Simplified Stormwater Application

Table-4: Simplified Approach Worksheet (*AKA Simplified Stormwater Method Application*)

Name of Property Owner(s):	Date:
Name of Applicant(s) [if different than Owner(s)]:	
Contact Phone #: Email Address:	
Address of Project:	
Description of Project:	
☐ Met with Municipal Engineer to discuss proposed project. [insert date of meeting]	
Distance from earth disturbance to nearest surface water feature (stream, pond, wetland, etc.) (if required by the Municipality, circle one): 50 feet or less More than 50 feet	
Total impervious area added since ordinance adoption (_____, 2022) = _____ Square Feet	

☐ **Step 1: Attach Simplified SWM Site Plan (i.e. sketch plan), per Section 1, Step 1**

Step 2: Determine the Impervious Area to be Managed

	Total Proposed Impervious Area (square feet):
	Total Earth Disturbance (square feet):

Step 3: Select the BMP(s) to be Used and Appropriate Sizing Criteria

Rain Barrel or Cistern

Proposed Impervious Surface from Column 1 in Table 1	Volume from Column 3 in Table 1		

Rain Garden/Bioretention or Dry Well #1

Proposed Impervious Surface from Column 1 in Table 2	Volume of BMP from Column 2 in Table 2	Area Dimensions of BMP - Column 3 in Table 2	Depth of BMP from Column 3 in Table 2	Types of Materials to be Used

Infiltration Trench or Dry Well #2

Proposed Impervious Surface from Column 1 in Table 3	Volume of BMP from Column 2 in Table 3	Area Dimensions of BMP - Column 3 in Table 3	Depth of BMP from Column 3 in Table 3	Types of Materials to be Used

☐ **Step 4: Complete, Sign & have Operation, Maintenance and Inspection Plan and Agreement Notarized and Recorded at the County Recorder of Deeds (when signed by Municipality)***

Note: For additional BMPs, use additional sheet(s).

     * All Drawings and Operation, Maintenance and Inspection Plan and Agreement must be recorded at the County by the applicant. A copy of all recorded documents must be provided to the Municipality.

Date Received:_____

Small Projects Processing Fee: $_____

Escrow: $_____

Appendix A.2
Simplified Approach to
Stormwater Management
for Small Projects

Handbook

Errata Notes:
The following corrections are noted for Figure 6:
1. Label for BMP #1 Cistern – should read "(166 Gallons)"
2. Label for BMP #2 Infiltration Trench – should read "(20'L x 3'W x 3.5'D)"

All revisions made by East Petersburg Borough were completed without consultation with Borton-Lawson and were completed at the sole discretion of East Petersburg Borough.

STORMWATER MANAGEMENT PROCEDURES
FOR MEETING THE SIMPLIFIED APPROACH REQUIREMENTS

Introduction

This Handbook has been developed to allow homeowners or applicants for small projects to comply with stormwater management requirements of the Stormwater Management Ordinance of the Municipality, including sizing, designing, locating and installing on-lot measures, referred to herein as "Best Management Practices" (BMPs). **Only projects that meet the size thresholds specified in the Municipality's Stormwater Management Ordinance may use this Simplified Approach** and are then not required to submit a formal Stormwater Management Site plan to the Municipality. However, these projects are still required to address certain requirements, such as stormwater quality, infiltration, rate and volume management goals as outlined in this Simplified Approach Handbook.

Pennsylvania Act 167 (PA Stormwater Management Act) was authorized on October 4, 1978 (32 P.S., P.L. 864) and gave Pennsylvania Municipalities the power to regulate activities that affect flooding, streambank erosion, stormwater runoff and surface and groundwater quantity and quality. The Municipality's Stormwater Management Ordinance was prepared to comply with the PA Act 167 requirements and includes provisions allowing this Simplified Approach to be used for small projects as specified in their Ordinance.

In the event of a conflict between this appendix and the Municipalities Stormwater Ordinance, the requirements as set forth in the Stormwater Ordinance prevail.

If the guidelines presented in this Handbook are followed, the applicant may not require professional engineering services to comply with these stormwater management goals. This Handbook is organized into five sections:

- **Section 1** describes requirements and a simplified approach for designing a suitable BMP, and a description of what needs to be included on the simplified stormwater management (SWM) site plan (i.e. sketch plan).
- **Section 2** presents definitions of key terms.
- **Section 3** presents options of BMPs that can be considered for on-lot stormwater management.
- **Section 4** illustrates an example of how to obtain the size and dimensions of a BMP(s) for a sample project.
- **Section 5** describes the requirements to be met for a "Simplified Approach Operation, Maintenance and Inspection Plan and Agreement".

The Simplified Approach requires:
- The applicant to submit the following to the Municipality for review and approval prior to beginning construction:
  - A Simplified Stormwater Management (SWM) Site Plan (i.e. sketch plan), and accompanying Worksheet, and
  - A completed and signed "Simplified Approach Operation, Maintenance and Inspection Plan and Agreement".
- The first 1-inch of rainfall runoff from proposed impervious surfaces (as defined by the Municipality's Ordinance) must be captured and removed from the stormwater runoff leaving the applicant's property.
- The applicant to record the "Simplified Approach Operation, Maintenance and Inspection Plan and Agreement" at the County's Recorder of Deeds after signature by the Municipality.

The purpose of requiring effective stormwater management from small projects is to help reduce stormwater runoff in the community, to maintain groundwater recharge, to prevent degradation of surface and groundwater quality, and to otherwise protect water resources and public safety.

What needs to be submitted to the Municipality?

☐ Simplified Approach Worksheet (Table 4)

☐ Simplified SWM site plan (i.e. sketch plan), containing the features described in Section 1, Step 1

☐ "Simplified Approach Operation, Maintenance and Inspection Plan and Agreement" must be signed, notarized and (after approval and signature by the Municipality) recorded at the County Recorder of Deeds.

If the applicant is using a contractor to construct the project, the worksheet and sketch plan must be shared with the contractor to ensure the BMP(s) are properly installed.

1. Determination of Simplified Approach Volume Requirements

All proposed impervious areas (as required by the Municipality's Ordinance) must be included in the determination of the amount of new impervious areas and the size of proposed BMPs needed to manage stormwater. Proposed impervious areas on an individual residential lot generally include, but are not limited to: roof area, pavement, sidewalks, driveways, patios, porches, permanent pools, or parking areas, etc. See the definitions provided in the Municipal Stormwater Ordinance and check with the Municipal Engineer to confirm what features of the proposed project must be included in the calculation of new impervious areas. All proposed impervious areas must be constructed so that runoff is conveyed to a BMP(s); no runoff may be directed to storm sewers, inlets or other impervious areas (i.e. street) without effective stormwater management from a site.

In addition, the use of low impact development is recommended to further minimize the effect of the new construction on water, land, and air. Low impact development is a method of development that incorporates design techniques that include: minimizing the amount of land disturbance, reducing the amount of impervious cover, disconnecting gutters and directing stormwater runoff to vegetated areas to infiltrate, and redirecting the flow of stormwater runoff from impervious surfaces to vegetated areas instead of the street or gutter.

