

# **STORMWATER MANAGEMENT DESIGN ASSISTANCE MANUAL**

**For Small Projects in  
East Earl Township, Lancaster County, Pennsylvania**

## **Small Projects Simplified Approach**

**Dated: July, 2014**  
*Revised September 2016*

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## I. Introduction:

This design manual has been created as a tool to help property owners manage stormwater on their property and streamline the process of designing on-site stormwater management facilities for **small construction projects from 1,000 square feet to 5,000 square feet**. Through the use of this manual, residents have the ability to determine the appropriate facilities for their property, project and budget. This design method is not intended to be used with large-scale subdivision / land development projects or activities that include infrastructure such as roadways.

The Stormwater Best Management Practices (Stormwater BMPs) listed in this manual should be used as a guide and are not a comprehensive list of options. Residents should contact East Earl Township to discuss alternative solutions for site specific applications.

## II. Importance of Stormwater Management:

Stormwater is the runoff produced by precipitation, snow melt, or ice melt. When land is developed or changed, the flow patterns of water and quality of water are also changed. Land development activities can affect characteristics of stormwater runoff, including the rate of runoff, volume of runoff, and quality of runoff. When runoff is not managed, the increased volume may aggravate flooding.

The objective of stormwater management is to prevent or mitigate the adverse impacts of the increase in rate and volume of stormwater runoff, while also protecting health, safety, and property. Stormwater BMPs aim to maintain water quality, encourage infiltration in appropriate areas, promote groundwater recharge, maintain the natural drainage characteristics of the site to the maximum extent practicable, and protect stream banks and beds.

## III. Standard Terms Used in the Manual:

The terms listed below are specific to the Stormwater Management Design Assistance Manual – Small Projects Simplified Approach

**Best Management Practice (BMP)** – Activities, facilities, designs, measures, or procedures used to manage stormwater impacts from regulated activities, to meet state water quality requirements, to promote groundwater recharge, and to otherwise meet the purposes of this Ordinance.

**Disturbed Area** – An unstabilized land area where an earth disturbance activity is occurring or has occurred.

**Flow Path** – The path that stormwater follows from the discharge point to the nearest property line or channelized flow (i.e. stream, drainage ditch, etc.). The length of the path is measured along the ground slope.

**Impervious Surface (Impervious Area)** – A surface that prevents the infiltration of water into the ground. Impervious surfaces and areas include but are not limited to roofs, additional indoor living spaces, patios and decks, garages, storage sheds and similar structures, streets, driveways, access drives, parking areas, and sidewalks. Any areas designed to be covered by loose surfacing materials such as gravel, stone and/or crushed stone, and intended for storage of and/or travel by vehicles, or pedestrians shall be considered impervious. Surfaces or areas designed, constructed and maintained to permit infiltration may be considered pervious.

**Karst** – A type of topography or landscape characterized by surface depressions, sinkholes, rock pinnacles/uneven bedrock surface, underground drainage, and caves. Karst is formed on carbonate rocks, such as limestone or dolomite.

**Regulated Activities** – Any earth disturbing activities or any activities that involve the alteration or development of land in a manner that may affect stormwater runoff.

**Runoff** – Any part of precipitation that flows over the land.

**Small Project – Regulated Activities that, measured on a cumulative basis from the effective date of the Ordinance, create additional impervious areas of more than 1,000 square feet and less than 4,000 square feet or involve Earth Disturbance Activity of an area less than 5,000 square feet and do not involve the alteration of stormwater facilities or watercourses.**

#### **IV. Determining What Type of Stormwater Management Submission is Needed:**

The following chart provides a guide to determine what type of stormwater submission is needed. Some projects will be exempt from preparing a stormwater management plan, but documentation of the project must still be filed with East Earl Township. Completion of the East Earl Township **Stormwater Management Worksheets** will determine what type of documentation is required for each project.

This manual is designed to assist those with projects that qualify as a Small Project (more than **1,000** square feet but less than 5,000 square feet of impervious area). If a formal Stormwater Management Plan is required in accordance with the East Earl Township Stormwater Management Ordinance, **please consult a qualified person (ex. Engineer, Surveyor).**

Stormwater Management Ordinance Status	Proposed New Impervious Area	Next Steps
Exempt per Section 502.A.	Up to 1,000 ft <sup>2</sup>	File Municipal Stormwater Management Worksheet with East Earl Township
Small Project per Definition	1,000 ft <sup>2</sup> to ≤ 5,000 ft <sup>2</sup>	Prepare a Small Project Plan per Section 501
Non-Exempt	Greater than 5,000 ft <sup>2</sup>	Prepare a SWM Site Plan per Article IV

## V. Using the Stormwater Management Worksheets:

Determining the new impervious area of a proposed project is the first step in using this Manual. Completing the attached East Earl Township Stormwater Management Worksheets will assist the property owner, or applicant, and East Earl Township in determining the impervious area of a proposed project and providing guidance through ensuing steps.

**Step 1:** Step 1 of the East Earl Township Stormwater Management Worksheet provides a table and directions on how to figure out the new impervious area proposed to be created. If the total new impervious area is less than or equal to 1,000 square feet, the project may qualify as an exemption. The owner will sign the Acknowledgement at the top of the sheet and file it with East Earl Township. East Earl Township will use this as a record of exempt projects and keep a running total of proposed impervious area since **the effective date of the East Earl Township Stormwater Management Ordinance 2014.**

**Step 2:** Step 2 of the East Earl Township Stormwater Management Worksheet provides guidance to determine the total volume of stormwater from new impervious surfaces that must be controlled using stormwater BMPs. This step involves calculating the volume of stormwater that can be controlled by planting new deciduous and / or evergreen trees, and the volume of stormwater that must be controlled using other BMP measures. Upon completion of these calculations, continue to Step 3.

**Step 3:** Step 3 of the East Earl Township Stormwater Management Worksheet provides guidance regarding the preparation of a Small Project Stormwater Site Plan, as outlined in this Design Manual, for approval by East Earl Township. This includes determining the types, sizes, and location of proposed Stormwater BMPs to be employed for a given project. The worksheets, Small Project Stormwater Site Plan, and Owner Acknowledgement will be brought to East Earl Township for approval. East Earl Township will use this submission as a record to keep a running total of proposed impervious area since the adoption of the East Earl Township Stormwater Management Ordinance, and to monitor the installation of the required Stormwater BMPs necessary to support the project.

## **VI. Small Project Stormwater Site Plan Requirements**

A Small Project Stormwater Site Plan depicts the existing conditions of a property and the location of proposed impervious surfaces. Depicting the relationship between the proposed activities and distances to things like property lines, streams, and vegetated areas will help determine if the stormwater runoff created by the proposed project can be managed naturally within the property or if additional Stormwater BMPs are needed to accommodate the stormwater runoff.

If a project requires the submission of a Small Project Stormwater Site Plan, the applicant may prepare and submit to East Earl Township a Small Project Stormwater Site Plan and the East Earl Township Stormwater Management Worksheet. The Lancaster County GIS Office can provide assistance to applicants to obtain property maps of existing features. A Small Project Stormwater Site Plan depicting the key features of the site must be drawn to scale and show the following:

- Property boundary.
- Site conditions (grassed areas, agricultural fields, direction of slope and stormwater flow on the property).
- Location of all existing and proposed structures (house, shed, addition, etc.) and any proposed downspouts. Include the dimensions of proposed structures.
- Distance from proposed downspouts to property line.
- All existing and proposed driveways and other impervious areas (stone and gravel driveways 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 for lots smaller than 5 acres.
- Distance from proposed structures or downspouts along the stormwater flow path to any stream or wooded area.
- Any other pertinent information that may be significant to the project site (existing drainage ways, steep slopes, etc.).
- Wells and on-site septic systems.

