STORMWATER MANAGEMENT
DESIGN ASSISTANCE MANUAL

For Small Projects in
Borough of Strasburg, Lancaster County, Pennsylvania

Small Projects
Simplified Approach

Dated: 9/12/2016

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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 new, relatively minor residential and accessory structure projects. 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 the Borough of Strasburg 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, control measures, planning or procedures used to minimize accelerated erosion and sedimentation and manage stormwater to protect, maintain, reclaim, and restore the quality of waters and the existing and designated uses of waters within this Commonwealth before, during and after earth disturbance activities.

Disconnected Impervious Area (DIA) – An impervious or impermeable surface that is disconnected from any stormwater drainage or conveyance system and is redirected or

directed to a pervious area, which allows for infiltration, filtration, and increased time of concentration.

Disturbed Area – Any 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) – Surfaces which prevent the infiltration of water into the ground. All structures, buildings, parking areas, driveways, roads, streets, sidewalks, decks, and any areas of concrete, asphalt, packed stone, and compacted soil shall be considered impervious surface if they prevent infiltration.

Karst – A type of topography or landscape characterized by features including but not limited to 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 surface.

Small Project – Regulated activities that, measured on a cumulative basis from June 22, 2004, create additional impervious areas of more than 1,000 sq. ft. and less than 2,500 sq. ft. or involve removal of ground cover, grading, filling or excavation of an area less than 5,000 sq. ft. 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 the Borough of Strasburg. Completion of the Borough of Strasburg **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 2,500 square feet of impervious area). If a formal Stormwater Management Plan is required in accordance with the Borough of Strasburg 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 ft²	File Municipal Stormwater Management Worksheet with Borough of Strasburg
Small Project per Definition	1,000 ft² to ≤ 2,500 ft²	Prepare a Small Project Plan per Section 501
Non-Exempt	Greater than 2,500 ft²	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 Borough of Strasburg Stormwater Management Worksheets will assist the property owner, or applicant, and the Borough of Strasburg in determining the impervious area of a proposed project and providing guidance through ensuing steps.

Step 1: Step 1 of the Borough of Strasburg 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 Statement on the application and file it with the Borough of Strasburg. The Borough of Strasburg will use this as a record of exempt projects and keep a running total of proposed impervious area since June 22, 2004.

The Borough of Strasburg will use this as a record of exempt projects and keep a running total of proposed impervious area since the adoption of the Borough of Strasburg Stormwater Management Ordinance. After exceeding 1,000 square feet of impervious area since the adoption of the Borough of Strasburg Stormwater Management Ordinance, a property owner will need to prepare a Minor Stormwater Site Plan or a Stormwater Management Site Plan in accordance with Article III

However, 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 this ordinance should the Borough of Strasburg determine that there is a potential for stormwater runoff associated with the proposed Regulated Activity to adversely affect adjacent or downstream public or private properties.

If the total new impervious area is 1,000 square feet and less than 2,500 square feet, the applicant will go on to Step 2. If the Regulated Activity involves only Earth Disturbance less than 5,000 square feet, the applicant shall contact the Borough of Strasburg for additional guidance.

Step 2: Step 2 of the Borough of Strasburg Stormwater Management Worksheet provides a process to determine the Disconnected Impervious Area (DIA). If the total new impervious area can be disconnected in accordance with the standards expressed in this Manual, projects of this size may be exempt from providing additional stormwater management controls. The owner will sign the Acknowledgement statement on the application and file it with the Borough of Strasburg. The Borough of Strasburg will use this as a record of exempt projects and keep a running total of proposed impervious area since June 22, 2004.

If the total new impervious area is greater than 1,000 square feet and less than or equal to 2,500 square feet, and if DIA requirements cannot be met for all the new impervious area, projects of this size may not be exempt from the volume and rate requirements of the Borough of Strasburg Stormwater Management Ordinance. In these cases, applicants will continue to Step 3.

Step 3: Step 3 of the Borough of Strasburg 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 4.

Step 4: Step 4 of the Borough of Strasburg Stormwater Management Worksheet provides guidance regarding the preparation of a Small Project Stormwater Site Plan, as outlined in this Design Manual, for approval by the Borough of Strasburg. This includes determining the types, sizes, and location of proposed Stormwater BMPs to be used for a given project. The worksheets, Small Project Stormwater Site Plan, and Owner Acknowledgement will be brought to the Borough of Strasburg for approval. The Borough of Strasburg will use this submission as a record to keep a running total of proposed impervious area since the adoption of the Borough of Strasburg Stormwater Management Ordinance, and to monitor the installation of the required Stormwater BMPs necessary to support the project.

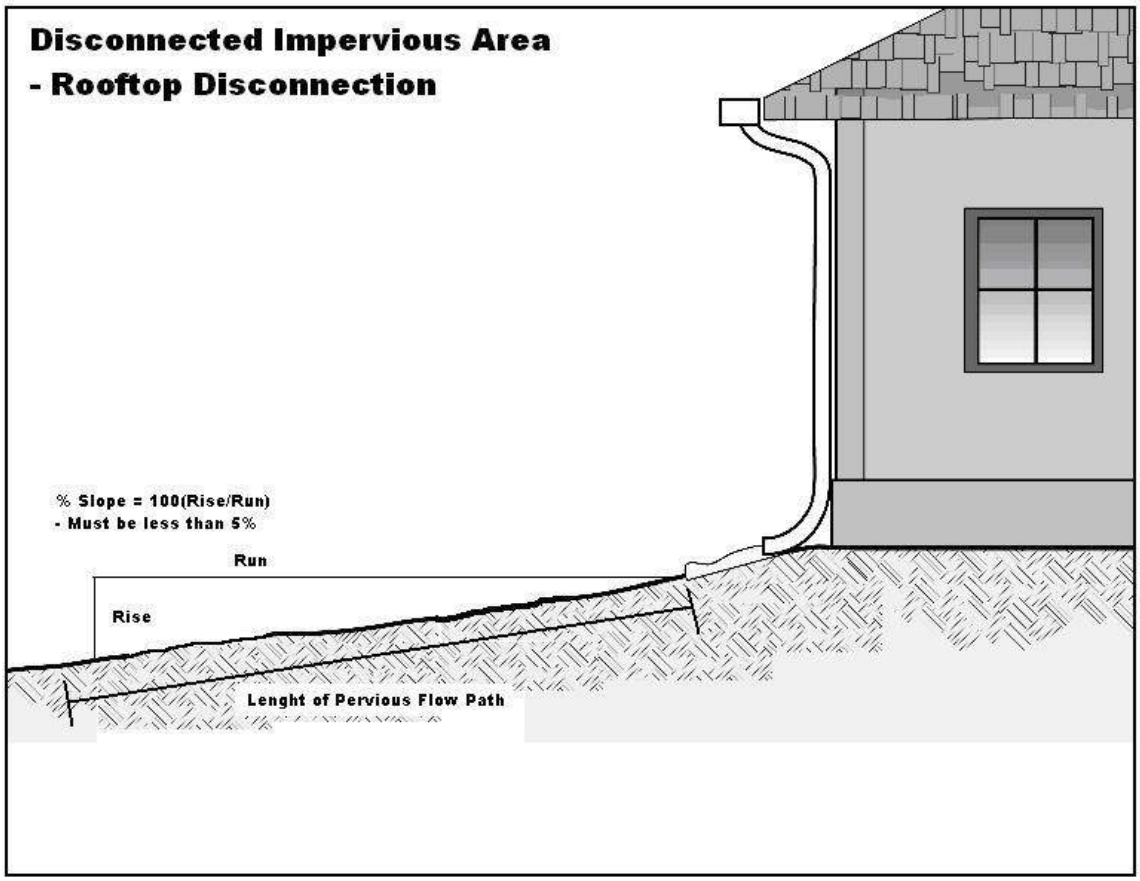
VI. DISCONNECTED IMPERVIOUS AREA (DIA):

When impervious surface areas like rooftops and paved areas are directed to a pervious area that allows for infiltration, filtration, and increased time of concentration, the impervious surface areas may qualify to be treated as Disconnected Impervious Area (DIAs).