Below are the steps that must be undertaken to meet the Ordinance requirements. The size and description of the proposed construction as well as important aspects related to the design of the BMP(s) must be documented in the Simplified Approach Worksheet found in Table 4. All individuals planning on using the Simplified Approach are required to review the planned project with the Municipal Engineer prior to initiating the Simplified Approach to confirm the following:

- That the proposed project is not otherwise exempt from the stormwater management control and engineered Stormwater Management Site Plan requirements of the Municipality's Stormwater Management Ordinance;
- That the proposed project size is within the range eligible to use this Simplified Approach;
- To determine which components of the proposed project must be included in the calculation of "impervious areas"; and
- Whether any local conditions are known to the Municipal Engineer that would preclude the use of any of the techniques included in this Simplified Approach.

Step 1 - Prepare the Simplified SWM Site Plan (i.e. sketch plan) that includes:

- Name and address of the owner of the property, and name and address of individual preparing the plan (if different than the property owner), along with the date of submission.
- Location of all existing structures including buildings, driveways, and roads within fifty (50) feet of the project site.
- Location of proposed structures, driveways, or other paved areas with approximate size in square feet.
- Location, and distance, of any existing surface water features, such as streams, lakes, ponds, wetlands or other natural waterbodies, within fifty (50) feet of the project site and/or BMPs. Depending upon the Municipality's requirements, the following may also be required (check with the Municipal Engineer):
  - The project and/or BMPs cannot cause earth disturbance within fifty (50) feet from a perennial or intermittent stream, wetland or waterbody. Protecting this area from non-disturbance along the aforementioned features helps protect the applicant's land from erosion, the flood carrying capacity of streams, and the water quality of the waterbody. Where the applicant cannot meet the 50-foot non-disturbance width, the applicant

should work with the Municipal Engineer to determine if a reduced width is acceptable, however a minimum of at least a 10 foot non-disturbance area width should be maintained.
- o If an existing buffer is legally prescribed (i.e., deed, covenant, easement, etc.) and it exceeds this requirement, the existing buffer must be maintained.
- Location, orientation, and dimensions of all proposed BMPs. For all rain gardens/bioretention, infiltration trenches, and dry wells the length, width, and depth must be included on the plan. For rain barrels or cisterns, the volume must be included.
- Location of any existing or proposed on-lot septic system and potable water wells showing rough proximity to infiltration facilities. See Section 3. Description of BMPs, for the appropriate setbacks for on-lot septic systems and potable water wells.

Step 2 –Determine the Impervious Area to be Managed
- Determine the total area of all proposed impervious surfaces that will need to drain to one or more BMP(s).
- Also determine the total area for proposed earth disturbance to complete the project and install the BMP(s). The total earth disturbance to complete a project is often greater than the project area to allow for access from construction vehicles, stock piling of materials and excavation. The total area of earth disturbance must account for all of the construction activities necessary to construct the project.
- Determine locations where BMP(s) need to be placed so that the appropriate amount of stormwater runoff from the proposed impervious surfaces can be captured and managed.

Step 3 – Select the BMP(s) to be Used and Determine Appropriate Sizing Criteria
- Select the BMP(s) to be used and determine the requirements of each from Section 3, Description of BMPs.
  - o For instance, the back half of a garage may drain to a rain barrel and the front half of the garage and a driveway may drain to a bioretention area. Each BMP will be sized differently, manage stormwater runoff and will need to be designed to be consistent with Section 3.
- Then obtain the required storage volume and surface area needed for each of the proposed BMP(s) from the appropriate heading below.
- Complete Table 4 Simplified Approach Worksheet.

For Rain Barrels/Cisterns:
Step 3A –Select the proposed impervious area value in Column 1 of Table 1 that is closest to, but not less than the determined value.

Step 3B – Determine the volume that needs to be provided in cubic feet and gallons to satisfy the volume requirements using Columns 2 and 3 in Table 1.

For Rain Gardens/Bioretention or Dry Well #1:
Step 3A – Select the proposed impervious area value in Column 1 of Table 2 that is closest to, but not less than the determined value.

Step 3B - Determine the volume that needs to be provided in cubic feet to satisfy the volume requirements using Column 2 in Table 2.
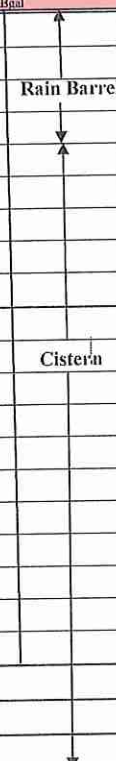
Step 3C – Using the value from Column 2 determined above, and the depth (D) of the proposed BMP, simply determine the surface area needed from Column 3 of Table 2.

Note: The arrows under Column 3 in Table 2 indicate which range of depths is appropriate for each BMP. To determine the depth based on the area, select an area that corresponds to the required volume, and is closest to, but not more than the area to be used. To determine the area based on the depth, select a depth that is closest to, but not less than the depth that is to be used.

For Infiltration Trench or Dry Well #2:
Step 3A – Select the proposed impervious area value in Column 1 of Table 3 that is closest to, but not less than the determined value.

Step 3B - Determine the volume that needs to be provided in cubic feet to satisfy the volume requirements using Column 2 in Table 3.

Step 3C – Using the value from Column 2 determined above, and the depth (D) of the proposed BMP, simply determine the surface area needed from Column 3 of Table 3.

Note: The arrows under Column 3 in Table 3 indicate which range of depths is appropriate for each BMP. To determine the depth based on the area, select an area that corresponds to the required volume, and is closest to, but not less than the area to be used. To determine the area based on the depth, select a depth that is closest to, but not less than the depth that is to be used.

Step 4 – Submit the final SWM Site Plan, Simplified Approach Worksheet, and signed and notarized "Simplified Approach Operation, Maintenance and Inspection Plan and Agreement" (a sample document is provided in the accompanying appendix) to the Municipality for review and approval prior to beginning construction. After the Municipality has signed the "Simplified Approach Operation, Maintenance and Inspection Plan and Agreement", record the Agreement at the County's Office of Recorder of Deeds. Construction can begin only after the Municipality has issued its approval of the proposed project to the applicant.