If Stormwater BMPs are required, the following information must also be shown on the plan:

- Location and size of proposed Stormwater BMPs.

Other Considerations for Small Project Stormwater Management Plans:

- While soil testing is not mandatory for Small Project Stormwater Management Plans, soil testing is highly recommended to select and apply the appropriate Stormwater BMPs. The use of soil maps, infiltration tests, and/ or perc tests may provide the applicant basic information about soil characteristics.
- Proposed stormwater management facilities must be designed to handle flows from the contributing area.

- The site shall not have any pre-existing stormwater drainage-related problems (as verified by East Earl Township), at the discretion of East Earl Township.
- Water quality shall be protected per Chapter 93 of PA Code.
- East Earl Township may inspect all Stormwater BMPs during and after construction / installation.
- Infiltration BMPs should not be constructed nor receive runoff until the entire contributory drainage area has achieved final stabilization.
- Ensure that infiltration in geologically susceptible areas such as, but not limited to, carbonate geology / karst topography do not cause adverse effects. The Small Project Stormwater Site Plan should incorporate steps to ensure that salt or chloride will not contaminate the groundwater.
- Selected Stormwater BMPs shall be designed, constructed, and maintained in accordance with the manufacturer's recommendation, the *Guide to Choosing Stormwater BMPs*, as may be updated or amended (see Appendix C of the Lancaster County Stormwater Management Plan), the *PA Stormwater Management BMP Manual*, or other written guidance acceptable to East Earl Township.
- Proposed sump pumps shall discharge to infiltration or vegetative Stormwater BMPs to the maximum extent practicable.

## **VII. Selecting Stormwater BMPs**

If the submission of a Small Project Stormwater Management Plan including the use of Stormwater BMPs is required, the applicant should review the compiled information in the *Guide to Choosing Stormwater BMPs*, as may be updated or amended (see Appendix C of the Lancaster County Stormwater Plan), as taken from the *PA Handbook of Best Management Practices for Developing Areas* and the *PA Stormwater Management BMP Manual*. These documents identify Stormwater BMPs that have been deemed to be of a nature and cost that will accomplish the goals of the East Earl Township Stormwater Ordinance, while not unduly burdening the residents. It will then be the Owner's responsibility to select a facility, determine the appropriate size and agree to construct and maintain that facility or facilities. The property owner is encouraged to utilize both multiple and hybrid versions of the facilities, as outlined in the documents mentioned above.



- If the total new impervious surface area is **less than or equal to 1,000 ft<sup>2</sup>**, the project is eligible to be exempted from the requirement to submit a Small Project Stormwater Site Plan or a SWM Site Plan, Sign Acknowledgement and file this sheet with East Earl Township.
- Applicants shall note that Regulated Activities that meet the exemption criteria may be required to manage stormwater runoff and provide plans and/or calculations as required in the Storm Water Management Ordinance should the Township determine that there is potential for stormwater runoff associated with the proposed Regulated Activity to adversely affect adjacent or downstream public or private properties.
- If total new impervious surface area is **greater than 1,000 ft<sup>2</sup>, and less than or equal to 5,000 ft<sup>2</sup>**, continue to Step 2.
- If the total new impervious surface area is **greater than to 5,000 ft<sup>2</sup>** then a Stormwater Management Plan shall be submitted in accordance with the East Earl Township Stormwater Management Ordinance.

**Step 2:** Calculate the volume of stormwater runoff created by new impervious surfaces. Use the following chart to determine this volume.

Impervious Area (ft <sup>2</sup> ) to be Managed (Sum of Step 1)	X	1.0 in/12 in = 0.083	=	Amount of Stormwater to be Managed (ft <sup>3</sup> )
	X	0.083	=	

Where permitted by East Earl Township, 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 = 6 ft<sup>3</sup> per tree      Evergreen Trees = 10 ft<sup>3</sup> per tree**

**Criteria:**

- Trees must be PA native species (See PA Stormwater BMP Manual for a list)
- Trees shall be a minimum 1" caliper tree and 3 feet tall shrub (min)
- Trees shall be adequately protected during construction
- No more than 25% of the required capture volume can be mitigated through the use of trees
- Dead trees shall be replaced by the property owner within 12 months
- Please consider the specifications for each tree species when determining location and spacing

Amount of Stormwater to be Managed (ft <sup>3</sup> ) (Sum of Step 2)	-	Tree Planting Credit (ft <sup>3</sup> )	=	Amount of Stormwater to be Managed (ft <sup>3</sup> )
	-		=	

Subtract the stormwater volume that can be managed by tree planting from the overall stormwater volume calculated in Step 2. The remaining cubic feet of stormwater must be managed through the installation of properly sized Stormwater BMPs. Select BMPs and size according to the volume of stormwater that needs to be managed.

**Step 3:** Determine the techniques to be used to manage the stormwater volume calculated in Step 2 and prepare the Small Project Stormwater Management Plan. Use the following information to determine the BMPs to be used to manage the proposed stormwater volume.

Alternatively, stormwater BMPs may be sized using the following Simple BMP Sizing table, below. To use this sizing table, convert the cubic square feet of stormwater from Step 2, to square feet using the conversion table below:

Impervious Area Runoff Volume (ft <sup>3</sup> ) to be Managed (Sum of Step 2)	÷	1.0 in/12 in = 0.083	=	Amount of Stormwater to be Managed (ft <sup>2</sup> )
	÷	0.083	=	

BMP Type		Simple BMP Sizing - Amount New Impervious Area to be Managed (ft <sup>2</sup> )											
		250	500	750	1000	1500	2000	2500	3000	3500	4000	4500	5000
Bioretention	Ex. Rain garden, Vegetated swale	21 ft <sup>2</sup> or	42 ft <sup>2</sup> or	62 ft <sup>2</sup> or	83 ft <sup>2</sup> or	125 ft <sup>2</sup> or	166 ft <sup>2</sup> or	208 ft <sup>2</sup> or	249 ft <sup>2</sup> or	191 ft <sup>2</sup> or	332 ft <sup>2</sup> or	374 ft <sup>2</sup> or	415 ft <sup>2</sup> or
	Ex. Dry well, Infiltration trench	53 ft <sup>2</sup>	105 ft <sup>2</sup>	155 ft <sup>2</sup>	208 ft <sup>2</sup>	313 ft <sup>2</sup>	415 ft <sup>2</sup>	520 ft <sup>2</sup>	623 ft <sup>2</sup>	728 ft <sup>2</sup>	830 ft <sup>2</sup>	935 ft <sup>2</sup>	1038 ft <sup>2</sup>

(Source: Lycoming County Planning Department)

The Simple BMP Sizing table is used as follows. After subtracting the stormwater volume that can be managed through the planting of new trees, match the remaining stormwater volume to the “Amount of New Impervious Area to be Managed” in white boxes in the table (rounding **up** to the next value if the number is between two values). Then look in the light grey box to determine the required size of the type of Stormwater BMP (bioretention or infiltration) being considered. For example, 1,000 square foot of new impervious surface area could be accommodated by an **83** cubic foot bioretention system. Bioretention systems such as a 13’x 13’x 1.5’ rain garden or a 36’x 2’x 3.5’ vegetated swale could be used to achieve this storage volume.