Rooftop Disconnection: A rooftop is considered to be completely disconnected if it meets the requirements listed below.

- The overland flow path from roof runoff discharge point has a positive slope of five percent (5%) or less.
- The length of the overland flow path is greater than 75 feet.

- Soils along the overland flow path are not classified as wetlands, i.e. infiltration is at least 1 inch per 24-hour day.
- The receiving pervious area shall not include another person's property.



Note: Downspout not required.

Determining Status of Rooftop DIA:

Step 1: Determine contributing area of the roof to each disconnected discharge (downspout).

Step 2: Determine the length of down slope pervious flow path available for each disconnected discharge.

Step 3: Determine the % slope of the pervious flow path, % slope = (rise/ run) x 100. Must be 5% or less.

Step 4: See the Partial Rooftop Disconnection table to determine the percentage of the area that can be treated as disconnected. If the available length of the flow path is equal to or greater than 75 ft, the discharge qualifies as entirely disconnected.

Partial Rooftop Disconnection		
Length of Pervious Flow Path* (ft) Lots 10,000 ft² and Under	Length of Pervious Flow Path* (ft)	Roof Area Treated as Disconnected
0 – 7.9	0 – 14	0%
8 – 15.9	15 – 29	20%
16 – 22.9	30 – 44	40%
23 – 29.9	45 – 59	60%
30 – 34.9	60 – 74	80%
35 or more	75 or more	100%

*Pervious flow path must be at least 15 feet from any impervious surface and cannot include impervious surfaces.

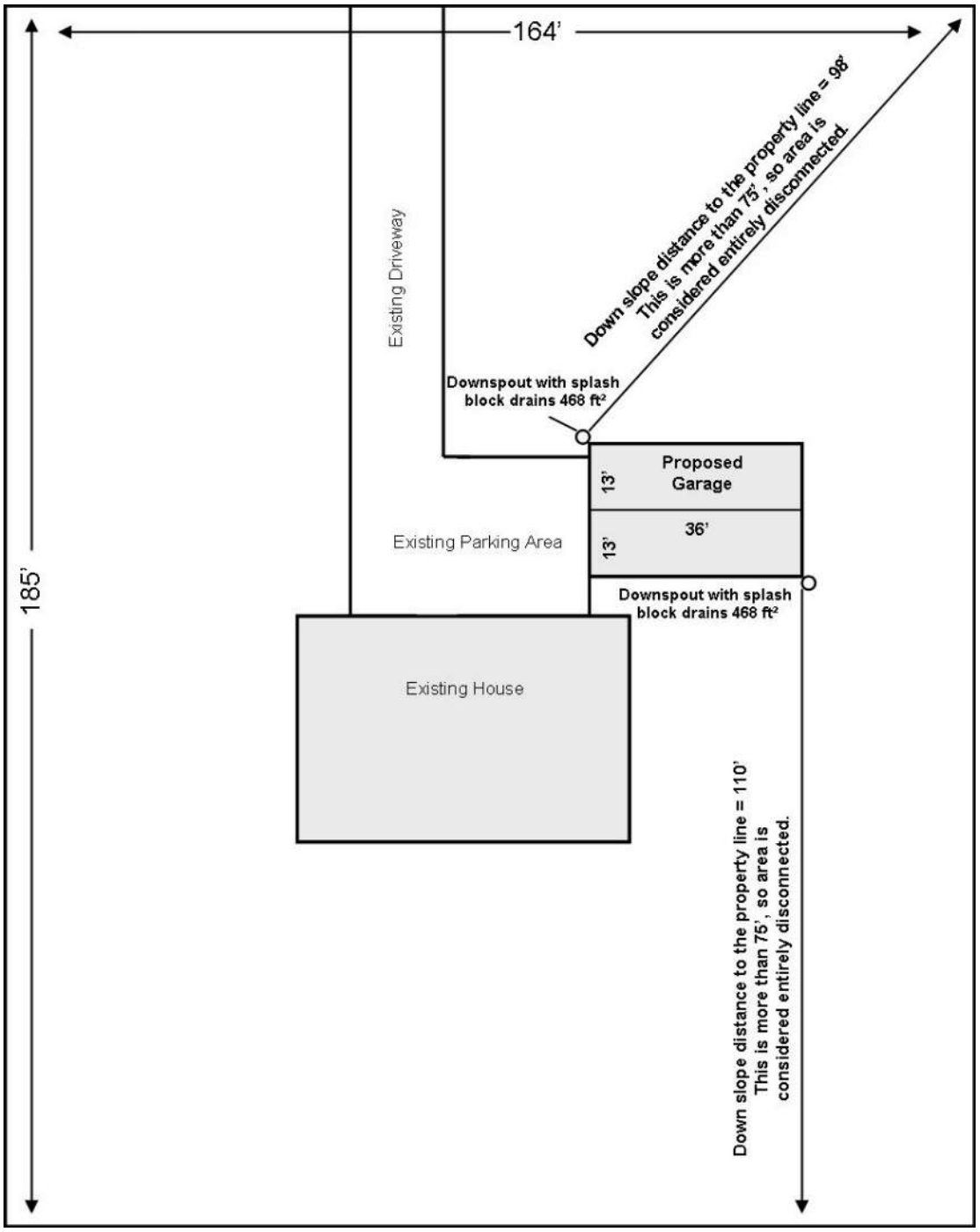
Other Impervious Surface Disconnection: When runoff from other impervious surfaces is directed to a pervious area that allows for infiltration, filtration, and increased time of concentration, the contributing impervious surface may qualify as disconnected. Other impervious surfaces include all non-rooftop surfaces, including but not limited to driveways, parking areas, walkways, porches, and decks. With regard to driveways, parking areas, and walkways, this analysis applies to only small or narrow facilities. Features such as commercial parking lots or commercial entrance / circulation drives shall not be included in this analysis. Other impervious surfaces can be considered disconnected if they, or the adjacent areas, meet the following requirements:

- The contributing flow path over the impervious area is not more than 75 feet.
- The length of overland flow is greater than or equal to the maximum length of flow over the impervious area.
- The slope of the contributing impervious area is five percent (5%) or less.
- The slope of the overland flow path is five percent (5%) or less.
- If discharge is concentrated at one or more discrete points, no more than 1,000 ft² may discharge to any one point. In addition, a gravel strip or other spreading device is required for concentrated discharges. For non-concentrated discharges along the entire edge of paved surface, a level spreader is not required; however, there must be provisions for the establishment of vegetation along the paved edge and temporary stabilization of the area until the vegetation is established.

REFERENCE: Philadelphia Water Department. 2006 & 2011. Stormwater Management Guidance Manual. Section 4: Integrated Site Design. Philadelphia, PA.

Example Project: The following example determines the status of DIA for a proposed 936 ft² garage.

This example meets the Disconnected Impervious Area criteria. to be exempted from the volume, rate, and SWM Site Plan requirements of the Borough of Strasburg Stormwater Management Ordinance.



Step 1: Determine the area to each disconnected discharge. The area draining to each downspout is 468 ft^2.

Step 2: The discharge on the north side of the garage has a 98 ft pervious flow path available. The south discharge has 110 ft pervious flow path available.

Step 3: The rise of the north discharge is 2 ft and the run is 75 ft for a slope of 2.6%. This is 5% or less so it qualifies. For the south discharge the rise is 4 ft and the run is 100 ft equaling a slope of 4%. This is 5% or less, so it qualifies.