Table 1: Simplified Approach - Calculating Rain Barrel/Cistern Storage Volume for 1" Rainfall[1]

Column 1	Column 2	Column 3	
Proposed Impervious Area (square feet)	Volume of Rain Barrel/Cistern[2] (cubic feet)	Volume of Rain Barrel/Cistern (gallons)	
I	V_{RBcf}	V_{RBgal}	
Sum of all Proposed Impervious Areas	$(1*(1/12)*I)/0.75=V_{RBcf}$	$V_{RBcf} * 7.48=V_{RBgal}$	
50	6	42	
100	11	83	
150	17	125	Rain Barrel
200	22	166	
250	28	208	
300	33	249	
350	39	291	
400	44	332	
450	50	374	
500	56	416	
550	61	457	Cistern
600	67	499	
650	72	540	
700	78	582	
750	83	623	
800	89	665	
850	94	706	
900	100	748	
950	106	790	
1000	112	831	
1050	117	873	
1100	123	914	
1150	128	956	

Column 1	Column 2	Column 3
1200	134	997
1250	139	1039
1300	145	1080
1350	150	1122
1400	156	1164
1450	162	1205
1500	167	1247
1550	173	1288
1600	178	1330
1650	184	1371
1700	189	1413
1750	195	1454
1800	200	1496
1850	206	1538
1900	212	1579
1950	217	1621
2000	223	1622
2050	228	1704
2100	234	1745
2150	239	1787
2200	245	1828
2250	250	1870
2300	256	1912
2350	262	1953
2400	267	1995
2450	273	2036
2499	278	2078

[1]The typical volume of a rain barrel is between 50-200 gallons, so more than one rain barrel may be needed. Larger volumes may require a cistern.
[2]It is assumed that the rain barrel/cistern is 25% full prior to receiving runoff.

Table 2: Simplified Approach – Calculating Rain Garden/Bioretention and Dry Well #1 Storage Volume and Surface Area for 1 Inch Rainfall

Column 1	Column 2	Column 3							
Total Proposed Impervious Area (square feet)	Volume of Rain Garden/Bioretention or Dry Well #1[1] (cubic feet)	Surface Area of Rain Garden/Bioretention or Dry Well #1 Acceptable Depths for Each BMP are indicated by the arrows below (square feet)							
		Area Required for a BMP with a Depth(D) of 0.5'	Area Required for a BMP with a Depth(D) of 1.0'	Area Required for a BMP with a Depth(D) of 1.5'	Area Required for a BMP with a Depth(D) of 2.0'	Area Required for a BMP with a Depth(D) of 2.5'	Area Required for a BMP with a Depth(D) of 3.0'	Area Required for a BMP with a Depth(D) of 3.5'	Area Required for a BMP with a Depth(D) of 4.0'
		Rain Garden /Bioretention (0.5'-1.0') ←		→ Dry Well #1 (1.5'-4.0')					→
I	V	$A(sf)$							
Sum of all Proposed Impervious Areas	$I*(1/12)*I= V$	$V/D=A$							
50	4	8	4	3	2	2	2	2	1
100	8	16	8	6	4	4	3	3	2
150	13	26	13	9	7	6	5	4	4
200	17	34	17	12	9	7	6	5	5
250	21	42	21	14	11	9	7	6	6
300	25	50	25	17	13	10	9	8	7
350	29	58	29	20	15	12	10	9	8
400	33	66	33	22	17	14	11	10	9
450	38	76	38	26	19	16	13	11	10
500	42	84	42	28	21	17	14	12	11

Column 1	Column 2	Column 3							
550	46	92	46	31	23	19	16	14	12
600	50	100	50	34	25	20	17	15	13
650	54	108	54	36	27	22	18	16	14
700	58	116	58	39	29	24	20	17	15
750	63	126	63	42	32	26	21	18	16
800	67	134	67	45	34	27	23	20	17
850	71	142	71	48	36	29	24	21	18
900	75	150	75	50	38	30	25	22	19
950	79	158	79	53	40	32	27	23	20
1000	83	166	83	56	42	34	28	24	21
1050	88	176	88	59	44	36	30	26	22
1100	92	184	92	62	46	37	31	27	23
1150	96	192	96	64	48	39	32	28	24
1200	100	200	100	67	50	40	34	29	25
1250	104	208	104	70	52	42	35	30	26
1300	108	216	108	72	54	44	36	31	27
1350	113	226	113	76	57	46	38	33	29
1400	117	234	117	78	59	47	39	34	30
1450	121	242	121	81	61	49	41	35	31
1500	125	250	125	84	63	50	42	36	32
1550	129	258	129	86	65	52	43	37	33
1600	133	266	133	89	67	54	45	38	34
1650	138	276	138	92	69	56	46	40	35
1700	142	284	142	95	71	57	48	41	36
1750	146	292	146	98	73	59	49	42	37
1800	150	300	150	100	75	60	50	43	38
1850	154	308	154	103	77	62	52	44	39
1900	158	316	158	106	79	64	53	46	40
1950	163	326	163	109	82	66	55	47	41
2000	167	334	167	112	84	67	56	48	42

Column 1	Column 2	Column 3							
2050	171	342	171	114	86	69	57	49	43
2100	175	350	175	117	88	70	59	50	44
2150	179	358	179	120	90	72	60	52	45
2200	183	366	183	122	92	74	61	53	46
2250	188	376	188	126	94	76	63	54	47
2300	192	384	192	128	96	77	64	55	48
2350	196	392	196	131	98	79	66	56	49
2400	200	400	200	134	100	80	67	58	50
2450	204	408	204	136	102	82	68	59	51
2500	208	416	208	139	104	84	70	60	52

[1] It is assumed that the rain garden/bioretention or the dry well #1 are empty prior to receiving runoff (i.e. 0% full)

Table 3: Simplified Approach - Calculating Infiltration Trench and Dry Well #2 Storage Volume and Surface Area for 1 Inch of Rainfall

Column 1	Column 2	Column 3							
Total Proposed Impervious Area (square feet)	Volume of Infiltration Trench or Dry Well #2[1] (cubic feet)	Surface Area of Infiltration Trench or Dry Well #2 — Acceptable Depths for Each BMP are indicated by the arrows below (square feet)							
		Area Required for a BMP with a Depth(D) of 1.5'	Area Required for a BMP with a Depth(D) of 2.0'	Area Required for a BMP with a Depth(D) of 2.5'	Area Required for a BMP with a Depth(D) of 3.0'	Area Required for a BMP with a Depth(D) of 3.5'	Area Required for a BMP with a Depth(D) of 4.0'	Area Required for a BMP with a Depth(D) of 4.5'	Area Required for a BMP with a Depth(D) of 5.0'
							Infiltration Trench (2.0'-5.0')		
		Dry Well #2 (1.5'-4.0')							
I	V	$A(sf)$							
Sum of all Proposed Impervious Areas	$(1*(1/12)*I)/(0.4)^1 = V$	$V/D = A$							
50	10	7	5	4	4	3	3	3	2
100	21	14	11	9	7	6	6	5	5
150	31	21	16	13	11	9	8	7	7
200	42	28	21	17	14	12	11	10	9
250	52	35	26	21	18	15	13	12	11
300	63	42	32	26	21	18	16	14	13
350	73	49	37	30	25	21	19	17	15
400	83	56	42	34	28	24	21	19	17
450	94	63	47	38	32	27	24	21	19
500	104	70	52	42	35	30	26	24	21
550	115	77	58	46	39	33	29	26	23
600	125	84	63	50	42	36	32	28	25
650	135	90	68	54	45	39	34	30	27
700	146	98	73	59	49	42	37	33	30
750	156	104	78	63	52	45	39	35	32