Once the sizing of necessary stormwater BMPs has been determined, prepare the necessary information required Small Project Stormwater Site Plan and submit to East Earl Township for review and approval. Bring the worksheets, BMP information (size, location, etc.), Owner Acknowledgement, and BMP Facilities and Maintenance Agreement (if applicable) to East Earl Township.

If an area greater than 5,000 square feet of earth is disturbed, an erosion and sedimentation (E & S) control plan must be prepared. East Earl Township may require that the E&S plan be submitted to, reviewed, and approved by the Lancaster County Conservation District prior to approval of the Small Project Stormwater Site Plan

**OWNER ACKNOWLEDGMENT**

- Development activities shall begin only after East Earl Township approves the Small Project Stormwater Site Plan.
- The installed Stormwater BMPs will not adversely affect any property, septic systems, or drinking water wells on this or any other property.
- If, after approval of the Small Project by East Earl Township, 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 East Earl Township 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.
- The applicant acknowledges that the proposed Disconnected Impervious Area and/or Stormwater BMPs will be a permanent fixture of the property that can not be altered or removed without approval by East Earl Township.

I (we) \_\_\_\_\_, hereby acknowledge the above statements 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 Small Project Stormwater Site Plan, the East Earl Township Stormwater Worksheet, and the Stormwater Management / BMP Facilities and Maintenance Agreement (if applicable) will be adhered to.

**Applicant Acknowledgement of Submission**

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

**East Earl Township Acknowledgement of Receipt**

Signature: \_\_\_\_\_ Date: \_\_\_\_\_  
Member – Board of Supervisors

**X. STORMWATER MANAGEMENT / BMP FACILITIES AND MAINTENANCE AGREEMENT**

**STORMWATER MANAGEMENT/ BMP FACILITIES AND MAINTENANCE AGREEMENT**

**THIS AGREEMENT**, made and entered into this \_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, by and between \_\_\_\_\_ hereinafter called the "Landowner," and East Earl Township, Lancaster County, Pennsylvania, hereinafter called the "Township."

**WHEREAS**, the Landowner is the owner of certain real property described as (Lancaster County Tax Map / Parcel Identification Number) \_\_\_\_\_ as recorded by deed in the land records of Lancaster County, Pennsylvania, Book \_\_\_\_\_ Page \_\_\_\_\_, hereinafter called the "Property";

**WHEREAS**, the Landowner is proceeding to build on and develop the property; and

**WHEREAS**, the Small Project Stormwater Site Plan, which is expressly made a part hereof, as approved or to be approved by the Township, provides for detention of stormwater within the confines of the property through the use of Stormwater Best Management Practices (Stormwater BMPs); and

**WHEREAS**, The Township and the Landowner, its successors and assigns, agree that the health, safety, and welfare of the residents of the Township, require that on-site Stormwater BMPs be constructed and maintained on the Property; and

**WHEREAS**, The Township requires that on-site Stormwater BMPs as shown on the Small Project Stormwater Site Plan be constructed and adequately maintained by the Landowner, its successors and assigns. Any additional requirements imposed by the Township are considered part of the Small Project Stormwater Site Plan.

**NOW, THEREFORE**, in consideration of the foregoing premises, the mutual covenants contained herein, and the following terms and conditions, the parties hereto agree as follows:

1. The Landowner in accordance with the specifications identified within the Small Project Stormwater Site Plan shall construct the onsite Stormwater BMPs.
2. The Landowner, its successors and assigns, shall adequately maintain the Stormwater BMPs. This includes all pipes and channels built to convey stormwater to the facility, as well as all structures, improvements, and vegetation provided to control the quantity and quality of the stormwater. Adequate maintenance is herein defined as good working condition so that these facilities are performing their design functions.
3. The Landowner, its successors and assigns, shall **visually** inspect the Stormwater BMPs after all rainfall events exceeding one inch of precipitation in a 24-hour period.

4. The Landowner, its successors and assigns, hereby grant permission to the Township, its authorized agents and employees, to enter upon the Property without prior notification at reasonable times and upon presentation of proper identification to inspect the Stormwater BMPs whenever the Township deems necessary.

5. In the event the Landowner, its successors and assigns, fails to maintain the Stormwater BMPs as shown on the Small Project Stormwater Site Plan and in good working condition, the Township may enter upon the Property and take whatever action is deemed necessary to maintain said Stormwater BMPs and to charge the costs of such repairs to the Landowner, its successors and assigns. This provision shall not be construed to allow the Township to erect any structure of permanent nature on the land of the Landowner unless such structures were part of the approved Small Project Stormwater Site Plan. It is expressly understood and agreed that the Township is under no obligation to routinely maintain or repair said facilities, and in no event shall this Agreement be construed to impose any such obligation on the Township.

6. In the event that the Township, 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 Township within thirty (30) days of receipt of invoice for all expenses incurred. The Township has the right to file a municipal lien for unpaid costs and expenses that have not been reimbursed thirty (30) days after receipt of invoice.

7. The intent and purpose of this Agreement is to ensure the proper maintenance of the Stormwater BMPs by the Landowner. This Agreement shall not be deemed to create any additional liability of any party for damage alleged to result from or be caused by nonpoint source pollution runoff. This Agreement imposes no liability of any kind whatsoever on the Township and the Landowner agrees to hold the Township harmless from any liability in the event the Stormwater BMPs fail to operate properly. In the event that a claim is asserted against the Township, its designated representatives or employees, the Township 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 Township shall be allowed, the Landowner shall pay all costs and expenses regarding said judgment.

8. This Agreement shall be binding to the Landowner, its administrators, executors, assigns, heirs and any other successors in interests, in perpetuity.