Step 4: Both of these discharges have pervious flow paths greater than 75 ft, so they qualify as entirely disconnected.

VII. 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 the Borough of Strasburg a Small Project Stormwater Site Plan and the Borough of Strasburg 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 owner name, address, email and phone number
- Property address (if different from owner address)
- Name address, email, and phone number of plan preparer (if not the owner)
- 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.
- Existing and proposed easements (gas, electric, stormwater, water, sewer, etc.)

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

- Location and size of proposed Stormwater BMPs.
- Details of BMPs as necessary for construction

Other Considerations for Small Project Stormwater Site Plans:

- For Small Project Stormwater Site 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 the Borough of Strasburg), at the discretion of the Borough of Strasburg.
- Water quality shall be protected per Chapter 93 of PA Code.
- The Borough of Strasburg 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 Storwmater BMPs shall be designed, constructed, and maintained in accordance with the manufacturer's recommendation, the *PA Stormwater Management BMP Manual*, or other written guidance acceptable to the Borough of Strasburg.
- Proposed sump pumps shall discharge to infiltration or vegetative Stormwater BMPs to the maximum extent practicable.

VIII. Selecting Stormwater BMPs

If the submission of a Small Project Stormwater Site Plan including the use of Stormwater BMPs is required, the applicant should review the compiled information in 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

Borough of Strasburg 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.

The Applicant may choose to install a Stormwater BMP facility as shown in the Stormwater Management Worksheets. The Stormwater BMP facility shall be constructed in accordance with the associated construction details, requirements and notes.

IX. Stormwater Management Worksheets

For Borough of Strasburg Use and Record of Project Area

Property Owner's Name _____

Address of Property _____

Parcel ID # _____

Phone Number _____ New Impervious Area Associated with this Project _____

Stormwater Management Submission Type: _____Small Project
_____Stormwater Management Plan

Total New Impervious Area Since Adoption of SWM Plan _____

Acknowledgement - I declare that I am the property owner, or representative of the owner, and that the information provided is accurate to the best of my knowledge. I understand that stormwater may not adversely affect adjacent properties or be directed onto another property without written permission. I also understand that false information may result in a stop work order or revocation of permits. Municipal representatives are also granted reasonable access to the property for review and/ or inspection of this project if necessary.

Signature _____ Date _____

Step 1: Determine the amount of new impervious surface area created by the proposed project. This includes any new impervious surface area that prevents infiltration of stormwater into the ground. New stone and gravel areas are considered impervious. Impervious surface areas existing before June 22, 2004 are not included in this calculation. Use additional sheets if necessary.

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Calculate new impervious area by completing this table.

Surface	Length (ft)	x	Width (ft)	=	Impervious Area (ft^2)
Buildings		x		=	
Driveway		x		=	
Parking Areas		x		=	
Patios/ walkways		x		=	
Other		x		=	
Total Proposed Impervious Surface Area (Sum of all impervious areas)					

a. If the total new impervious surface area is **less than or equal to 1,000 ft²**, 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 Borough of Strasburg.

b. 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 this ordinance should the Municipality determine that there is a potential for stormwater runoff associated with the proposed Regulated Activity to adversely affect adjacent or downstream public or private properties.

c. If total new impervious surface area is **greater than 1,000 ft², and less than or equal to 2,500 ft²**, continue to Step 2.

d. If the total new impervious surface area is **greater than 2,500 ft²** then a Stormwater Management Plan shall be submitted in accordance with the Borough of Strasburg Stormwater Management Ordinance.

Step 2: Determine Disconnected Impervious Area (DIA). All or parts of new impervious surfaces may qualify as Disconnected Impervious Area if runoff is directed to a pervious area that allows for infiltration, filtration, and increased time of concentration. The volume of stormwater that needs to be managed could be reduced through DIA.

Rooftop Disconnection Criteria

- Overland flow path from the discharge area or impervious area has a positive slope of 5% or less.
- Soils are not classified as wetlands
- The receiving pervious area shall not include another person's property.

Paved Disconnection Criteria: Other impervious surfaces (driveways, walkways, porches, decks, etc.) and gravel can be considered disconnected if it meets the criteria above and:

- Runoff does not flow over impervious area for more than 75 feet.
- The length of overland flow is greater than or equal to the contributing flow path.
- The slope of the contributing impervious areas is 5% or less.
- If discharge is concentrated at one or more discrete points, no more than 1,000 ft² may discharge to any one point. In addition, a gravel strip or other spreading device is required for concentrated discharges. Non-concentrated discharges along the entire edge of paved surface must include provisions for the establishment of vegetation along the paved edge and temporary stabilization of the area until the vegetation is established.
- If these criteria can be met, the DIA credit = 0.

Partial Rooftop Disconnection		
Length of Pervious Flow Path (ft) Lots ≤ 10,000 ft²	**Length of Pervious Flow Path (ft)**	**DIA Credit Factor**
35 or more	75 or more	0
30 – 34.9	60 – 74	0.2
23 – 29.9	45 – 59	0.4
16 – 22.9	30 – 44	0.6
8 – 15.9	15 – 29	0.8
0 – 7.9	0 - 14	1.0
Pervious flow path must be at least 15 feet from any impervious surface		

Using the calculations from Step 1, complete the table below. This will determine the impervious area that may be excluded from the area that needs to be managed through stormwater BMPs. If the total impervious area to be managed = 0, the area can be considered entirely disconnected.

Surface	Proposed Impervious Area	x	DIA Credit	=	Impervious Area (ft^2) to be Managed
Buildings (area to each downspout)		x		=	
Driveway		x		=	
Parking Areas		x		=	
Patios/ walkways		x		=	
Other		x		=	
Total Proposed Impervious Surface Area to be managed (Sum of all impervious areas)					

- If the total new impervious surface area can be entirely disconnected, sign Acknowledgement and file worksheets with the Borough of Strasburg.
- If the total new impervious surface area is **greater than 1,000 ft² and less than or equal to 2,500 ft²** and can not be entirely disconnected, continue to Step 3.
- If the total new impervious surface area is **greater than 2,500 ft²** and cannot be disconnected, the project may not be submitted with a Small Project Stormwater Site Plan. Discontinue this worksheet and prepare a SWM Site Plan in accordance with Article IV of the Borough of Strasburg Stormwater Management Ordinance.

Step 3: Calculate the volume of stormwater runoff created by new impervious surfaces. Use the following chart to determine this volume.

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

Where permitted by the Borough of Strasburg, 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^3 per tree **Evergreen Trees = 10 ft^3 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^3) (from above)	-	Tree Planting Credit (ft^3)	=	Amount of Stormwater to be Managed (ft^3)
	-		=	

Subtract the stormwater volume that can be managed by tree planting from the overall stormwater volume. The remaining 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 4: Determine the techniques to be used to manage the stormwater volume calculated in Step 3 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 3, to square feet using the conversion table below:

Amount of Stormwater to be Managed (ft^3) (Sum of Step 3)	÷	1.0 in/12 in = 0.083	=	New Impervious Area to be Managed (ft^2)
	÷	0.083	=	

BMP Type		Simple BMP Sizing - Amount New Impervious Area to be Managed (ft^2)											
		250	500	750	1000	1500	2000	2500	3000	3500	4000	4500	5000
Bioretention	Ex. Rain garden, Vegetated swale	21 ft^3 or	42 ft^3 or	62 ft^3 or	83 ft^3 or	125 ft^3 or	166 ft^3 or	208 ft^3 or	249 ft^3 or	291 ft^3 or	332 ft^3 or	374 ft^3 or	415 ft^3 or
Infiltration	Ex. Dry well, Infiltration trench	53 ft^3	105 ft^3	155 ft^3	208 ft^3	313 ft^3	415 ft^3	520 ft^3	623 ft^3	728 ft^3	830 ft^3	935 ft^3	1,038 ft^3

(Source: Lycoming County Planning Commission)

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 the Borough of Strasburg for review and approval. Bring the worksheets, BMP information (size, location, etc.), Owner Acknowledgement, and BMP Facilities and Maintenance Agreement (if applicable) to Borough of Strasburg.