Column 1	Column 2	Column 3							
800	167	112	84	67	56	48	42	38	34
850	177	118	89	71	59	51	45	40	36
900	188	126	94	76	63	54	47	42	38
950	198	132	99	80	66	57	50	44	40
1000	208	139	104	84	70	60	52	47	42
1050	219	146	110	88	73	63	55	49	44
1100	229	153	115	92	77	66	58	51	46
1150	240	160	120	96	80	69	60	54	48
1200	250	167	125	100	84	72	63	56	50
1250	260	174	130	104	87	75	65	58	52
1300	271	181	136	109	91	78	68	61	55
1350	281	188	141	113	94	81	71	63	57
1400	292	195	146	117	98	84	73	65	59
1450	302	202	151	121	101	87	76	68	61
1500	313	209	157	126	105	90	79	70	63
1550	323	216	162	130	108	93	81	72	65
1600	333	222	167	134	111	96	84	74	67
1650	344	230	172	138	115	99	86	77	69
1700	354	236	177	142	118	102	89	79	71
1750	365	244	183	146	122	105	92	82	73
1800	375	250	188	150	125	108	94	84	75
1850	385	257	193	154	129	110	97	86	77
1900	396	264	198	159	132	114	99	88	80
1950	406	271	203	163	136	116	102	91	82
2000	417	278	209	167	139	120	105	93	84
2050	427	285	214	171	143	122	107	95	86
2100	438	292	219	176	146	126	110	98	88
2150	448	299	224	180	150	128	112	100	90
2200	458	306	229	184	153	131	115	102	92

Column 1	Column 2	Column 3							
2250	469	313	235	188	157	134	118	105	94
2300	479	320	240	192	160	137	120	107	96
2350	490	327	245	196	164	140	123	109	98
2400	500	334	250	200	167	143	125	112	100
2450	510	340	255	204	170	146	128	114	102
2500	521	348	261	209	174	149	131	116	105

[1] Assumes a percent void volume of 40%

12/3/2021

Table-4: Simplified Approach Worksheet (*AKA Simplified Stormwater Method Application*)

Name of Property Owner(s):	Date:
Name of Applicant(s) [if different than Owner(s)]:	
Contact Phone #: Email Address:	
Address of Project:	
Description of Project:	

☐ Met with Municipal Engineer to discuss proposed project. [insert date of meeting]

Distance from earth disturbance to nearest surface water feature (stream, pond, wetland, etc.)

(if required by the Municipality, circle one):   50 feet or less   More than 50 feet

Total impervious area added since ordinance adoption (_____, 2022) = _____ Square Feet

☐ **Step 1:** Attach Simplified SWM Site Plan (i.e. sketch plan), per Section 1, Step 1

Step 2: Determine the Impervious Area to be Managed

Total Proposed Impervious Area (square feet):
Total Earth Disturbance (square feet):

Step 3: Select the BMP(s) to be Used and Appropriate Sizing Criteria

Rain Barrel or Cistern

Proposed Impervious Surface from Column 1 in Table 1	Volume from Column 3 in Table 1			

Rain Garden/Bioretention or Dry Well #1

Proposed Impervious Surface from Column 1 in Table 2	Volume of BMP from Column 2 in Table 2	Area Dimensions of BMP - Column 3 in Table 2	Depth of BMP from Column 3 in Table 2	Types of Materials to be Used

Infiltration Trench or Dry Well #2

Proposed Impervious Surface from Column 1 in Table 3	Volume of BMP from Column 2 in Table 3	Area Dimensions of BMP - Column 3 in Table 3	Depth of BMP from Column 3 in Table 3	Types of Materials to be Used

☐ **Step 4:** Complete, Sign & have Operation, Maintenance and Inspection Plan and Agreement Notarized and Recorded at the County Recorder of Deeds (when signed by Municipality)*

Note: For additional BMPs, use additional sheet(s).

    * All Drawings and Operation, Maintenance and Inspection Plan and Agreement must be recorded at the County by the applicant. A copy of all recorded documents must be provided to the Municipality.

2.   Definitions

These definitions apply only to this Simplified Approach to Stormwater Management for Small Projects Handbook. The definitions included in the Municipality's Stormwater Management Ordinance also apply. Where there are conflicts, the definitions in the Stormwater Management Ordinance prevail.

Best Management Practice (BMP) – As defined in the Municipality's Stormwater Management Ordinance, but generally including activities, facilities, designs, measures or procedures used to manage stormwater impacts from land development and earth disturbance activities to meet stormwater quality, runoff control and groundwater recharge protection requirements. BMPs include, but are not limited to, a wide variety of practices and devices such as: infiltration facilities (dry wells and infiltration trenches), filter strips, low impact design, bioretention (rain gardens), grassed swales, and manufactured devices (cisterns and rain barrels). Structural stormwater BMPs are permanent appurtenances to the project site.

Geotextile - A fabric manufactured from synthetic fibers which provides a separation between different types of media (i.e., soil and stone), and is used to achieve specific objectives, including infiltration or filtration.

Hotspot - Areas where land use or activities generate highly contaminated runoff, with concentrations of pollutants that are higher than those that are typically found in stormwater (e.g. vehicle salvage yards, recycling facilities, vehicle fueling stations, fleet storage areas, vehicle equipment and cleaning facilities, and vehicle service and maintenance facilities).

Impervious Surface - As defined in the Municipality's Stormwater Management Ordinance, but generally including any surface that prevents the infiltration of water into the ground. Impervious surfaces generally include, but are not limited to, streets, sidewalks, pavements, driveway areas, or roofs. The applicant should review the Municipality's Stormwater Management Ordinance or consult with the Municipal Engineer to confirm what components of the proposed project are considered "impervious surfaces". Decks, swimming pools, compacted soils or stone surfaces (such as for vehicle movement or parking), among other features, may be included in the Municipality's definition of "impervious surfaces".

Infiltration - Movement of surface water into the soil, where it is absorbed by plant roots, transpired or evaporated into the atmosphere, or percolated downward to recharge groundwater.

Low Impact Development - A land development and construction approach that uses various land planning, design practices, and technologies to simultaneously conserve and protect natural resource systems, and reduce infrastructure costs.

Percent Void Volume – The volume of void space, expressed as a percentage, of the total volume of the storage facility (void volume + volume of solid materials providing structural support for the storage facility).

Pervious Surface - Any area not defined as impervious surface.

Potable – A water supply that is either absent of contaminants or contains contaminant levels that are below a given threshold level that makes the water as suitable for drinking.

Runoff - Any part of precipitation that flows over the land surface.

Stormwater - Drainage runoff from the surface of the land resulting from precipitation, or snow or ice melt.

3. Description of BMPs

The following is a description of several types of BMPs that could be implemented. The requirements of each BMP as described below are taken directly from the PA Stormwater BMP Manual (December, 2006). Refer to the PA BMP Manual (latest version) which can be found on the PA Department of Environmental Protection's website.

