough website at www.lititzborough.org) for more detailed information, picture guides, and related information.

Vegetated Swales/Filter Strips/Buffers

1. The flow path for runoff from impervious areas shall be vegetated and maintained in a stable non-erosive condition. Erosion shall be repaired and vegetation re-established in a timely manner.
2. Vehicles shall not park or drive on the infiltration area and care shall be taken to avoid excess compaction by mowers or other equipment.
3. The area shall remain graded to promote sheet flow of the runoff and infiltration of the rainfall.
4. Trash and sediment shall be removed and disposed of properly and in a timely manner.

Tree Plantings

1. Trees shall be maintained in a healthy, vigorous growing condition.
2. Care shall be taken to not overly compact the ground above the tree root system.
3. Dead trees shall be replaced by the property owner within 6 months.
4. Replacement trees shall be a minimum 1 inch caliper deciduous tree or a minimum 5 foot tall evergreen tree.

Underground Infiltration Trenches, Beds or Pits/ Dry Wells/ Seepage Pits

1. Roof gutters, downspouts, roof leaders, inlets, and overflows shall be regularly inspected for leaves, trash, debris and sediment and cleaned out as necessary to maintain the system in good condition.
2. The surface vegetation shall be maintained in good condition.
3. Vehicles shall not park or drive on the infiltration area and care shall be taken to avoid excess compaction by mowers or other equipment.
4. Regularly inspect after heavy rainfall events to make sure water is being infiltrated into the soil.

Surface Retention Basins/Infiltration Basins or Berms/Rain Gardens

1. Regularly inspect the basin after heavy rainfall events to make sure the water collected drains down within approximately 3 days.

2. The flow path for runoff from impervious areas to the basin shall be maintained in a stable non-erosive condition.
3. Roof gutters, downspouts, roof leaders, inlets, and overflows shall be regularly inspected for leaves, trash, debris and sediment and cleaned out as necessary to maintain the system in good condition.
4. The vegetation on the surface of the basin shall be maintained in healthy, vigorous growing condition. Dead plant material shall be replaced within 6 months.
5. Vehicles shall not park or drive on the infiltration area and care shall be taken to avoid excess compaction by mowers or other equipment.
6. Trash and sediment shall be removed and disposed of properly and in a timely manner.
7. The berm and overflow pipe shall be maintained in good working condition.
8. Mulch cover is to be maintained, re-spread and replaced as needed to prevent erosion, reduce weed growth, and assist with plant survival, without restricting the infiltration of water.

Rain Barrels

1. The storage facility shall be routinely emptied to allow for storage of additional rainwater/subsequent rainfall events.
2. Roof gutters, downspouts, roof leaders, inlets, and overflows shall be regularly inspected for leaves, trash, debris and sediment and cleaned out as necessary to maintain the system in good condition
3. Overflow outlets shall be kept free and clear of debris.

Pervious Pavers

1. Pavers shall be maintained in accordance with specific manufacture recommendations to permit required infiltration.
2. Surface shall be maintained clear of debris, sediment, and unwanted vegetation.
3. Sand, grit and other similar type snow removal material shall not be utilized in snow removal process.
4. Infiltration stone between pavers shall be kept up to proper surface elevation.
5. Areas that have differentially settled shall be reset to grade.

APPENDIX B

Rain Garden Native Planting List

Perennials and Ferns:

Blue false indigo (*Baptisia australis*)
Blue flag iris (*Iris versicolor*)
Blue star (*Amsonia tabernaemontana*)
Blue vervain (*Verbena hastata*)
Boltonia (*Boltonia asteroides*)
Boneset (*Eupatorium perfoliatum*)
Bottlebrush grass (*Hystrix patula*)
Broomsedge (*Andropogon virginicus*)
Cardinal flower (*Lobelia cardinalis*)
Cinnamon fern (*Osmunda cinnamomea*)
Culvers root (*Veronicastrum virginicum*)
Golden ragwort (*Senecio aureus*)
Goldenrod (*Solidago patula*, *S. rugosa*)
Great blue lobelia (*Lobelia siphilitica*)
Green bullrush (*Scirpus atrovirens*)
Horsetail (*Equisetum* species)
Marsh marigold (*Caltha palustris*)
Mistflower (*Eupatorium coelestinum*)
Monkey flower (*Mimulus ringens*)
New England aster (*Aster novae-angliae*)
New York aster (*Aster novi-belgii*)
Obedient plant (*Physotegia virginiana*)
Royal fern (*Osmunda regalis*)
Seedbox (*Ludwigia alternifolia*)
Sensitive fern (*Onoclea sensibilis*)
Sneezeweed (*Helenium autumnale*)
Soft rush (*Juncus effusus*)
Swamp milkweed (*Asclepias incarnata*)
Swamp rose mallow (*Hibiscus moscheutos*)
Swamp sunflower (*Helianthus angustifolius*)
Switchgrass (*Panicum virgatum*)
Threadleaf coreopsis (*Coreopsis verticillata*)
Tussock sedge (*Carex stricta*)
White turtlehead (*Chelone glabra*)
Woolgrass (*Scirpus cyperinus*)