If an area greater than 5,000 square feet of earth is disturbed, an erosion and sedimentation (E & S) control plan must be prepared. The Borough of Strasburg 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 the Borough of Strasburg 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 the Borough of Strasburg, 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 Borough of Strasburg 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 the Borough of Strasburg.

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 Borough of Strasburg Stormwater Worksheet, and the Stormwater Management / BMP Facilities and Maintenance Agreement (if applicable) will be adhered to.

Applicant Acknowledgement of Submission

Signature:_____ Date: _____

Borough of Strasburg Acknowledgement of Receipt

Signature:_____ Date: _____
<< Title >>

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 Borough of Strasburg, Lancaster County, Pennsylvania, hereinafter called the "Borough."

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 Borough, provides for detention of stormwater within the confines of the property through the use of Stormwater Best Management Practices (Stormwater BMPs); and

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

WHEREAS, The Borough 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 Borough 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 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 Borough, 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 Borough 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 Borough 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 Borough 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 Borough 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 Borough.

6. In the event that the Borough, 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 Borough within thirty (30) days of receipt of invoice for all expenses incurred. The Borough 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 Borough and the Landowner agrees to hold the Borough harmless from any liability in the event the Stormwater BMPs fail to operate properly. 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 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.

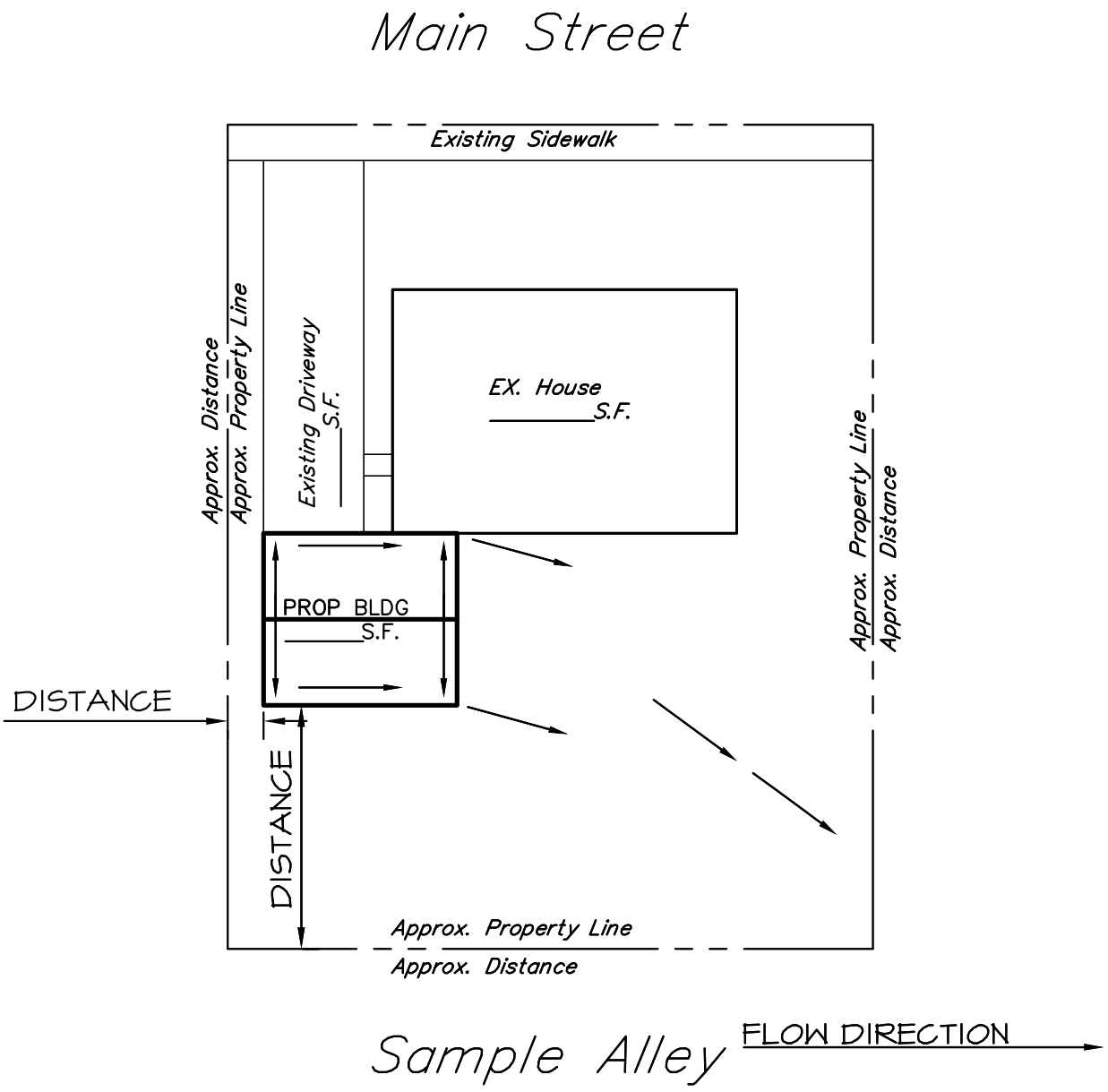
Landowner:

Signature:_____ Date: _____
Printed Name:_____

Borough of Strasburg:

Signature:_____ Date: _____
Printed Name:_____
Title:_____

APPENDIX



BOROUGH OF STRASBURG

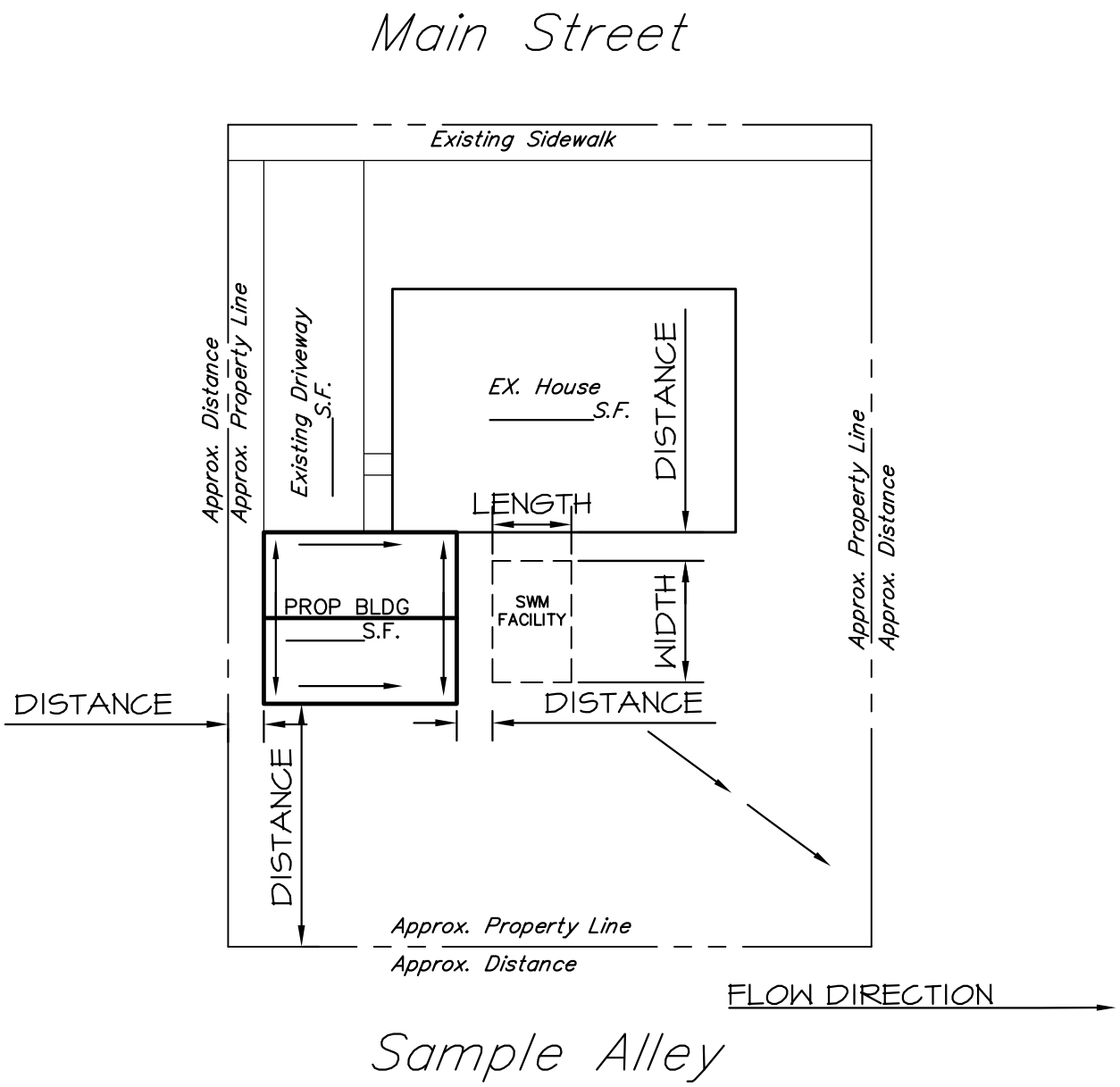
ATTACHMENT 1 SAMPLE SKETCH/SITE PLAN

JOB NUMBER:

EA group, inc.
ENGINEERS & LANDSCAPE ARCHITECTS
743 SOUTH BROAD STREET
LITITZ, PA 17543
(717) 626-7271 FAX (717) 626-7040
www.eagroup.com

SCALE: N.T.S.	DRAWING: N/A
DRAWN BY:	SKETCH: 1 OF 1
DATE: 2016	

1:1



BOROUGH OF STRASBURG

ATTACHMENT 2 SAMPLE SWM SITE PLAN

JOB NUMBER:

ELA group, inc.
ENGINEERS & LANDSCAPE ARCHITECTS
743 SOUTH BROAD STREET
LITITZ, PA 17543
(717) 626-7271 FAX (717) 626-7040
www.elagroup.com

SCALE: N.T.S.

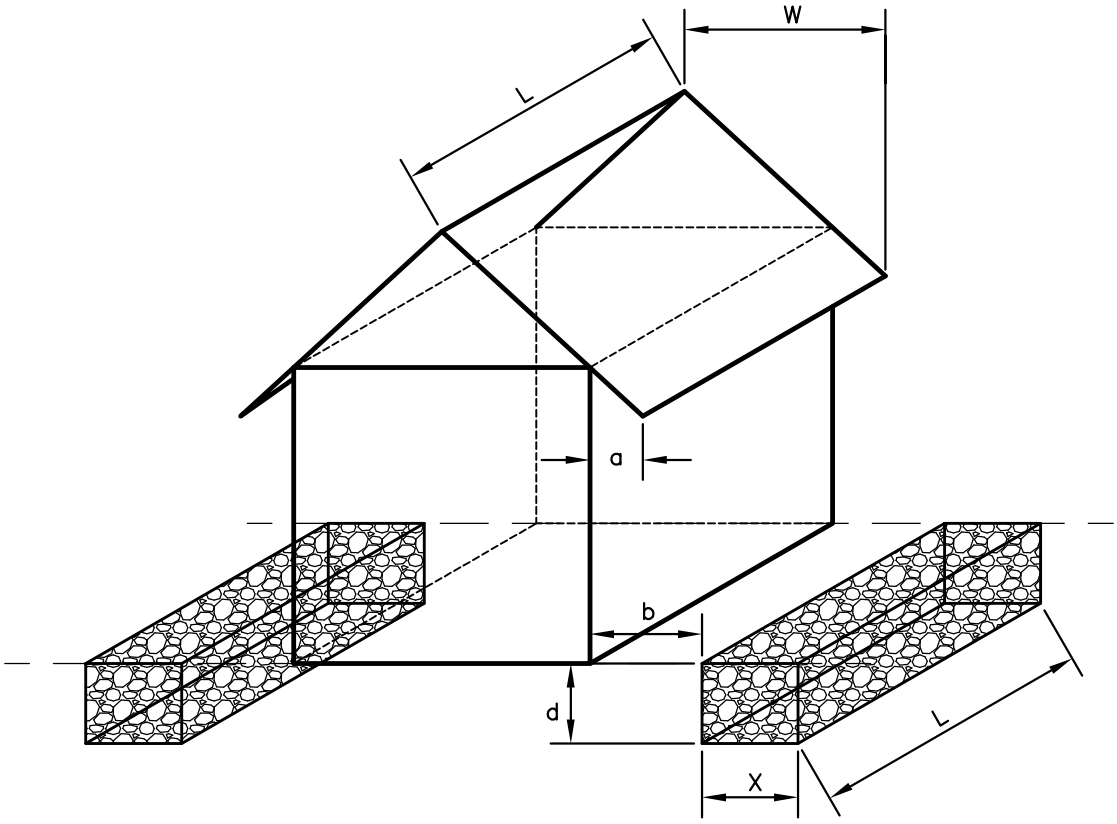
DRAWN BY:

DATE: 2016

DRAWING: N/A

SKETCH: 1 OF 1

1.1



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

BOROUGH OF STRASBURG

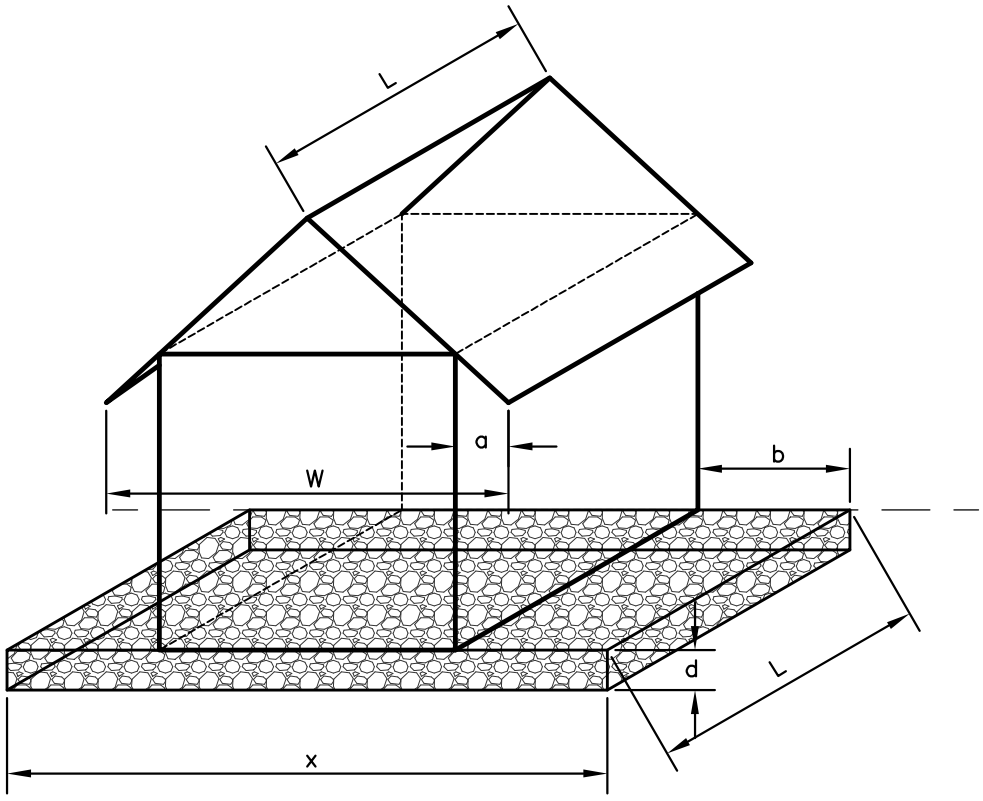
ATTACHMENT 3 STORMWATER MANAGEMENT STRUCTURES WITHOUT GUTTERS

JOB NUMBER: -

EA group, inc.
ENGINEERS & LANDSCAPE ARCHITECTS
743 SOUTH BROAD STREET
LITITZ, PA 17543
(717) 626-7271 FAX (717) 626-7040
www.eagroup.com

SCALE: N.T.S.
DRAWN BY:
DATE: 2016

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

BOROUGH OF STRASBURG

ATTACHMENT 3 STORMWATER MANAGEMENT STRUCTURES WITHOUT GUTTERS

JOB NUMBER: -

EA group, inc.
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743 SOUTH BROAD STREET
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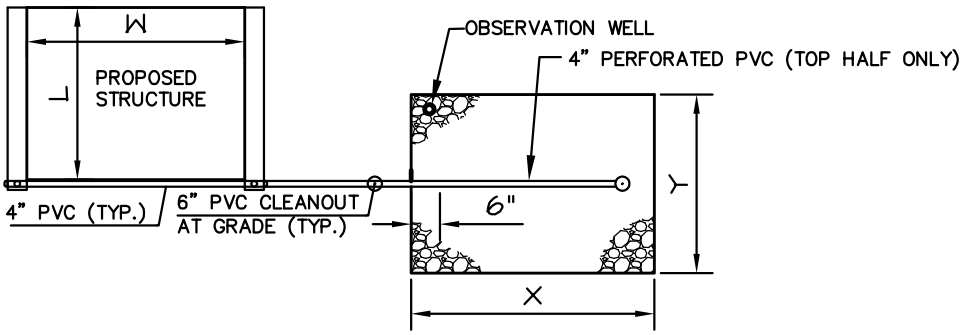
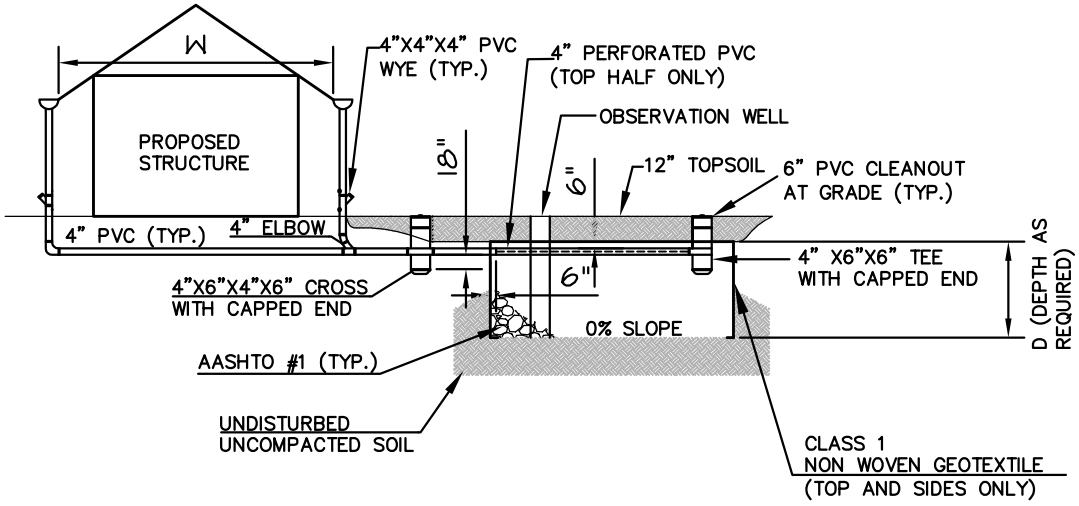
(717) 626-7271 FAX (717) 626-7040
www.eagroup.com

SCALE: N.T.S.
DRAWN BY:
DATE: 2016

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

BOROUGH OF STRASBURG

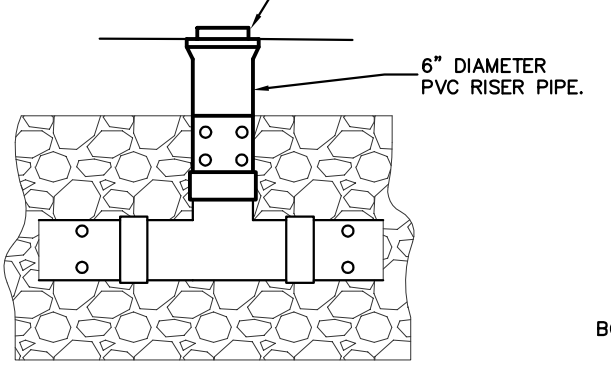
ATTACHMENT 4 STORMWATER MANAGEMENT SAMPLE STRUCTURE WITH GUTTERS

JOB NUMBER: -

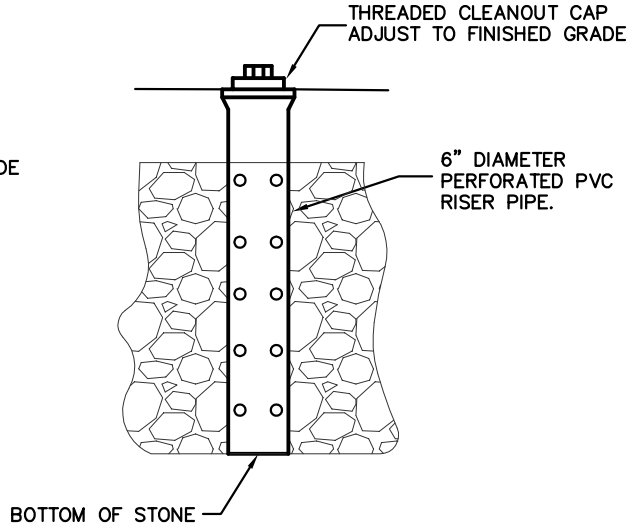
ELA group, inc.
ENGINEERS & LANDSCAPE ARCHITECTS
743 SOUTH BROAD STREET
LITITZ, PA 17543
(717) 626-7271 FAX (717) 626-7040
www.elagroup.com