Rain Barrels/Cisterns

Rain Barrels are large containers that collect drainage from roof leaders and temporarily store water to be released to lawns, gardens, and other landscaped areas after the rainfall has ended. Rain Barrels are typically between 50 to 200 gallons in size. The stored water can also be used as a non-potable water supply. Cisterns are larger than rain barrels having volumes of 200 gallons or more, and can be placed either on the surface or underground. Figures 1 and 2 show examples of rain barrels and cisterns, respectively, that could be used to manage stormwater from a project. Rain barrels and cisterns are manufactured in a variety of shapes and sizes. All of these facilities must make provisions for the following items:

- There must be a means to release the water stored in the container between storm events in order for the necessary storage volume to be available for the next storm.
- Stormwater must be kept from entering other potable systems, and pipes and storage units must be clearly marked "Do Not Drink".
- An overflow outlet should be placed a few inches below the top of the storage container with an overflow pipe to divert flow away from structures once the storage containers are filled.
- Use screens to filter debris, and covers (lids) placed over the containers to prevent insects and debris from entering the storage chamber.
- Make sure cisterns are watertight and do not leak.
- Rain barrels are typically assumed to be 25% full to calculate volume since they are not always emptied before each storm. The tables contained in this Handbook were developed to account for the 25% increase in the required storage of a rain barrel or a cistern.

Source (picture on left): http://www.rfcity.org/Eng/Stormwater/YourProperty/YourProperty.htm
Source (picture on right): :http://www.floridata.com/tracks/transplantedgardener/Rainbarrels.cfm

Figure 1: Rain Barrels

Source (for both pictures): Pennsylvania Stormwater BMP Manual (PADEP, 2006)

Figure 2: Cisterns

Infiltration Trench

An infiltration trench is a long, narrow, rock-filled trench, with or without a perforated pipe placed within the rock to distribute water evenly along the trench, that receives stormwater runoff, and has no outlet. Runoff is stored in the void space between the stones and in the pipe, and infiltrates through the bottom of the trench into the underlying soil matrix. Figure 3 shows a typical cross-section of an infiltration trench configuration. Infiltration trenches shall incorporate or make provisions for the following elements:

- These facilities should be located a minimum of ten (10) feet (or as otherwise required by the Municipality) from the building foundation to avoid foundation seepage problems, and are not recommended if their installation would create a risk of flooding other structures constructed at or below grade.
- Perforated pipe placed within the rock is to be set level.
- The width is limited to between **3 to 8 feet**, and the depth ranges from **2 to 5 feet**. Given the variability of local groundwater and bedrock formations, a shallow bed with wider footprint is generally recommended. Should the applicant run into a limiting factor (ground water or bedrock) during construction, consultation with the Municipal Engineer is required.
- Trench should be wrapped in nonwoven geotextile (top, sides, and bottom).
- There should be a positive overflow that allows stormwater that cannot be stored or infiltrated to be discharged into a nearby vegetated area.
- Roof downspouts may be connected to infiltration trenches, but should contain a cleanout to collect sediment and debris before entering the infiltration area.
- Infiltration testing is recommended to ensure soil is capable of infiltrating stormwater.
- It is recommended that there be a 2 foot clearance above the regularly occurring seasonal high water table, and have a minimum depth to bedrock of 2 feet.
- The infiltration trench should be at least 50 feet from individual water supply wells, 100 feet from community or municipal water supply wells, and 50 feet from any septic system component. It should not be located near stormwater Hotspots (refer to B.2 Definitions).
- The infiltration trench should be located so that it presents no threat to sub-surface structures such as building foundations and basements.
- Protect infiltration areas from compaction by heavy equipment during and after construction.
- Infiltration trenches should be constructed after all earth disturbance associated with a given project or site is stabilized to avoid clogging.
- The ratio of the drainage area which stormwater runoff is collected from to the area of the footprint (bottom area) of the infiltration portion of the facility should be as small as possible with a ratio of less than 5:1 preferred.

DEPTH (D) =
WIDTH (W) =
LENGTH (L) =

PLAN

WIDTH (W)

2'-0" MIN.

AASHTO #1 STONE

6" PERFORATED PVC (TYP.)

LENGTH (L)

4' DIA MANHOLE W/ * FRAME & COVER OR GRATE

PROVIDE 4" PVC (SDR35) WYE AT FINISHED GRADE FOR CLEANOUT/OVERFLOW

4"Ø DOWNSPOUT

PROPOSED BUILDING

4" PVC SLOTTED CAP

SECTION

CLEANOUT/MONITORING WELL W/ SLOTTED CAP (TYP.)

DEPTH (D)

6" SANITARY TEE (TYP.)

6" PERFORATED PVC

6" PERFORATED PVC (TYP.)

6"

GEOTEXTILE MATERIAL (SIDES AND TOP ONLY)

1/2 D

AASHTO #1 STONE

12" MIN COVER

SNOUT

12" MIN.

6" PVC

10' MIN.

* NOTE: ALTERNATE SUMP DIMENSIONS AND MATERIALS MAY BE UTILIZED IF APPROVED BY BOROUGH ENGINEER.

TYPICAL INFILTRATION TRENCH DETAIL

ARRO

108 WEST AIRPORT ROAD
LITITZ, PA 17543
Tel 717.569.7021

SCALE:	DATE	DWG. NO.
NONE	12/9/2021	1 OF 1
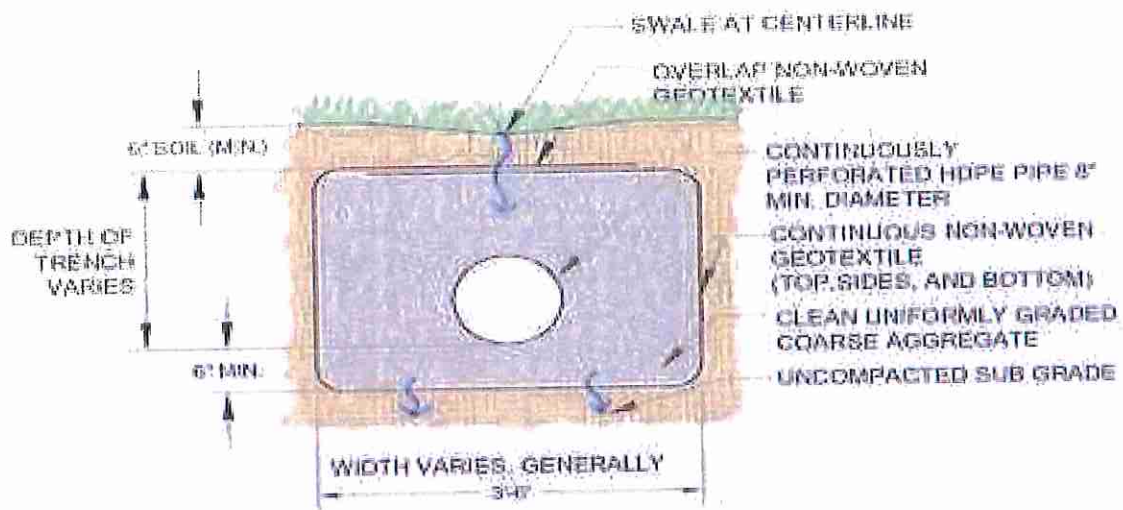
Source: Pennsylvania Stormwater BMP Manual (PADEP, 2006)

