Simplified Approach to Stormwater Management for Small Projects

Westtown Township Handbook

Date: **September 2016**

This handbook was prepared in accordance with the
County-wide Act 167 Stormwater Management Plan for Chester County, PA

STORMWATER MANAGEMENT PROCEDURES FOR MEETING THE SIMPLIFIED APPROACH REQUIREMENTS

Introduction

On December 16, 2013 the Westtown Township Adopted the County-wide Act 167 Stormwater Management Ordinance. This Handbook has been developed to allow homeowners or applicants for small projects to comply with stormwater management requirements of the Westtown Township Stormwater Management Ordinance, including sizing, designing, locating and installing on-lot measures, referred to herein as "Best Management Practices" (BMPs). **Only projects that meet the criteria listed below as outlined in the Westtown Township Stormwater Management Ordinance may use this Simplified Approach** and are then not required to submit a formal Stormwater Management Site plan to the Municipality.

- Any project that creates new additional impervious coverage greater than 1,000 square feet (ft^2) but not more than 2,000 ft^2
- The cumulative total of all new additional impervious coverages since December 16, 2013 that create a total impervious coverage greater than 1,000 ft^2 but not more than 2,000 ft^2
- Any project which results in earth disturbance greater than 5,000 ft^2

Note: Any project which creates additional impervious coverage less than 1,000 ft^2, with a cumulative total less than 1,000 ft^2, may voluntarily opt to implement BMP(s) using the simplified approach.

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 Westtown Township 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 the Ordinance.

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

- **Section 1** presents descriptions of BMPs that can be considered for on-lot stormwater management.
- **Section 2** presents definitions of key terms.
- **Section 3** describes requirements and steps for using the 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 4** illustrates an example of how to obtain the size and dimensions of a BMP(s) for a sample project, complete a site plan, and prepare a worksheet.

- **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 Westtown Township 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 Westtown Township Stormwater Management 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 Chester County Recorder of Deeds after signature by Westtown Township and before starting construction.

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 Westtown Township?

- ☐ Simplified Approach Worksheet (Table 4)
- ☐ Simplified SWM site plan (i.e. sketch plan), containing the features described in Section 3, Step 1.
- ☐ "Simplified Approach Operation, Maintenance and Inspection Plan and Agreement" must be signed, notarized and (after approval and signature by the Township) recorded at the Chester 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. 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, which 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 fully 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

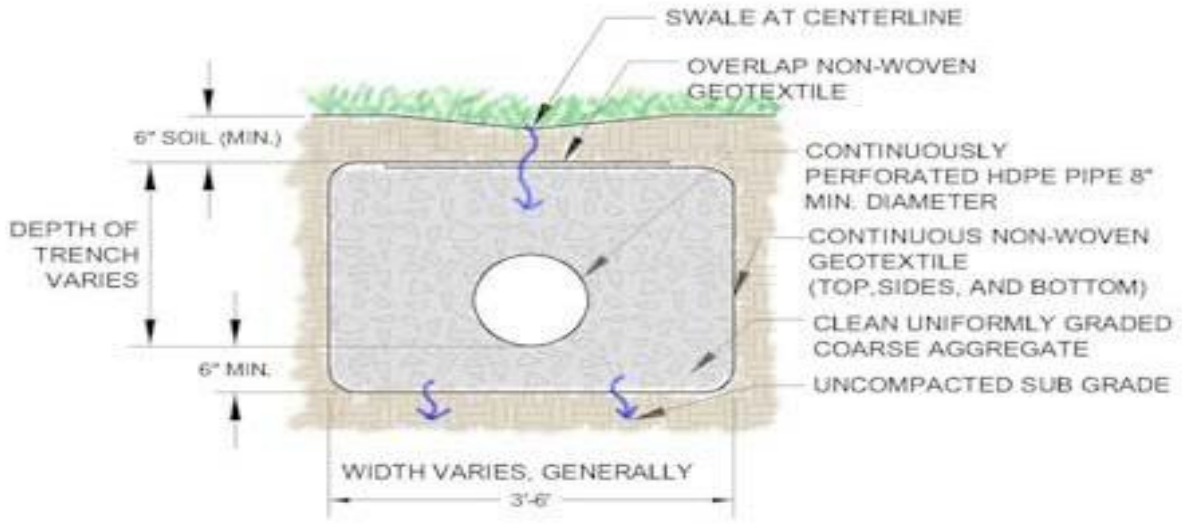
Source (for both pictures): Pennsylvania Stormwater BMP Manual (PADEP, 2006)