**Landowner:**

Signature: \_\_\_\_\_  
Printed Name: \_\_\_\_\_

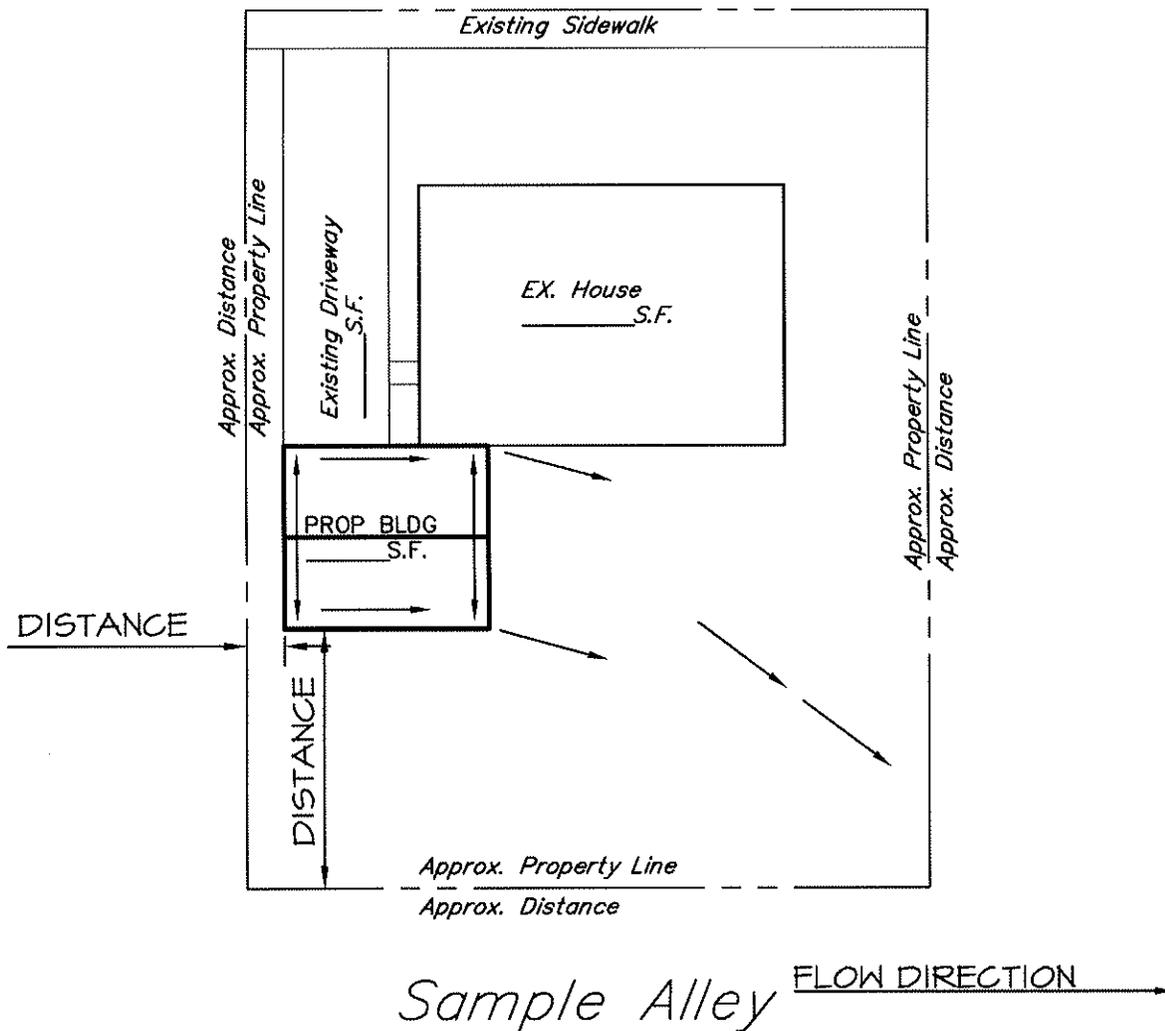
Date: \_\_\_\_\_

**East Earl Township:**

Signature: \_\_\_\_\_  
Printed Name: \_\_\_\_\_  
Title: \_\_\_\_\_

Date: \_\_\_\_\_

Main Street



REVISED SEPTEMBER 2016

EAST EARL TOWNSHIP  
ATTACHMENT I SAMPLE SKETCH/SITE PLAN

JOB NUMBER:

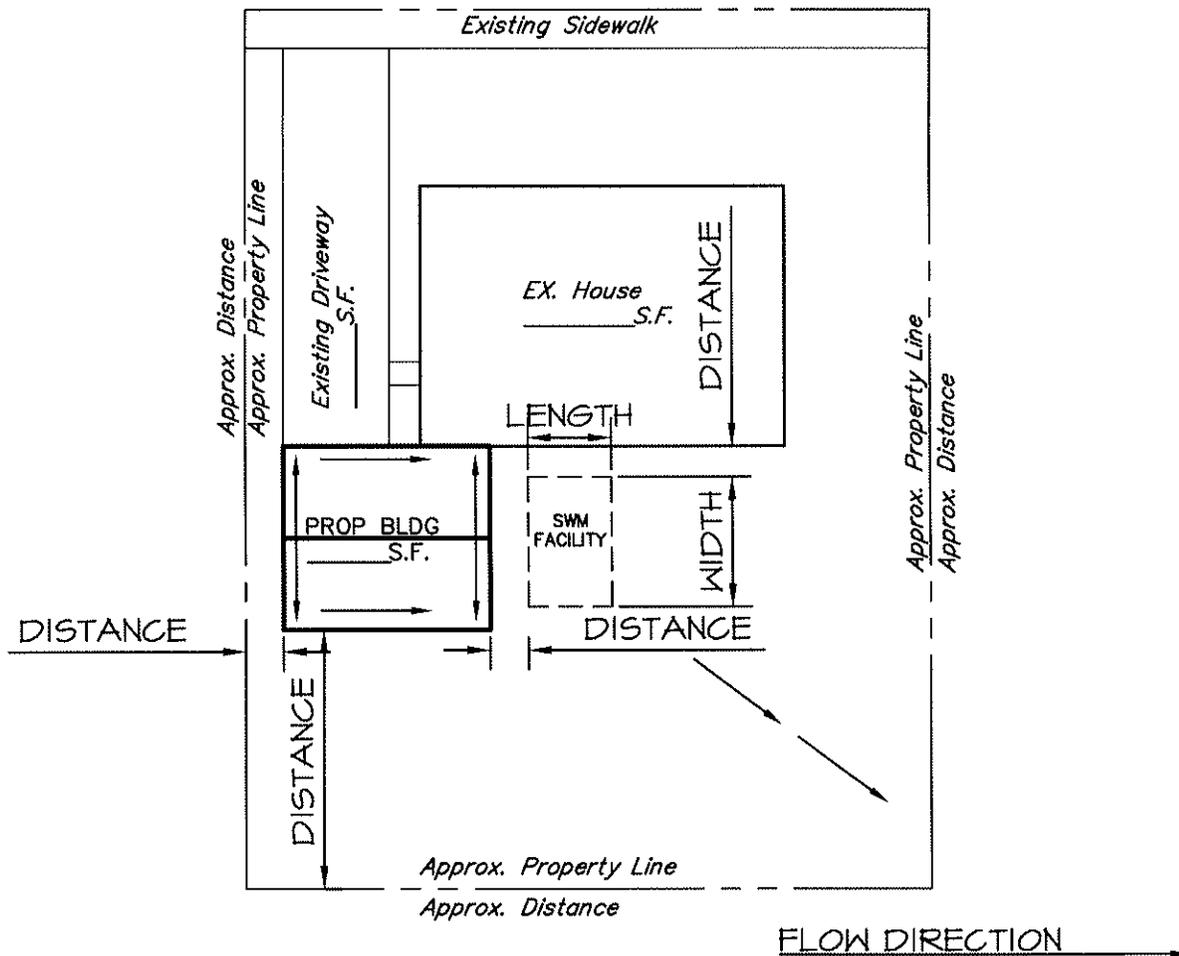
**EA**  
group, inc.  
ENGINEERS & LANDSCAPE ARCHITECTS