Figure 3: Cross-Section of Typical Infiltration Trench

Rain Garden/Bioretention Area

A Rain Garden (Bioretention Area) is an excavated depression area on the surface of the land in which native vegetation is planted to filter and use stormwater runoff. Runoff ponds on top of the surface of the rain garden and then infiltrates into an enhanced soil/planting mix below the surface where plants can use the water to grow. Bioretention improves water quality, with the vegetation planted in the facility filtering the water, and the root systems encouraging or promoting infiltration. Figure 4 shows a cross-section of a typical rain garden. Key elements of a rain garden include:

- Recommended ponding depths not exceeding **1 foot.**
- Native vegetation that can tolerate dry and wet weather.
- An overflow area where, if the bioretention area were to overflow, the overflow would flow over pervious surfaces (i.e. grass, meadow), and would not cause harm to property, or;
- An overflow, such as a domed riser, to allow excess flow from large storms to travel to other infiltration areas, pervious areas, or connected storm systems designed to receive the excess runoff.
- For most areas, slopes should be limited to 3:1, maximum; however, where space is limited, 2:1 side slopes may be acceptable with approval from the municipal engineer.
- The soil/planting mix depth should not be less than 1.5 feet deep and typically consist of a mixture of topsoil, sand and compost (i.e. mulch). The topsoil, sand and compost should be uniformly mixed by volume in a 50%, 30%, 20% mixture, respectively.
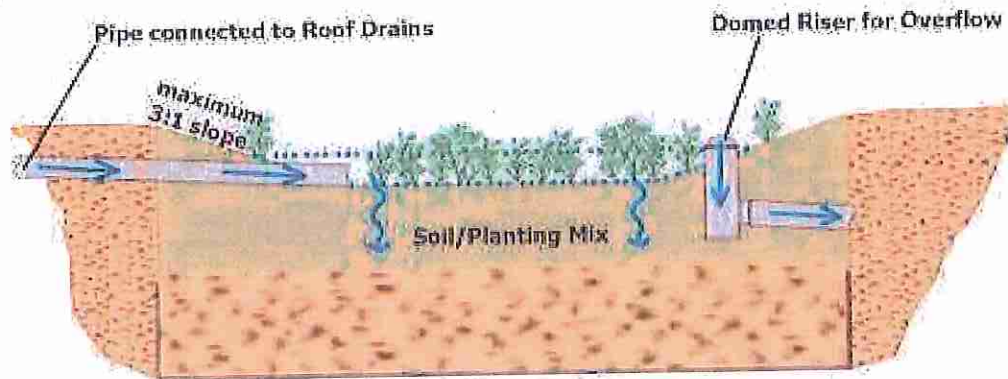

Source: Pennsylvania Stormwater BMP Manual (PADEP, 2006)

Figure 4: Cross-Section of Typical Rain Garden/Bioretention Area

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Dry Wells

A dry well, also referred to as a seepage pit, is a subsurface storage facility that temporarily stores and infiltrates runoff from the roofs of buildings or other impervious surfaces. A dry well can be either a structural prefabricated chamber (Dry Well #1) or an excavated pit filled with stone fill (Dry Well #2). Dry Wells discharge the stored runoff via infiltration into the surrounding or underlying soils. Figure 5 shows a typical prefabricated dry well and a typical dry well configuration with stone fill. The following elements shall be incorporated into all dry well designs:

- These facilities should be located a minimum of ten (10) feet (or as otherwise required by the Municipality) from the building foundation to avoid foundation seepage problems, and are not recommended if their installation would create a risk of flooding other structures constructed at or below grade.
- Dry well should be constructed after all earth disturbance associated with a given project or site is stabilized to avoid clogging.
- During construction, compaction of the subgrade soil in the bottom of the dry well should be avoided, and construction should be performed only with light machinery.
- For Dry Well #2 designs, the depth of dry well should be between **1.5 feet to 4 feet**. Gravel fill should consist of uniformly graded stone with an average diameter of between one and one half and two (1.5 –2.0) inches with the gravel fill wrapped in a nonwoven geotextile to separate the stone fill from the surrounding soil.
- At least 1 foot of soil must be placed over the top of the dry well.
- Dry wells should be inspected at least four (4) times annually as well as after large storm events.
- Dry wells should have overflow pipes to allow high volumes of runoff to overflow the facility and flow into a connected infiltration area, pervious area, or other connected storm sewer designed to receive the excess runoff.
- Every dry well must have at least one monitoring well to assist in the inspection of the dry well to determine how much water is retained within the well during dry weather periods.
- Infiltration testing is recommended to ensure the underlying soil is capable of infiltrating the needed volume of stormwater.
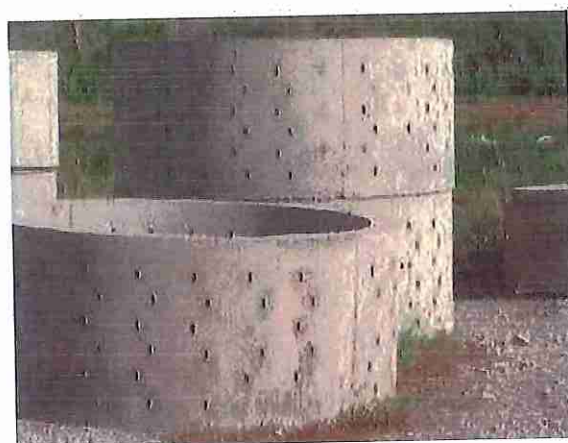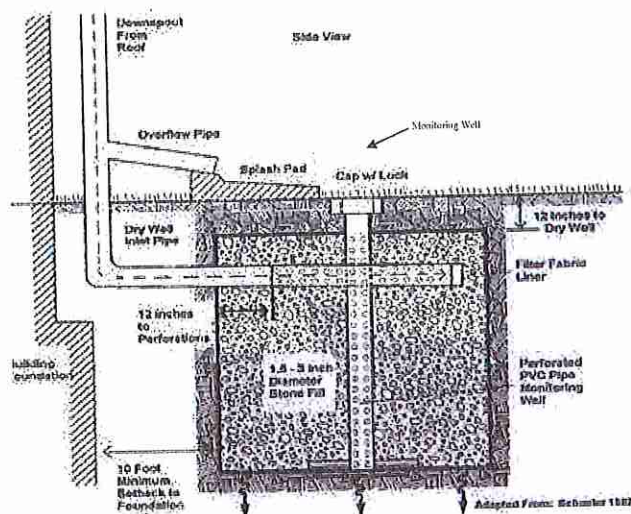
Figure 5: Typical Dry Well Configuration filled with Stone Fill (DRY WELL #2) (Left) and Structural Prefabricated Chamber (DRY WELL #1) (Right)

4. Example

Simplified Approach to Stormwater Management for a Residential Garage and Driveway addition

Joe Homeowner wants to build a 400 square foot two car garage, and a 540 square foot (30' long x 18' wide) impervious driveway that is graded so that the stormwater runoff drains to the grassy area along one edge of the driveway. (An annotated copy of Table 1 is provided below as Table 5 and an annotated copy of Table 3 is provided below as Table 6, and outlines the steps of this example) and a completed Table 4 is provided as Table 7.