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:

- Unless otherwise approved by the Municipal Engineer, these facilities should be located a minimum of:
  - Fifteen (15) feet 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.
  - Ten (10) feet from any property lines, easements, or rights-of-way.
  - Fifty (50) feet from water supply wells
  - Twenty (20) feet from any sewage system component.
- Installation of an infiltration trench cannot cause earth disturbance within fifty (50) feet from a perennial or intermittent stream, wetland or waterbody. Protecting this area from 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 in all cases.
- These facilities should not be located near stormwater Hotspots (refer to B.2 Definitions).
- 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**.
- 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 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.



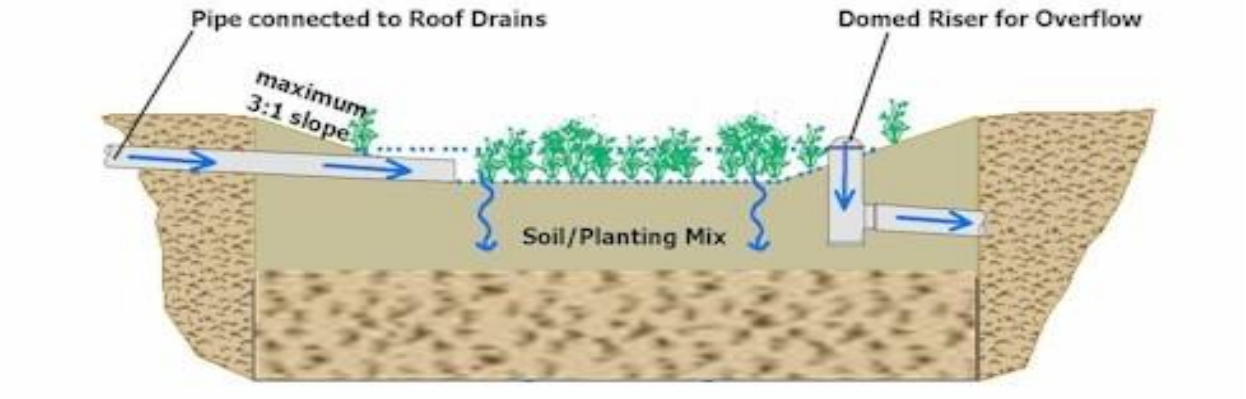
Source: Pennsylvania Stormwater BMP Manual (PADEP, 2006)

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:

- Unless otherwise approved by the Municipal Engineer, these facilities should be located a minimum of:
  - Fifteen (15) feet 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.
  - Ten (10) feet from any property lines, easements, or rights-of-way.
  - Fifty (50) feet from water supply wells
  - Twenty (20) feet from any sewage system component.
- Installation of a rain garden cannot cause earth disturbance within fifty (50) feet from a perennial or intermittent stream, wetland or waterbody. Protecting this area from 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 in all cases.
- These facilities should not be located near stormwater Hotspots (refer to B.2 Definitions).
- 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.