743 SOUTH BROAD STREET  
LITITZ, PA 17543  
(717) 626-1271 FAX (717) 626-1040  
www.eiagroup.com

SCALE: N.T.S.  
DRAWN BY:  
DATE: 2014

DRAWING:  
N/A  
SKETCH:  
1 OF 1

Main Street



Sample Alley

REVISED SEPTEMBER 2016

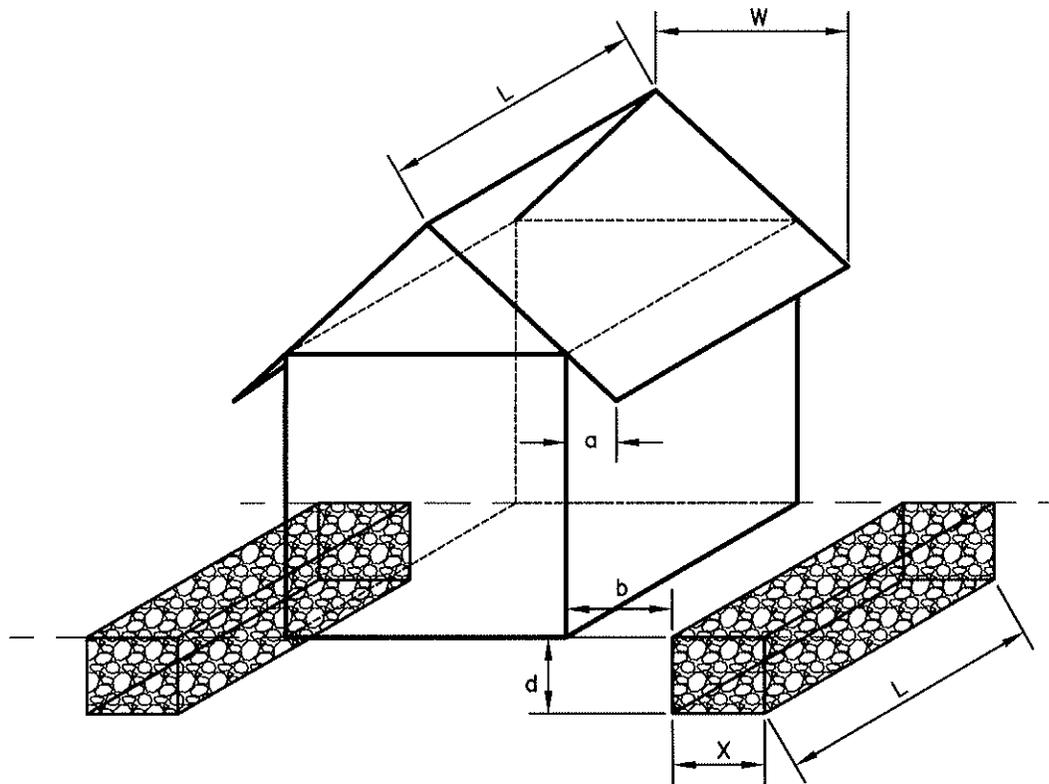
EAST EARL TOWNSHIP  
ATTACHMENT 2 SAMPLE SWM SITE PLAN

JOB NUMBER:

**ELAG** 743 SOUTH BROAD STREET  
LITITZ, PA 17543  
(717) 626-1211 FAX (717) 626-7040  
www.elagroup.com  
**Group, Inc.**  
ENGINEERS & LANDSCAPE ARCHITECTS

SCALE:	N.T.S.
DRAWN BY:	
DATE:	2014

DRAWING:	N/A
SKETCH:	1 OF 1



**KEY**

- L = LENGTH OF STRUCTURE ROOF = LENGTH OF SEEPAGE TRENCH (FT.)
- W = WIDTH OF ONE SIDE OF THE ROOF (FT)
- a = EAVE/OVERHANG (FT)
- b = DISTANCE FROM STRUCTURE WALL TO SEEPAGE TRENCH (FT)  
= a + 1 FT => PLACE FROM EDGE OF TRENCH ONE FOOT PAST EAVES
- x = WIDTH OF SEEPAGE TRENCH (FT)
- d = DEPTH OF SEEPAGE TRENCH (FT)

REQUIRED VOLUME OF TRENCH =>  $L*W*1/12 = L*X*d*0.4$  =>  $X=0.14W$  for  $d=1.5'$

Ratio: 3.6 to 1

**NOTES**

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

REVISED SEPTEMBER 2016

**EAST EARL TOWNSHIP**

ATTACHMENT 3 STORMWATER MANAGEMENT STRUCTURES WITHOUT GUTTERS

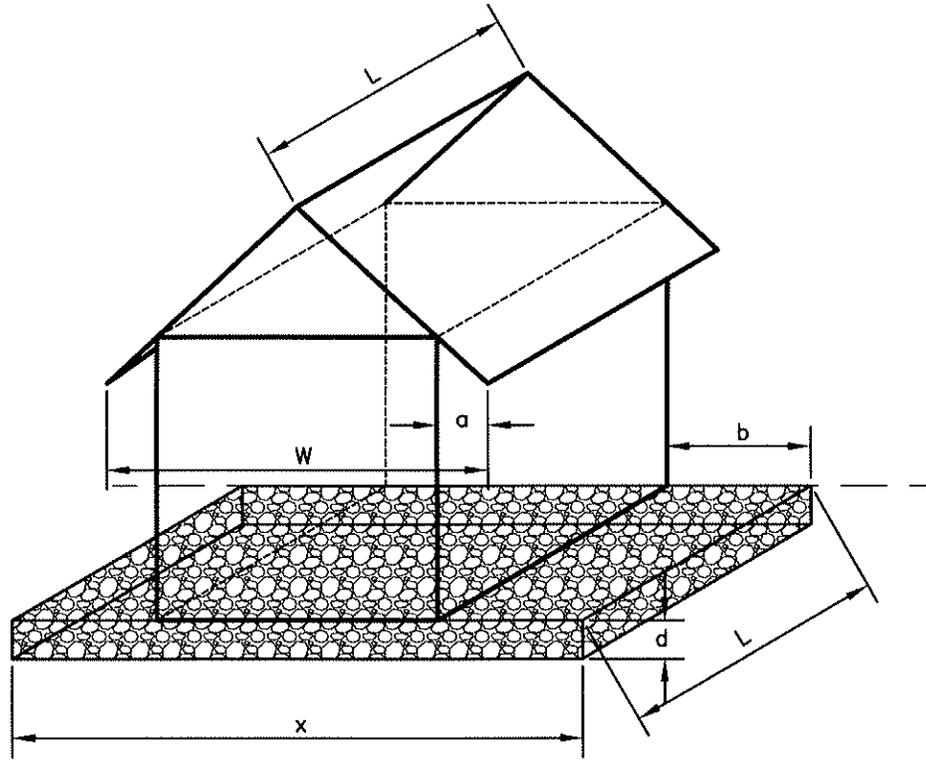
JOB NUMBER:

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 LITITZ, PA 17543  
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SCALE:	N.T.S.
DRAWN BY:	
DATE:	2014

DRAWING:	N/A
SKETCH:	1 OF 2



**KEY**

- L = LENGTH OF STRUCTURE ROOF = LENGTH OF SEEPAGE TRENCH (FT.)
- W = WIDTH OF ONE SIDE OF THE ROOF (FT)
- a = EAVE/OVERHANG (FT)
- b = DISTANCE FROM STRUCTURE WALL TO SEEPAGE TRENCH (FT)  
= a + 1 FT => PLACE FROM EDGE OF TRENCH ONE FOOT PAST EAVES
- x = WIDTH OF SEEPAGE TRENCH (FT)  
x = W + 2FT
- d = DEPTH OF SEEPAGE TRENCH (FT)  
D = 6" TO 8" (AVERAGE)

**NOTES**

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

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**EAST EARL**

ATTACHMENT 3 STORMWATER MANAGEMENT STRUCTURES WITHOUT GUTTERS

JOB NUMBER:

-

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**Group, Inc.**  
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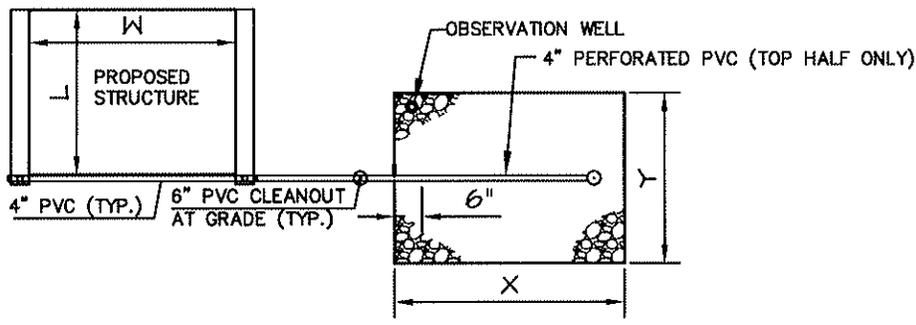
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DRAWN BY:  
DATE: 2014

DRAWING:

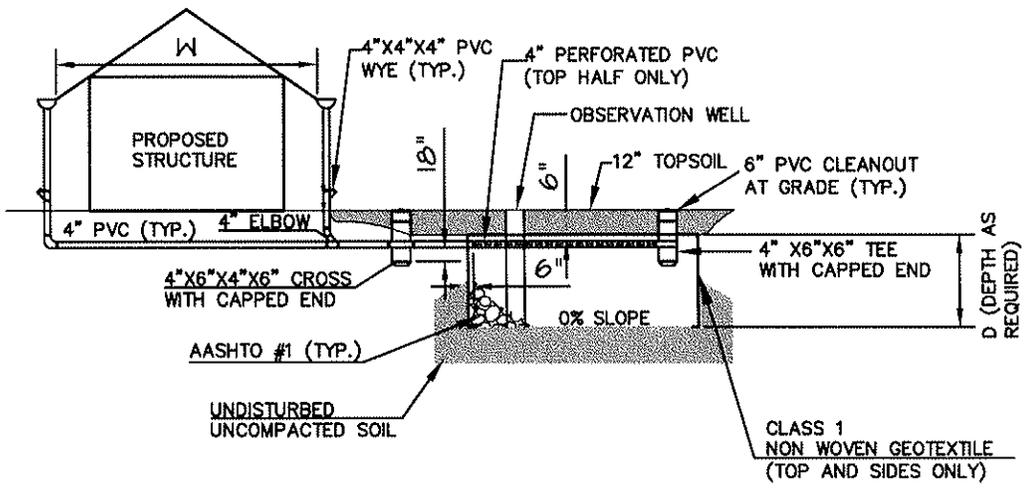
N/A

SKETCH:

2 OF 2



PLAN VIEW



SECTION VIEW

- KEY**
- 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 OF BED =  $L * W * 1/12 = X * Y * D * 0.4$  [ASSUME X=W D=2']  
 $Y=0.11L$   
 RATIO 4.76 TO 1  
 (IMPERVIOUS TO INFILTRATION)

- NOTES**
- 1.) BOTTOM OF BED TO BE D+1' BELOW GRADE TO ACCOUNT FOR 1' OF TOPSOIL.
  - 2.) PIPING AND CLEANOUTS TO BE CENTERED WITHIN INFILTRATION BED.
  - 3.) BED TO BE CHECKED REGULARLY TO MAINTAIN PROPER OPERATION.
  - 4.) SEE SHEET 2 OF 2 FOR ADDITIONAL DETAILS

REVISED SEPTEMBER 2016

**EAST EARL TOWNSHIP**

**ATTACHMENT 4 STORMWATER MANAGEMENT SAMPLE STRUCTURE WITH GUTTERS**

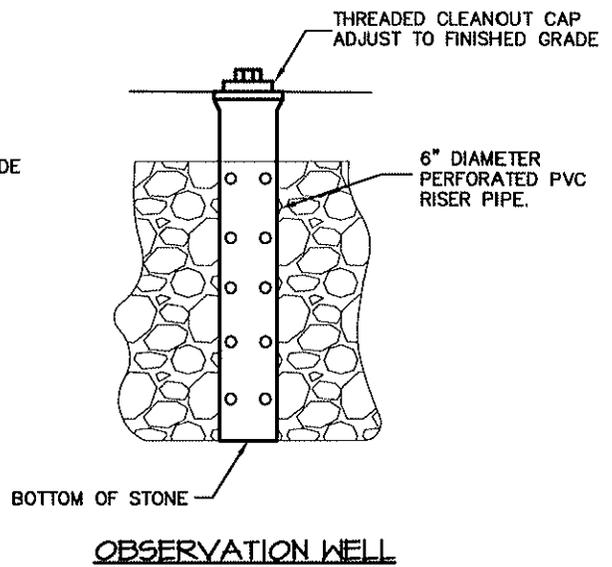
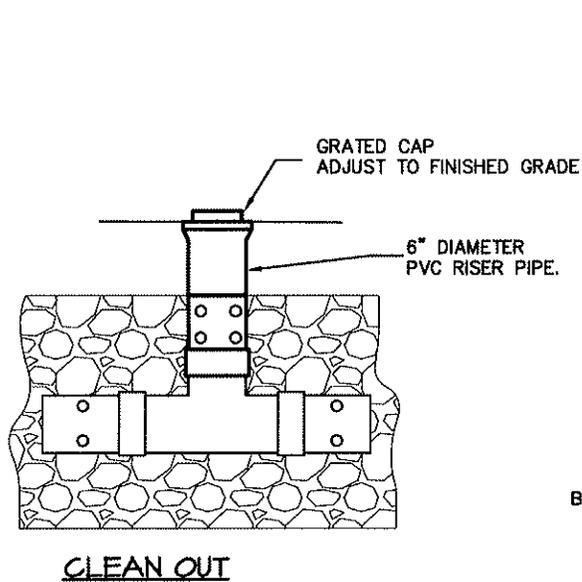
JOB NUMBER:  
-

**BA**  
**grody, inc.**  
 ENGINEERS & LANDSCAPE ARCHITECTS  
 743 SOUTH BROAD STREET  
 LITITZ, PA 17543  
 (717) 626-1271 FAX (717) 626-7040  
 www.elagroup.com