STEP 1 – Make a sketch of the site plan as shown in Figure 6.

STEP 2 - Determine the total area of all proposed impervious surfaces to drain to each BMP:

Garage Roof (Front)	10 ft. x 20 ft.	=	200 sq. ft
Garage Roof (Rear)	10 ft. x 20 ft.	=	200 sq. ft.
Driveway	30 ft. x 18 ft.	=	540 sq. ft.

Total Proposed Impervious Surface			**940 sq. ft.**
Total Proposed Earth Disturbance Area			**2,500 sq. ft. (estimated)**

Note: If the driveway used pervious pavement (i.e. paving blocks), then the total impervious area would only be 400 square feet, and no stormwater management practices would need to control runoff from the project.

STEP 3 – Select the BMP(s) to be Used and Appropriate Sizing Criteria

Select a BMP or combination of BMPs from Section 3 to be used to satisfy the volume requirement. Determine the length, width, depth and other requirements for the BMPs in Section 3. A BMP needs to be placed to catch runoff from the back of the garage, and a BMP needs to be placed to capture runoff from the front of the garage and the driveway. Figure 6 shows the direction the runoff flows and the locations where the BMPs are to be placed.

Joe Homeowner would like to use a rain barrel (BMP #1) to capture the runoff from the rear of the garage and an infiltration trench (BMP #2) to capture runoff from the front of the garage and the driveway.

BMP #1 (Rain Barrel/Cistern) – Steps 3A and 3B

STEP 3A - Select the proposed impervious area value for BMP #1, the rain barrel or cistern, in Column 1 that is closest to, but not less than 200 in Table 1:

The value in Column 1 that is closest to but is not less than 200 is 200.

STEP 3B - Determine the volume that BMP #1 must be to satisfy the volume requirements using Columns 2 and 3 in Table 1:

The volume in gallons of the rain barrel/cistern to be used as BMP #1, assuming the rain barrel/cistern is 25% full, is determined by finding the value in Column 3 for the same row that corresponds to the impervious area value determined in Step 1. Therefore, the volume of BMP #1, the rain barrel/cistern must be ≥ 166 gallons. Depending on the size of the rain barrel(s), a combination of rain barrels could be used in succession as shown in Figure 1, or a cistern could be used.

BMP #2 (Infiltration Trench) - Steps 3A through 3C

STEP 3A - Select the proposed impervious area value for BMP #2, the infiltration trench, using Column 1 in Table 6:

Find the row in Column 1 that is closest to but not less than 740 (200 from the front of the garage + 540 from the driveway). Therefore, the value selected is 750.

STEP 3B - Determine the volume that BMP #2, the infiltration trench must be to satisfy the volume requirements using Column 2 in Table 6:

The volume of the infiltration trench to be used as BMP #2, assuming a percent void volume of 40%, is determined by finding the value Column 2 that is in the same row as 750 square feet from Column 1 as described in Step 2. Therefore, the volume of BMP #2 must be 156 cubic feet.

STEP 3C - Utilizing the value from Column 2 determined above, and the surface area that the proposed BMP will occupy, determine the depth needed using Column 3 in Table 6:

Joe Homeowner would like to place the infiltration trench along the edge of the driveway so it would have a length of 20 feet. The smallest width that can be used, as stated in the infiltration trench requirements in Section 3, is 3 feet. Therefore, the area of the infiltration trench is:

$$20 \text{ feet} * 3 \text{ feet} = 60 \text{ square feet}$$

To find the minimum depth of the trench move toward the right side of the table from 156 cubic feet in Column 2 to Column 3, and find the column with a value of as close to but not more than 60 square feet, which is 52 square feet. Then obtain the minimum depth of the facility by reading the depth from the column heading at the top of the table. Therefore, the depth of the trench would need to be 3 feet.

Selected BMPs:
    BMP #1: Rain barrel(s) that provides for at least 166 gallons, and
    BMP #2: A 20' long x 3' wide x 3' deep infiltration trench

Table 5: Example – Calculating Storage Volume for Rain Barrel/Cistern

Column 1	Column 2	Column 3		
Proposed Impervious Area (square feet)	Volume of Rain Barrel/Cistern[1] (cubic feet)	Volume of Rain Barrel/Cistern (gallons)		
1	V_{RBcf}	V_{RBgal}		
Sum of all Proposed Impervious Areas	$(1*(1/12)*1)/0.75 = V_{RBcf}$	$V_{RBcf} * 7.48 = V_{RBgal}$		
50	6	42	Rain Barrel	
100	11	83		
150	17	125		
2 200	22	**3** 166		
250	28	208		
300	33	249		
350	39	291		
400	44	332		
450	50	374		
500	56	416		
550	61	457	Cistern	
600	67	499		
650	72	540		
700	78	582		
750	83	623		
800	89	665		
850	94	706		
900	100	748		
950	106	790		
999	111	830		

[1]Assume that the rain barrel/cistern is 25% full

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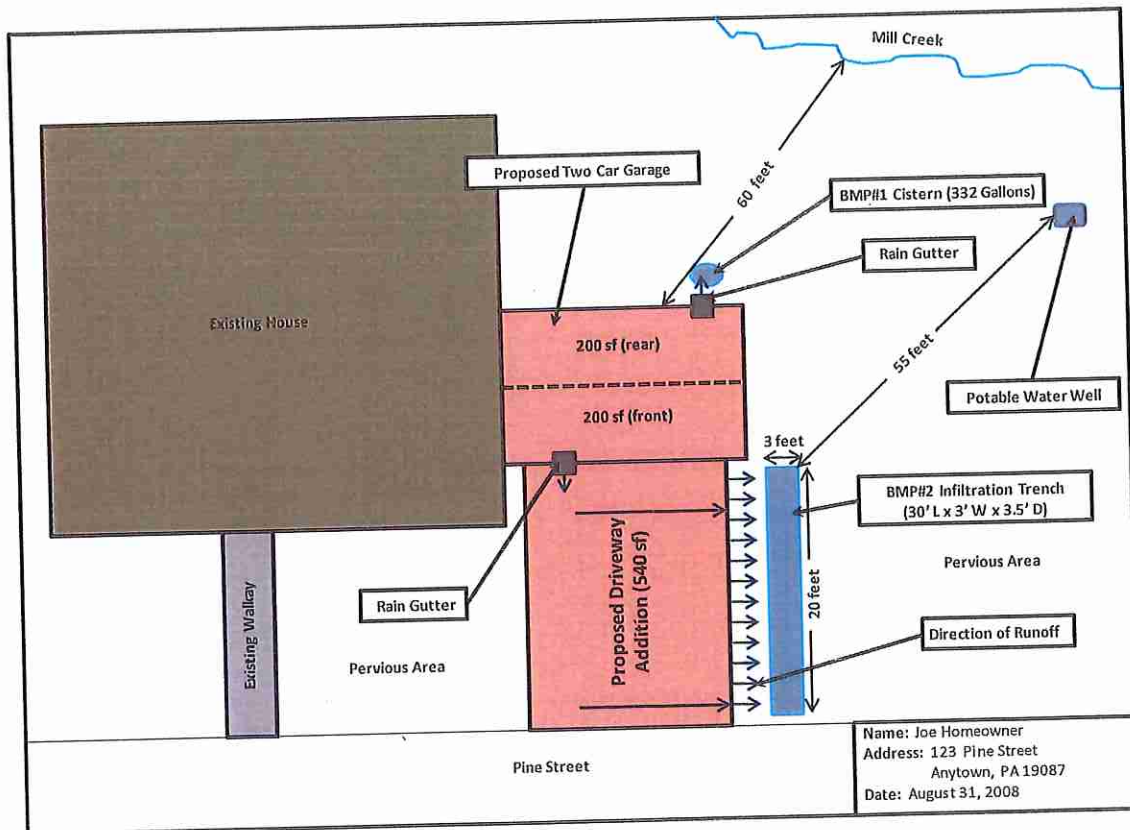
Figure 6: Example of Simplified Stormwater Management Site Plan for Joe Homeowner