SCALE: N.T.S.
DRAWN BY:
DATE: 2016

DRAWING: N/A
SKETCH: 1 OF 2

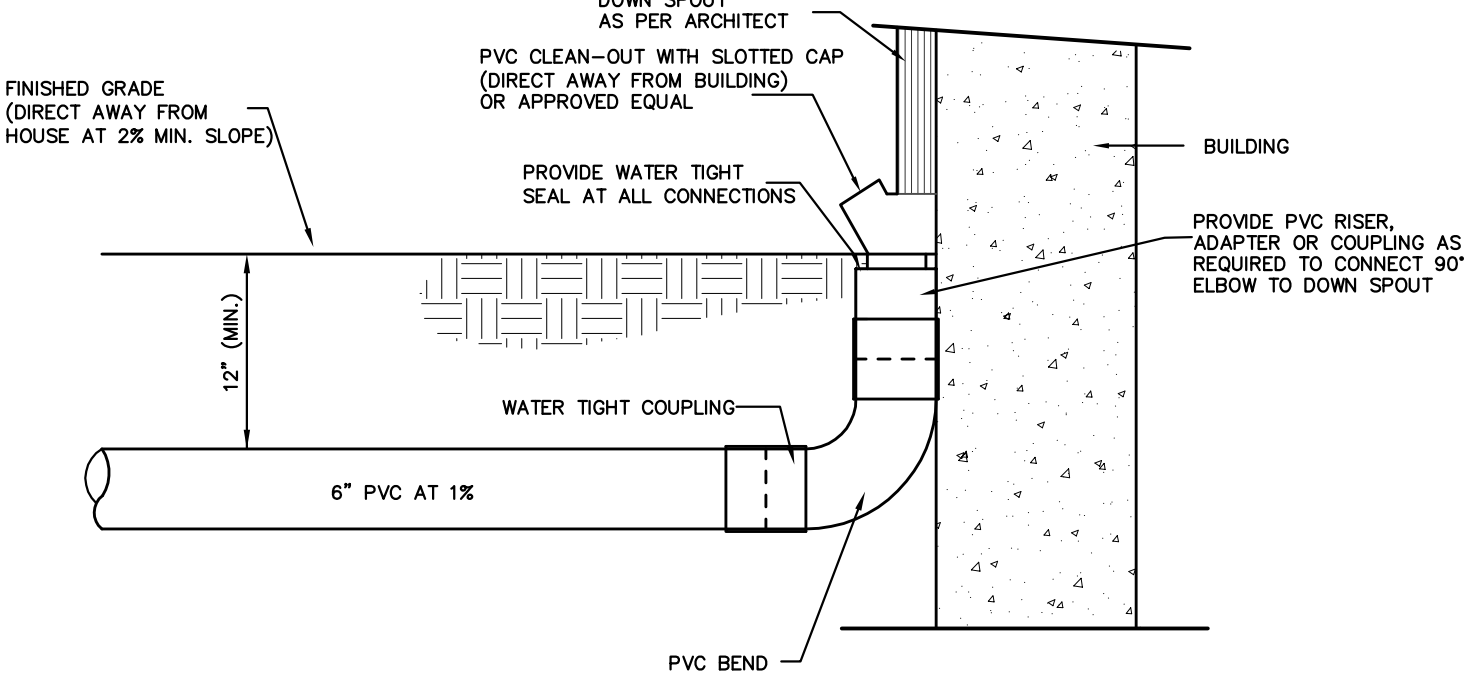


CLEAN OUT



OBSERVATION WELL

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



CONNECTION TO DOWN SPOUT

BOROUGH OF STRASBURG

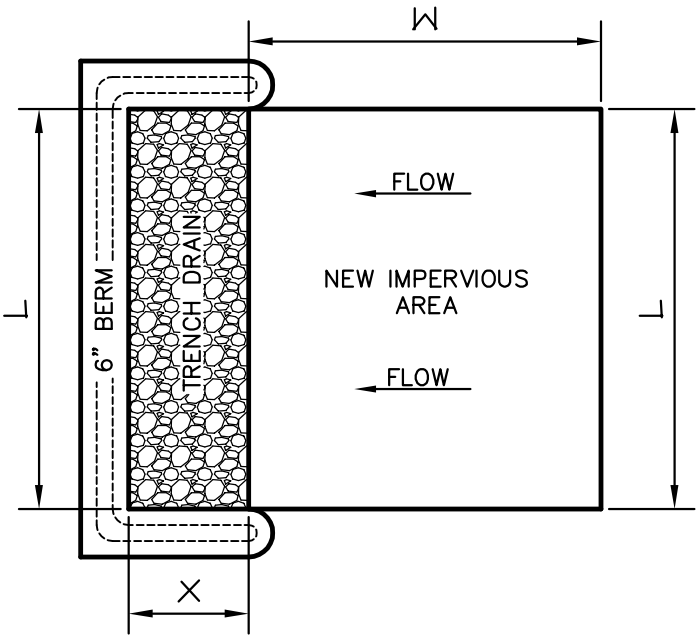
ATTACHMENT 4-1 DOWNSPOUT/CLEAN OUT/OBSERVATION WELL DETAILS

JOB NUMBER: -

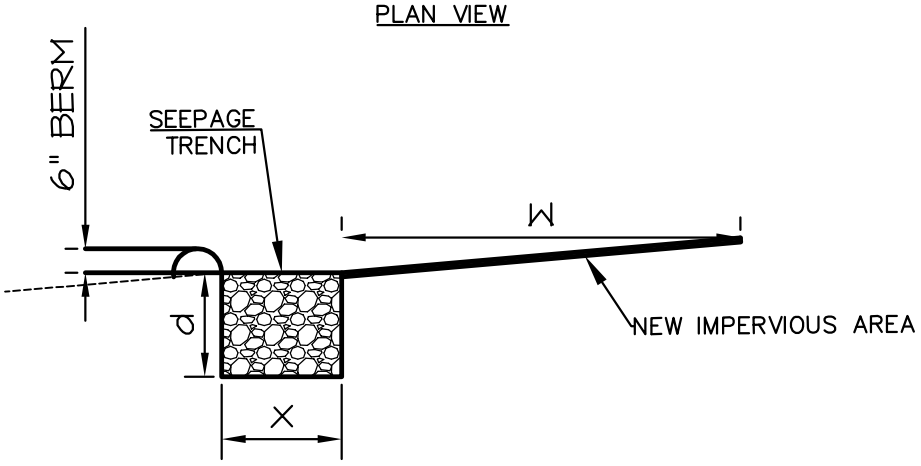
EA group, inc.
ENGINEERS & LANDSCAPE ARCHITECTS
743 SOUTH BROAD STREET
LITITZ, PA 17543
(717) 626-7271 FAX (717) 626-7040
www.eagroup.com

SCALE: N.T.S.
DRAWN BY:
DATE: 2016

DRAWING: N/A
SKETCH: 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.