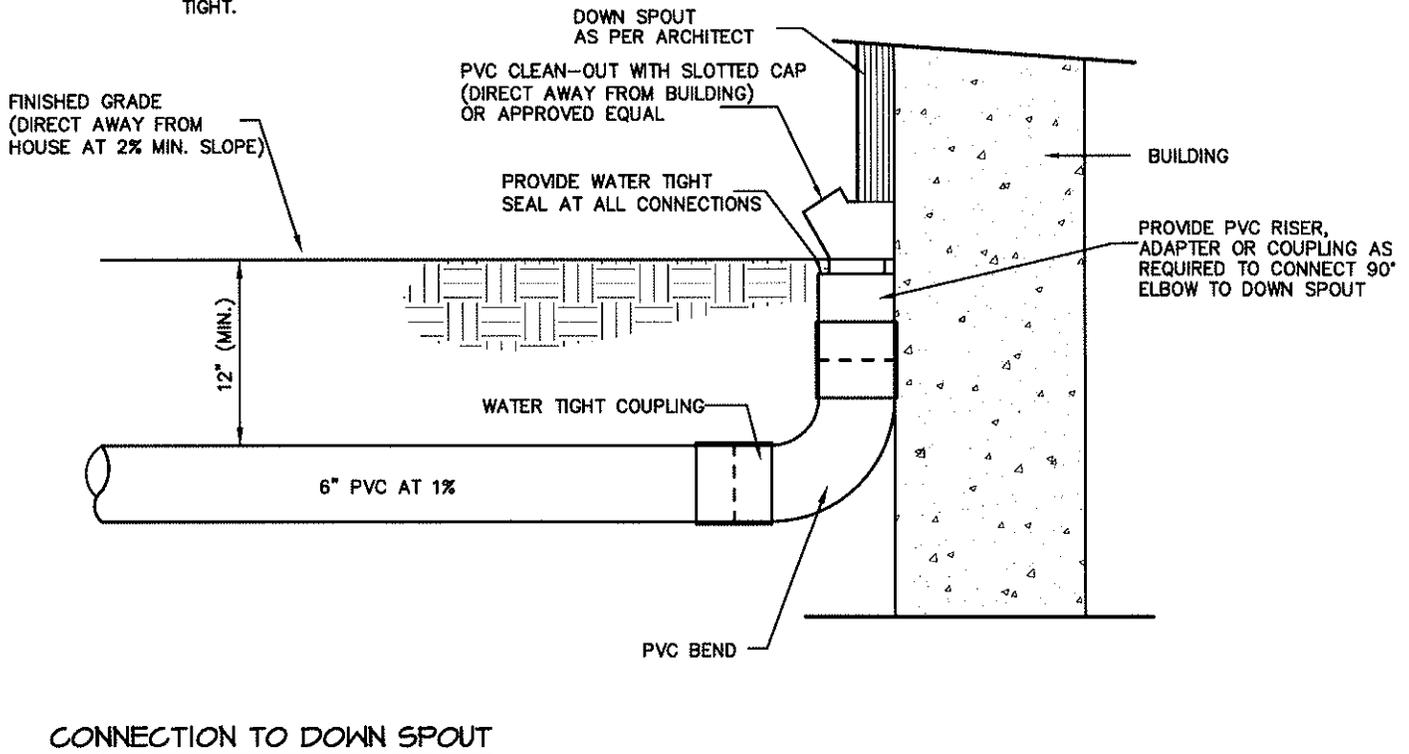
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 DRAWN BY:  
 DATE: 2014

DRAWING:  
N/A  
 SKETCH:  
1 OF 2

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NOTE:  
CONTRACTOR SHALL PROVIDE ALL  
FITTINGS, ADAPTERS, COUPLINGS AND  
OTHER APPURTENANCES AS REQUIRED TO  
CONNECT STORM CONVEYANCE SYSTEM.  
ALL CONNECTIONS SHALL BE WATER  
TIGHT.



REVISED SEPTEMBER 2016

**EAST EARL TOWNSHIP**  
ATTACHMENT 4-IDOWNSPOUT/CLEAN OUT/OBSERVATION WELL DETAILS

JOB NUMBER:

-

**BA** GROUP, Inc.  
143 SOUTH BROAD STREET  
LITITZ, PA 17543  
(717) 626-1211 FAX (717) 626-1040  
www.bagroup.com  
ENGINEERS & LANDSCAPE ARCHITECTS

SCALE:

N.T.S.

DRAWING:

N/A

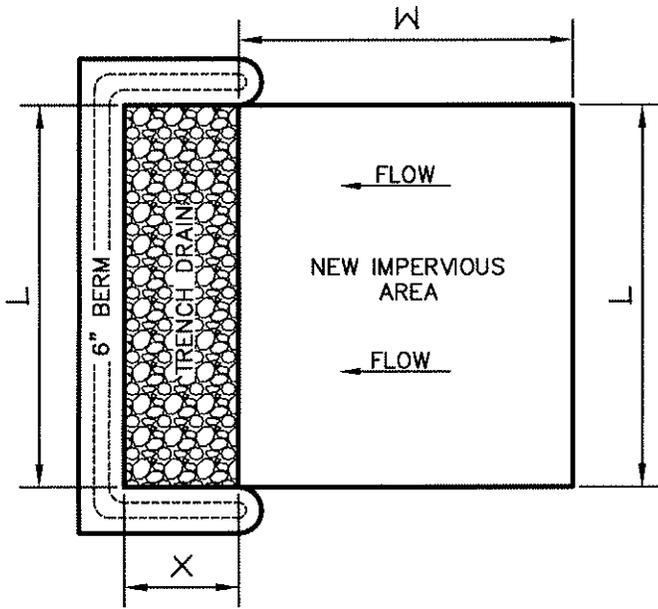
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SKETCH:

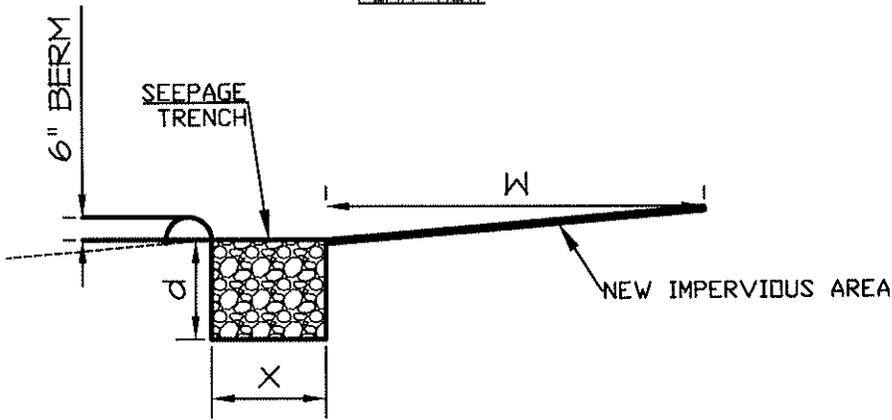
DATE:

2014

2 OF 2



PLAN VIEW



SECTION VIEW

**KEY**

- L = LENGTH OF NEW IMPERVIOUS SURFACE (FT) =LENGTH OF SEEPAGE TRENCH
- W = WIDTH OF NEW IMPERVIOUS SURFACE -MAY NOT EXCEED 75'
- X = WIDTH OF SEEPAGE TRENCH (FT)
- d = DEPTH OF SEEPAGE TRENCH (FT)