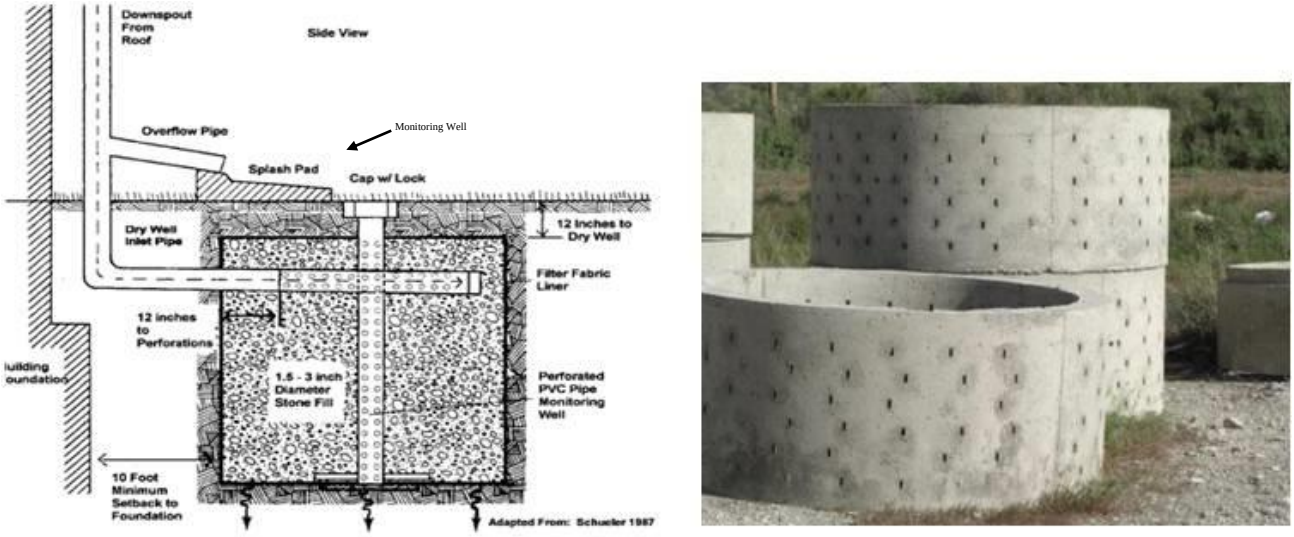
Source: Pennsylvania Stormwater BMP Manual (PADEP, 2006)

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

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:

- Unless otherwise approved by the Municipal Engineer, these facilities should be located a minimum of:
  - Fifteen (15) feet 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.
  - Ten (10) feet from any property lines, easements, or rights-of-way.
  - Fifty (50) feet from water supply wells
  - Twenty (20) feet from any sewage system component.
- Installation of a dry well cannot cause earth disturbance within fifty (50) feet from a perennial or intermittent stream, wetland or waterbody. Protecting this area from 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 in all cases.
- These facilities should not be located near stormwater Hotspots (refer to B.2 Definitions).
- 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.



Source (for picture on left): http://www.seagrant.sunysb.edu/pages/BMPsForMarinas.htm
Source (for picture on right): http://www.copelandconcreteinc.net/1800652.html

Figure 5: Typical Dry Well Configuration filled with Stone Fill (DRY WELL #2) (Left) and Structural Prefabricated Chamber (DRY WELL #1) (Right)

2. Definitions

These definitions apply only to this Simplified Approach to Stormwater Management for Small Projects Handbook. The definitions included in the Westtown Township Stormwater Management Ordinance also apply.

Best Management Practice (BMP) – As defined in the Westtown Township 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), permeable paving, 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 Township'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 Stormwater Management Ordinance and if needed consult with the Municipal Engineer to confirm what components of the proposed project are considered "impervious surfaces". Compacted soils or stone surfaces (such as for vehicle movement or parking), among other features, are included in the 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. Steps for Using the Simplified Approach

All proposed impervious areas (as defined by the Westtown Township Stormwater Management 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 Section 2 and check with the Municipal Engineer to confirm what features of the proposed project must be included in the calculation of new impervious areas. Sidewalks or patios that are constructed with gravel or pervious pavers and will not be disturbed or altered in the future may not need to be included in this calculation (check with the Municipal Engineer). In these cases, the amount of proposed impervious area may be reduced for proposed patios, and sidewalks through the use of gravel, pervious pavement, and turf pavers. 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.

All individuals planning on using the Simplified Approach are encouraged 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 Westtown Township 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.

The steps that must be undertaken to meet the Ordinance requirements follow. Tables 1 through 3 are provided after these steps to assist with required calculations. 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 at the end of this section.