The labels within the figure include:

- Mill Creek
- Existing House
- Proposed Two Car Garage
- 60 feet
- BMP#1 Cistern (332 Gallons)
- Rain Gutter
- 200 sf (rear)
- 200 sf (front)
- 55 feet
- Potable Water Well
- 3 feet
- BMP#2 Infiltration Trench (30' L x 3' W x 3.5' D)
- Pervious Area
- Proposed Driveway Addition (540 sf)
- Rain Gutter
- 20 feet
- Direction of Runoff
- Existing Walkway
- Pervious Area
- Pine Street
- Name: Joe Homeowner
- Address: 123 Pine Street
- Anytown, PA 19087
- Date: August 31, 2008

Table 6: Example – Calculating Storage Volume Surface Area and Depth for Infiltration Trench

Column 1	Column 2	Column 3							
Total Proposed Impervious Area (square feet)	Volume of Infiltration Trench or Dry Well #2 [1] (cubic feet)	Surface Area of Infiltration Trench or Dry Well #2 — Acceptable Depths for Each BMP are indicated by the arrows below (square feet)							
		Area Required for a BMP with a Depth(D) of 1.5'	Area Required for a BMP with a Depth(D) of 2.0'	Area Required for a BMP with a Depth(D) of 2.5'	Area Required for a BMP with a Depth(D) of 3.0'	Area Required for a BMP with a Depth(D) of 3.5'	Area Required for a BMP with a Depth(D) of 4.0'	Area Required for a BMP with a Depth(D) of 4.5'	Area Required for a BMP with a Depth(D) of 5.0'
							Infiltration Trench (2.0'-5.0')		
				Dry Well #2 (1.5'-4.0')					
I	V				A(sf)				
Sum of all Proposed Impervious Areas	$(I*(1/12)*J)/(0.4) = V$				$V/D = A$				
50	10	7	5	4	3	3	3	2	2
100	21	14	10	8	7	6	5	5	4
150	31	21	16	13	10	9	8	7	6
200	42	28	21	17	14	12	10	9	8
250	52	35	26	21	17	15	13	12	10
300	63	42	31	25	21	18	16	14	13
350	73	49	36	29	24	21	18	16	15
400	83	56	42	33	28	24	21	19	17
450	94	63	47	38	31	27	23	21	19
500	104	69	52	42	35	30	26	23	21
550	115	76	57	46	38	33	29	25	23
600	125	83	63	50	42	36	31	28	25
650	135	90	68	54	45	39	34	30	27
700	146	97	73	58	49	42	36	32	29
Step 3A (750) →	**Step 3B (156)**	104	78	Step 3C	**52**	45	39	35	31
800	167	111	83	67	56	48	42	37	33
850	177	118	89	71	59	51	44	39	35
900	188	125	94	75	63	54	47	42	38
950	198	132	99	79	66	57	49	44	40
999	208	139	104	83	69	59	52	46	42

[1] Assumes a percent void volume of 40%

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Table 7: Simplified Approach Worksheet – Example for *Joe Homeowner*

Name of Property Owner(s): **Joe Homeowner**	Date: **8/26/12**

Name of Applicant(s) [if different than Owner(s)]: **N/A**

Contact Phone #: **610-555-1234**	Email Address: **joe@homeowner.com**

Address of Project: **123 Pine St., Anytown, PA 19355**

Description of Project: **Add a 2-car garage and driveway**

☐ Met with Municipal Engineer to discuss proposed project. [date of meeting 6/1/12]

Distance from earth disturbance to nearest surface water feature (stream, pond, wetland, etc.)

(if required by the Municipality, circle one):   50 feet or less   ⬭More than 50 feet⬭

[X]	**Step 1:** Attach Simplified SWM Site Plan (i.e. sketch plan), per Section .1, Step 1

Step 2: Determine the Impervious Area to be Managed

Total Proposed Impervious Area (square feet): **940 sq. feet**

Total Earth Disturbance (square feet): **~ 2,500 sq. feet**

Step 3: Select the BMP(s) to be Used and Appropriate Sizing Criteria

Rain Barrel or Cistern

Proposed Impervious Surface from Column 1 in Table 1	Volume from Column 3 in Table 1			
200 sq. feet	**166 gallons**			

Rain Garden/Bioretention or Dry Well #1

Proposed Impervious Surface from Column 1 in Table 2	Volume of BMP from Column 2 in Table 2	Area Dimensions of BMP - Column 3 in Table 2	Depth of BMP from Column 3 in Table 2	Types of Materials to be Used
N/A				

Infiltration Trench or Dry Well #2

Proposed Impervious Surface from Column 1 in Table 3	Volume of BMP from Column 2 in Table 3	Area Dimensions of BMP - Column 3 in Table 3	Depth of BMP from Column 3 in Table 3	Types of Materials to be Used
740 sq. feet	**156 cubic feet**	**20 ft by 3 ft**	**3 ft**	**Infiltration trench, uniformly graded aggregate, 8" HDPE pipe, geotextile, grass planted on top.**

[X]	**Step 4:** Complete, Sign & have Operation, Maintenance and Inspection Agreement Notarized and Recorded at the County Recorder of Deeds (when signed by the Municipality)

Note: For additional BMPs, use additional sheet(s).

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5. Simplified Approach Operation, Maintenance and Inspection Plan and

Agreement

It is the property owner's responsibility to properly maintain BMPs. It is also the property owner's responsibility to inform any future buyers of the function, operation, and maintenance needed for any BMPs on the property prior to the purchase of the property. The accompanying sample "Simplified Approach Operation, Maintenance and Inspection Plan and Agreement" (see accompanying appendix) outlines the maintenance required for each type of BMP, the responsibilities of the property owner, and the rights of the Municipality in regards to inspection and enforcement of the maintenance requirements.

The "Simplified Approach Operation, Maintenance and Inspection Plan and Agreement" must be signed, notarized and submitted to the Municipality. Following the signature by the Municipality, the property owner must have the Agreement recorded at the County Recorder of Deeds, so that the Agreement will be applicable to future property owners.