REQUIRED VOLUME OF TRENCH =>  $L*W*1/12=X*L*d*0.4$  =>  $X=0.14W$  FOR  $d=1.5'$

**NOTES**

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

REVISED SEPTEMBER 2016

**EAST EARL TOWNSHIP**

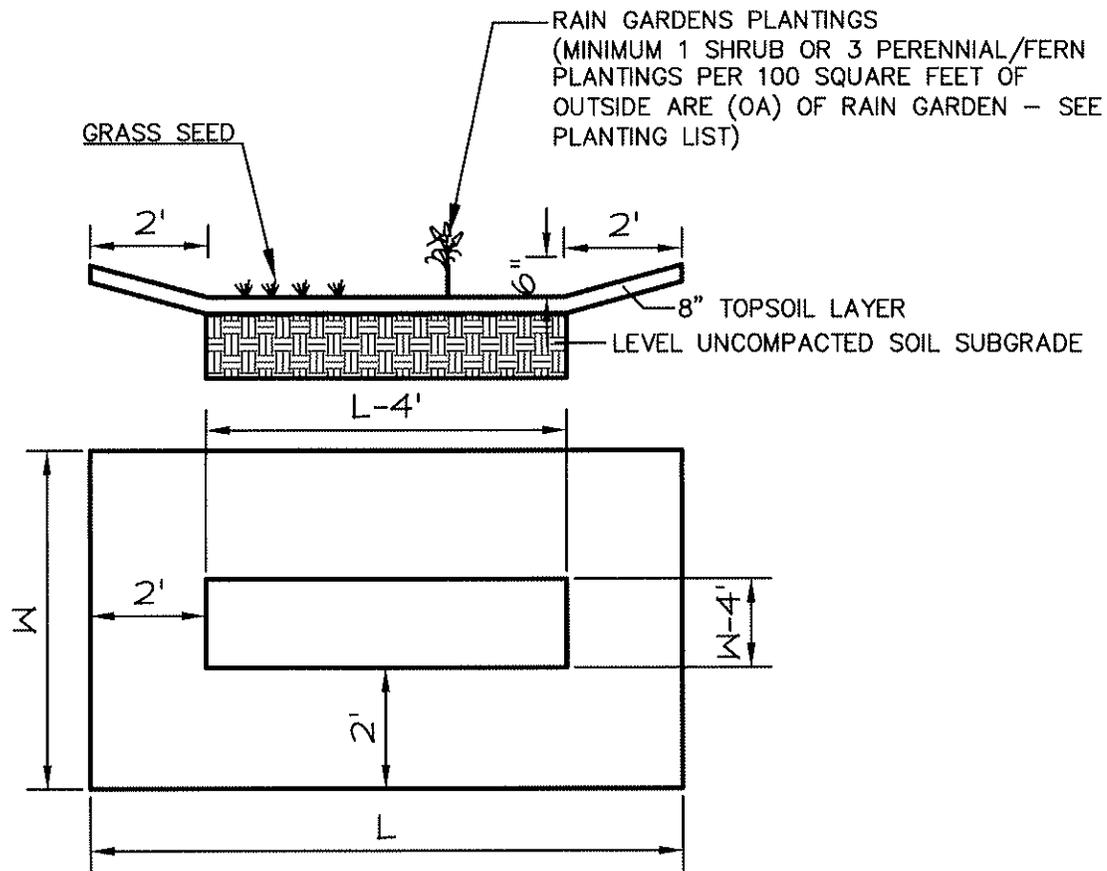
ATTACHMENT 5 STORMWATER MANAGEMENT AT GRADE IMPERVIOUS

JOB NUMBER:

**DLA** 148 SOUTH BROAD STREET  
LITITZ, PA 17543  
(717) 626-7271 FAX (717) 626-7040  
www.dlagroup.com  
**group, inc.**  
ENGINEERS & LANDSCAPE ARCHITECTS

SCALE:	N.T.S.
DRAWN BY:	
DATE:	2014

DRAWING:	N/A
SKETCH:	1 OF 1



- 1.) CALCULATE REQUIRED RAIN GARDEN VOLUME (V)  
 $(RV) = \text{SQUARE FEET OF NEW IMPERVIOUS AREA} \times (0.083')$        $RV = \underline{\hspace{2cm}} \text{ FT}^3$
- 2.) CALCULATE OUTSIDE AREA OF RAIN GARDEN (OA)  
 $(OA) = \text{LENGTH (L)} \times \text{WIDTH (W)}$        $OA = \underline{\hspace{2cm}} \text{ FT}^2$
- 3.) CALCULATE INSIDE AREA OF RAIN GARDEN (IA)  
 $(IA) = [(L)-4'] \times [(W)-4']$        $IA = \underline{\hspace{2cm}} \text{ FT}^2$
- 4.) CALCULATE AVERAGE AREA OF RAIN GARDEN (AA)  
 $(AA) = (OA)/2 + (IA)/2$        $AA = \underline{\hspace{2cm}} \text{ FT}^2$
- 5.) CALCULATE STORAGE VOLUME (SV)  
 $(SV) = (AA) \times 0.5'$        $SV = \underline{\hspace{2cm}} \text{ FT}^3$
- 6.) CHECK FOR ADEQUATE STORAGE  
 STORAGE VOLUME (SV) MUST BE GREATER THAN REQUIRED VOLUME (RV)  
 $RV = \underline{\hspace{2cm}} \text{ FT}^3 > SV = \underline{\hspace{2cm}} \text{ FT}^3$
- 7.) ADJUST RAIN GARDEN SIZE  
 IF STORAGE VOLUME (SV) IS NOT GREATER THAN REQUIRED VOLUME (RV), INCREASE THE SIZE OF THE RAIN GARDEN AND REPEAT STEPS 2-6.

REVISED SEPTEMBER 2016

**EAST EARL TOWNSHIP**  
**ATTACHMENT 6 RAIN GARDEN**

JOB NUMBER:  
 DRAWING:  
 N/A  
 SKETCH:  
 1 OF 1

**IA**  
**group inc.**  
 ENGINEERS & LANDSCAPE ARCHITECTS

743 SOUTH BROAD STREET  
 LITITZ, PA 17543  
 (717) 626-7271 FAX (717) 626-1040  
 www.iaigroup.com

SCALE:      N.T.S.  
 DRAWN BY:  
 DATE:      2014

DRAWINGS: K:\112\12-231 5/4/14 UPDATE\Details-East Earl.dwg - PLOTTED: Aug 22, 2016 10:55 am

## Rain Garden Native Planting List

### **Perennials and Ferns**

Blue false indigo (*Baptista 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-anglia*)  
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*)

**Small Projects Guide-Sample Operation & Maintenance Plan**

**Construction:**

1. Install erosion and sedimentation control facilities
2. Stormwater Management Facility (ies) shall be installed before impervious areas are completed. If earthwork is involved during the construction of the impervious area, then extreme caution shall be taken so that sediment does not wash into the SWM Facility (ies).
3. Mark the locations of the SWM facility (ies).
4. Excavate the SWM Facility to the required depth. Contact municipality for inspection prior to filling. If standing water is encountered, a SWM Site Plan may need to be submitted; contact Municipal Engineer. All excavated materials shall be removed from the site or stabilized.

For stone Infiltration Structures

5. Line excavation with Geotextile.
6. Backfill SWM facility with required stone. If required: Install piping, cleanouts and associated facilities as detailed.
7. If required: Close geotextile material over stone bedding.
8. If required: Place topsoil over trench.
9. Stabilize and seed all disturbed areas.

For Rain Gardens

10. Place topsoil over excavated area.
11. Install plantings as shown on the plan.
12. Stabilize and seed all disturbed areas.

**Maintenance:**

1. The SWM facility shall be checked regularly to ensure that no standing water exists in the facility 3 days after a rain event. If water is encountered, the facility may need to be modified. Notification of the municipality is required if facility is not functioning before any modifications are made.
2. Monitor the SWM facility to ensure that no sediment, grass clippings, leaves, and other similar accumulations occur on top of, and/or within, the SWM Facility.
3. Homeowner to submit an inspection report to the Township one year after construction and every 3<sup>rd</sup> year thereafter.

I have read and agree to the above Operation and Maintenance Plan. I, as the property owner, am responsible for the proper construction and operation and maintenance for the SWM Facilities. If I fail to adhere to any of these tasks, the Township may perform the services required and charge the appropriate fees. Nonpayment of the fees may result in a lien against my property.

\_\_\_\_\_  
Applicant Name (Printed)

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date