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 of property lines, easements, and rights-of-way.
- 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.
- 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 proximity to the proposed BMP(s). See Section 1, 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 1, Description of BMPs.
    - 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 1.
- 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 "Simplified Approach Operation, Maintenance and Inspection Plan and Agreement" to Westtown Township for review and approval. Once approved by the Township, the "Simplified

Approach Operation, Maintenance and Inspection Plan and Agreement" must be signed and notarized. After the Township has signed the "Simplified Approach Operation, Maintenance and Inspection Plan and Agreement", record the Agreement at the Chester County Office of Recorder of Deeds. Construction can begin only after the Township has issued its approval of the proposed project to the applicant, including agreement signatures and recordation.

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

Column 1	Column 2	Column 3	
Proposed Impervious Area[2] (square feet)	**Volume of Rain Barrel/Cistern[3] (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	
1,000	111	831	

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. Rain barrel/cistern use may be considered for larger impervious areas than those shown but the required volume in such cases may render these as an impractical BMP.
3. 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 Depth(D) of 0.5'	*Area Required for a Depth(D) of 1.0'*	*Area Required for a Depth(D) of 1.5'*	*Area Required for a Depth(D) of 2.0'*	*Area Required for a Depth(D) of 2.5'*	*Area Required for a Depth(D) of 3.0'*	*Area Required for a Depth(D) of 3.5'*	*Area Required for a Depth(D) of 4.0'*
		Rain Garden /Bioretention (0.5'-1.0')		**Dry Well #1 (1.5'-4.0')**					
I	V	*A(sf)*							
Proposed Impervious Areas	1*(1/12)**I*= V	V/D=A							
100	8	17	8	6	4	3	3	2	2
150	13	25	13	8	6	5	4	4	3
200	17	33	17	11	8	7	6	5	4
250	21	42	21	14	10	8	7	6	5
300	25	50	25	17	13	10	8	7	6
350	29	58	29	19	15	12	10	8	7
400	33	67	33	22	17	13	11	10	8
450	38	75	38	25	19	15	13	11	9
500	42	83	42	28	21	17	14	12	10
550	46	92	46	31	23	18	15	13	11
600	50	100	50	33	25	20	17	14	13
650	54	108	54	36	27	22	18	15	14
700	58	117	58	39	29	23	19	17	15
750	63	125	63	42	31	25	21	18	16
800	67	133	67	44	33	27	22	19	17
850	71	142	71	47	35	28	24	20	18
900	75	150	75	50	38	30	25	21	19
950	79	158	79	53	40	32	26	23	20
1000	83	167	83	56	42	33	28	24	21
1050	88	175	88	58	44	35	29	25	22
1100	92	183	92	61	46	37	31	26	23
1150	96	192	96	64	48	38	32	27	24
1200	100	200	100	67	50	40	33	29	25
1250	104	208	104	69	52	42	35	30	26
1300	108	217	108	72	54	43	36	31	27
1350	113	225	113	75	56	45	38	32	28
1400	117	233	117	78	58	47	39	33	29
1450	121	242	121	81	60	48	40	35	30
1500	125	250	125	83	63	50	42	36	31
1550	129	258	129	86	65	52	43	37	32
1600	133	267	133	89	67	53	44	38	33
1650	138	275	138	92	69	55	46	39	34
1700	142	283	142	94	71	57	47	40	35
1750	146	292	146	97	73	58	49	42	36
1800	150	300	150	100	75	60	50	43	38
1850	154	308	154	103	77	62	51	44	39
1900	158	317	158	106	79	63	53	45	40
1950	163	325	163	108	81	65	54	46	41
2000	167	333	167	111	83	67	56	48	42