BOROUGH OF STRASBURG

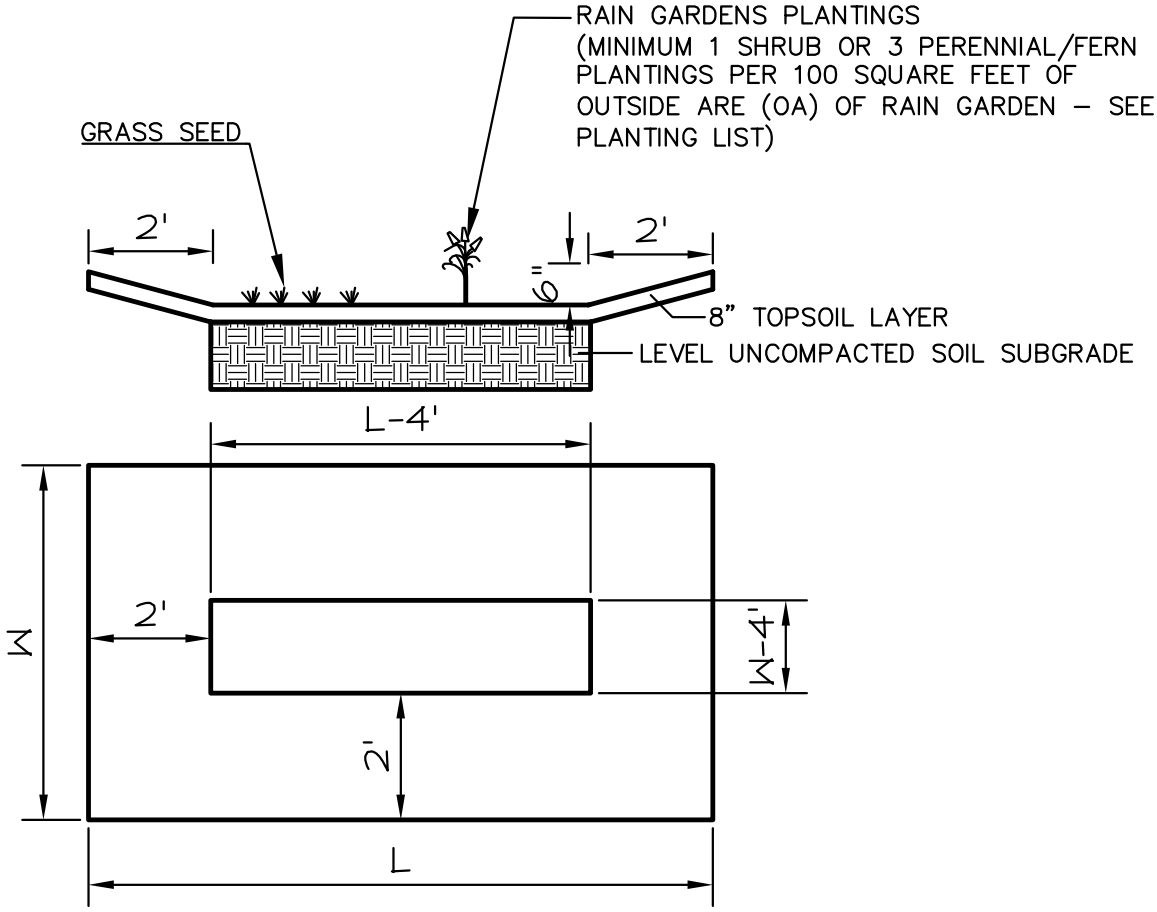
ATTACHMENT 5 STORMWATER MANAGEMENT AT GRADE IMPERVIOUS

JOB NUMBER:

EA group, inc.
ENGINEERS & LANDSCAPE ARCHITECTS
743 SOUTH BROAD STREET
LITITZ, PA 17543
(717) 626-7271 FAX (717) 626-7040
www.eagroup.com

SCALE: N.T.S.
DRAWN BY:
DATE: 2016

DRAWING: N/A
SKETCH: 1 OF 1



1.) CALCULATE REQUIRED RAIN GARDEN VOLUME (V)
(RV) = SQUARE FEET OF NEW IMPERVIOUS AREA X (0.083') RV=_____FT3

2.) CALCULATE OUTSIDE AREA OF RAIN GARDEN (OA)
(OA) = LENGTH (L) X WIDTH (W) OA=_____FT2

3.) CALCULATE INSIDE AREA OF RAIN GARDEN (IA)
(IA) = [(L)–4'] X [(W)–4'] IA=_____FT2

4.) CALCULATE AVERAGE AREA OF RAIN GARDEN (AA)
(AA) = (OA)/2 + (IA)/2 AA=_____FT2

5.) CALCULATE STORAGE VOLUME (SV)
(SV) = (AA) X 0.5' SV=_____FT3

6.) CHECK FOR ADEQUATE STORAGE
STORAGE VOLUME (SV) MUST BE GREATER THAN REQUIRED VOLUME (RV)
RV= ____FT3 > SV=____FT3

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.

BOROUGH OF STRASBURG

ATTACHMENT 6 RAIN GARDEN

JOB NUMBER:

EA group, inc.
ENGINEERS & LANDSCAPE ARCHITECTS
743 SOUTH BROAD STREET
LITITZ, PA 17543
(717) 626-7271 FAX (717) 626-7040
www.eagroup.com

SCALE: N.T.S.
DRAWN BY:
DATE: 2016

DRAWING: N/A
SKETCH: 1 OF 1

1.1

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 asteroids)
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 siphlitica)
Green bullrush (Scirpus atrovirens)
Horsetail (Equisetum species)
Marsh marigold (Caltha palustris)
Mistflower (Eupatorium colestinum)
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 (Calicarpa americana)
Arrowwood (Viburnum dentatum)
Black chokeberry (Aronia melanocarpa)
Broad-leaved meadowsweet (Spirea latifolia)
Buttonbush (Cephalanthus occidentalis)
Elderberry (Sambucus canadansis)
Inkberry (Ilex glabra)
Narrow-leaved meadowsweet (Spirea alba)
Ninebark (Physocarpus opulifolius)
Possumhaw (Viburnum nudum)
Red-osier dogwood (Cornus sericea)
St. Johnswort (Hypericum densiflorium)
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 of 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 Borough one year after construction and every 3rd year there afterwards.

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 Borough 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

Borough of Strasburg
Stormwater Infiltration Trench/Bed Construction Certification

ELA Group, Inc. shall be contacted prior to the construction of infiltration systems. All proposed changes shall be approved prior to construction. Any "No" responses shall be clarified within the comments.

Project Name:	
Lot and/or System Number:	
Date of Installation:	
Contractor and Contact Information:	

Excavation	**Y**	**N**	**NA**	**Comments**
Identify approved changes from the Plans.				
Installed in approved location.				
Approved distance away from existing and proposed dwellings. Identify distance.				
Field staked by a Professional Surveyor and constructed within the drainage easement.				
Bottom excavated to the approved depth below existing grade.				
Subsoil of the trench/bed has not been compacted by excavation.				
Bottom of the trench/bed has been appropriately prepared for infiltration.				
Limiting zones were not encountered that would impact infiltration.				
Proper amount of topsoil cover provided over system.				
Identify the excavated dimensions of the system, including length, width, and depth.				
Filter Fabric Placement				
Non-woven soil separation filter fabric (sides, and top of system) installed.				
Pipe projections do not allow entry of sediment.				
Fabric has not been damaged by stone backfilling.				

Borough of Strasburg
Stormwater Infiltration Trench/Bed Construction Certification

Aggregate Material	**Y**	**N**	**NA**	**Comments**
Stone size and type as specified installed. Identify.				
Clean/washed aggregate has been installed.				
Observation Well, Clean-Outs, and Distribution Piping.				
Required distribution piping (size, material, and type) has been installed.				
Observation wells are properly secured within the trench/bed.				
Perforated pipe has been installed within the stone backfill.				
Solid pipe has been installed within the earth backfill.				
Removable grated caps are provided and set to finished grade elevation.				
A minimum of two observation wells are provided at opposite ends of the system - centered within the system for trenches or opposite corners for beds.				
Roof & Hardscape Area Drainage connection				
The required roof leader conveyance system has been installed.				
The approved roof area is conveyed to the system.				
Any stubbed roof leader connections have been field marked and properly plugged.				
Area drains have been installed and required hardscape area is conveyed to the system.				
Sediment Control				
All sediment-laden runoff has been directed away from the system.				
All required temporary sediment removal facilities have been installed.				
Sediment has not entered the system at any time.				

Borough of Strasburg
Stormwater Infiltration Trench/Bed Construction Certification

Note: Provide sufficient details and dimensions to accurately field locate entire footprint and depth of installed system. Identify and dimension all installed components including cleanouts, observation wells, area drains, roof leader and hardscape area connections, etc.
Figure 1 – Field Constructed Location of Infiltration System

I hereby certify that the installation of the infiltration system has been constructed in accordance with the approved Plans. Any deviations from the approved Plans have been documented and approved by the Borough and/or the Borough Engineer. Furthermore, I certify that the infiltration system has been installed using acceptable construction standards and methods.

Name of Company and Authorized Representative:_____

Signature:_____ **Date:**_____