Shrubs:

American beautyberry (*Callicarpa americana*)
Arrowwood (*Viburnum dentatum*)
Black chokeberry (*Aronia melanocarpa*)
Broad-leaved meadowsweet (*Spiraea latifolia*)
Buttonbush (*Cephalanthus occidentalis*)
Elderberry (*Sambucus canadensis*)
Inkberry (*Ilex glabra*)
Narrow-leaved meadowsweet (*Spiraea alba*)
Ninebark (*Physocarpus opulifolius*)
Possumhaw (*Viburnum nudum*)
Red-osier dogwood (*Cornus sericea*)
St. Johnswort (*Hypericum densiflorum*)
Silky dogwood (*Cornus amomum*)
Smooth alder (*Alnus serrulata*)
Spicebush (*Lindera benzoin*)
Swamp azalea (*Rhododendron viscosum*)
Swamp rose (*Rosa palustris*)
Sweet pepperbush (*Clethra alnifolia*)
Wild raisin (*Viburnum cassinoides*)
Winterberry (*Ilex verticillata*)
Virginia sweetspire (*Itea virginica*)

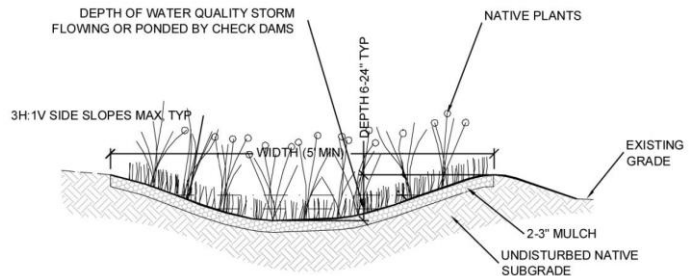
APPENDIX C

VEGTATED SWALES FOR CONVEYANCE

Vegetated Swale

Description:

A **vegetated swale** is a broad, shallow drainage channel densely planted with a variety of trees, shrubs, and/or grasses. Stormwater runoff is both slowed and absorbed as it flows within the channel. Key elements of a vegetated swale include:



Vegetated Swale detail

- Installed with slopes ranging from 1-6%
- Side slopes range from 3:1 to 5:1
- Bottom width of 5 feet minimum
- Planted with dense, low-growing native vegetation that is water-resistant and drought resistant.

Recommended Resources:

Maintenance and Care Considerations: A recommend resource for vegetated swales is the *Homeowner's Guide for Best Management Practices Operations and Maintenance* by the Lancaster County Clean Water Consortium, 2018.

https://www.lititzborough.org/sites/lititzpa/files/uploads/homeowners_bmp_om_guide_-_draft_10_6_17_reduced.pdf

Elements of a Vegetative Swale Checklist:

| | |
|-------------------|---|
| Conveyance | <ul style="list-style-type: none"> <input type="checkbox"/> Vegetated Swales should be approximately 5 foot wide at a minimum. <input type="checkbox"/> Vegetated swales shall be designed with moderate side slopes flatter than 3:1 for most conditions. <input type="checkbox"/> Vegetated swales shall have a maximum longitudinal slope of 4% (e.g. 4 foot drop over a horizontal distance of 100 feet). |
| Treatment | <ul style="list-style-type: none"> <input type="checkbox"/> The average surface ponding depth shall be no more than 8 inches deep. <input type="checkbox"/> A maximum ponding depth of 1 ft should be maintained at the longitudinal midpoint of the vegetated swale and a maximum depth of 18 inches at the end point. <input type="checkbox"/> Swales should contain a 2 – 4 inch amended soil layer and a 2 – 3 inch mulch layer. <input type="checkbox"/> The amended soil layer of a vegetated swale should be a 50/50 mixture of the excavated native soils and mature organic compost. |

| | |
|----------------------------------|--|
| Vegetation | <ul style="list-style-type: none"> □ Grasses or sedges are typically used in vegetated swales, but other native plants can be used as well. |
| Maintenance (minimum) | <ul style="list-style-type: none"> □ Vegetated swales shall be inspected annually and should be inspected after large storm events. □ Eroded side slopes and channel bottoms shall be stabilized as necessary. □ If the surface of the dry swale becomes clogged to the point that standing water is observed on the surface 48 hours after precipitation events, the bottom shall be roto-tilled or cultivated to break up any hard-packed sediment, and then reseeded. □ Vegetation in dry swales shall be mowed as required to maintain minimum grass heights in the 4-6 inch range. □ Every five years, the channel bottom of dry swales should be scraped to remove sediment and to restore original cross section and infiltration rate, and should be seeded to restore ground cover, where necessary. |