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 Depth(D) of 1.5'	*Area Required for a Depth(D) of 2.0'*	*Area Required for a Depth(D) of 2.5'*	*Area Required for a Depth(D) of 3.0'*	*Area Required for a Depth(D) of 3.5'*	*Area Required for a Depth(D) of 4.0'*	*Area Required for a Depth(D) of 4.5'*	*Area Required for a Depth(D) of 5.0'*
		Dry Well #2 (1.5'-4.0')					Infiltration Trench (2.0'-5.0')		
I	V	*A(sf)*							
Proposed Impervious Area	(1*(1/12)**I*)/ (0.4)[1] =V	V/D=A							
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
750	156	104	78	63	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
1000	208	139	104	83	69	60	52	46	42
1050	219	146	109	88	73	63	55	49	44
1100	229	153	115	92	76	65	57	51	46
1150	240	160	120	96	80	68	60	53	48
1200	250	167	125	100	83	71	63	56	50
1250	260	174	130	104	87	74	65	58	52
1300	271	181	135	108	90	77	68	60	54
1350	281	188	141	113	94	80	70	63	56
1400	292	194	146	117	97	83	73	65	58
1450	302	201	151	121	101	86	76	67	60
1500	313	208	156	125	104	89	78	69	63
1550	323	215	161	129	108	92	81	72	65
1600	333	222	167	133	111	95	83	74	67
1650	344	229	172	138	115	98	86	76	69
1700	354	236	177	142	118	101	89	79	71
1750	365	243	182	146	122	104	91	81	73
1800	375	250	188	150	125	107	94	83	75
1850	385	257	193	154	128	110	96	86	77
1900	396	264	198	158	132	113	99	88	79
1950	406	271	203	163	135	116	102	90	81
2000	417	278	208	167	139	119	104	93	83

1. Assumes a percent void volume of 40%

Table-4: Simplified Approach Worksheet

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.) (Circle one): 50 feet or less More than 50 feet					
☐ **Step 1**: Attach Simplified SWM Site Plan (i.e. sketch plan), per Section 3, 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).

4. Example

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

Joe Homeowner wants to build a 400 square foot garage, and a 720 square foot (40′ 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 excerpt from Table 1 is provided below as Figure 1 and an annotated excerpt from Table 3 is provided below as Figure 2 to outline the steps of this example. A completed Table 4 is provided as Figure 4).

STEP 1 – Make a sketch of the site plan as shown in Figure 3.

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	40 ft. x 18 ft.	=	720 sq. ft.

Total Proposed Impervious Surface			**1,120 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 1 to be used to satisfy the volume requirement. Determine the length, width, depth and other requirements for the BMPs in Section 1. 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 3 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 - See Figure 1 on page 23

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

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, or a cistern could be used.

BMP #2 (Infiltration Trench) - Steps 3A through 3C – See Figure 2 on Page 24

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

Find the row in Column 1 that is closest to but not less than 920 (200 from the front of the garage + 720 from the driveway). Therefore, the value selected is 950.

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

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 in Column 2 that is in the same row as 950 square feet from Column 1. Therefore, the volume of BMP #2 must be 198 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 3:

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 1, is 3 feet. Therefore, the area of the infiltration trench is:

20 feet * 3 feet = 60 square feet

To find the minimum depth of the trench move toward the right side of the table from 198 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 57 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 3.5 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 3.5′ deep infiltration trench

Figure 1: Example – Calculating Storage Volume for Rain Barrel/Cistern using Table 1

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)**	
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	**Rain Barrel**
150	17	125	
Step 3A 200	22	**Step 3B** 166	
250	28	208	
300	33	249	
350	39	291	
400	44	332	
450	50	374	
500	56	416	
550	61	457	
600	67	499	**Cistern**
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

Figure 2: Example – Calculating Storage Volume Surface Area and Depth for Infiltration Trench Using Table 3

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	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
750	156	104	78	63	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

Step 3A → **Step 3B** → **Step 3C**

[1] Assumes a percent void volume of 40%

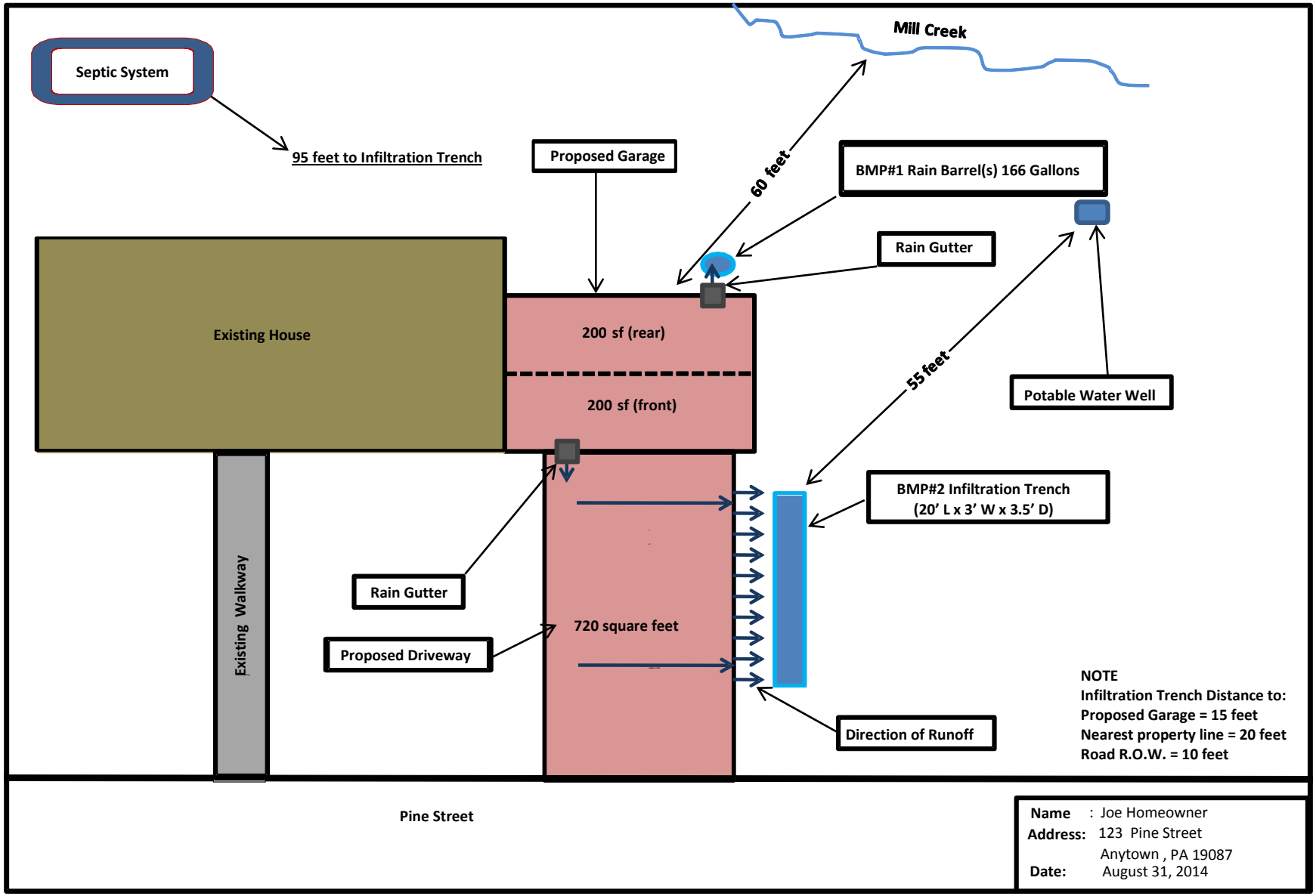


Figure 3. Example of Simplified Stormwater Management Site Plan for Joe Homeowner

Figure 4: 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 6/1/14]					
Distance from earth disturbance to nearest surface water feature (stream, pond, wetland, etc.) (Circle one): 50 feet or less More than 50 feet					
[x] **Step 1**: Attach Simplified SWM Site Plan (i.e. sketch plan), per Section 3, Step 1					
Step 2: Determine the Impervious Area to be Managed					
	Total Proposed Impervious Area (square feet): **1,120 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
	920 sq. feet	**198 cubic feet**	**20 ft by 3 ft**	**3.5 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).

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 sample "Simplified Approach Operation, Maintenance and Inspection Plan and Agreement" outlines the maintenance required for each type of BMP, the responsibilities of the property owner, and the rights of Westtown Township in regards to inspection and enforcement of the maintenance requirements.

The "Simplified Approach Operation, Maintenance and Inspection Plan and Agreement" must be completed by the property owner and submitted to Westtown Township for review along with the Site Plan and Simplified Approach Worksheet. Once the Township has approved this submission, the Agreement must be signed, notarized and submitted to the Township for signature. Following the signature by the Township, 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, and a copy of the final recorded Agreement must be returned to the Township. No construction can commence until the Township has received a copy of the final recorded Agreement.