

STONYCREEK RIVER WATERSHED

BERLIN BOROUGH

STORMWATER MANAGEMENT

ORDINANCE

ORDINANCE NO. 332

BERLIN BOROUGH, SOMERSET COUNTY,

PENNSYLVANIA

Adopted at a Public Meeting Held on

April 7, 2011

Article I - General Provisions

Section 101.	Short Title
Section 102.	Statement of Findings
Section 103.	Purpose
Section 104.	Statutory Authority
Section 105.	Applicability
Section 106.	Repealer
Section 107.	Severability
Section 108.	Compatibility with Other Requirements

Article II - Definitions

Article III - Stormwater Management Standards

Section 301.	General Requirements
Section 302.	Exemptions
Section 303.	Volume Controls
Section 304.	Rate Controls

Article IV - Stormwater Management Site Plan Requirements

Section 401.	Plan Requirements
Section 402.	Plan Submission
Section 403.	Plan Review
Section 404.	Modification of Plans
Section 405.	Resubmission of Disapproved Stormwater Management Site Plans
Section 406.	Authorization to Construct and Term of Validity
Section 407.	As-Built Plans, completion Certificate and Final Inspection

Article V - Operation and Maintenance

Section 501.	Responsibilities of Developers and Landowners
Section 502.	Operation and Maintenance Agreements

Article VI - Fees and Expenses

Section 601.	General
--------------	---------

Article VII - Prohibitions

Section 701.	Prohibited Discharges and Connections
Section 702.	Roof Drains
Section 703.	Alteration of SWM BMPs

Article VIII - Enforcement and Penalties

Section 801.	Right-of-Entry
Section 802.	Inspection
Section 803.	Enforcement
Section 804.	Suspension and Revocation
Section 805.	Penalties
Section 806.	Appeals

Article IX - References

Appendix A:	Operation and Maintenance Agreement
Appendix B:	Disconnected Impervious Area (DIA)
Appendix C:	Stormwater Management for Small Projects
Appendix D:	Management District Map

ARTICLE I - GENERAL PROVISIONS

Section 101. Short Title

This Ordinance shall be known and may be cited as the "Berlin Borough Stonycreek River Watershed Stormwater Management Ordinance".

Section 102. Statement of Findings

The Borough Council of the Borough of Berlin finds that:

- A. Inadequate management of accelerated runoff of stormwater resulting from development throughout a watershed increases flows and velocities, contributes to erosion and sedimentation, overtaxes the carrying capacity of streams and storm sewers, greatly increases the cost of public facilities to carry and control stormwater, undermines flood plain management and flood control efforts in downstream communities, reduces groundwater recharge, threatens public health and safety, and increases non-point source pollution of water resources.
- B. A comprehensive program of stormwater management, including reasonable regulation of development and activities causing accelerated runoff, is fundamental to the public health, safety and welfare and the protection of people of the Commonwealth, their resources and the environment.
- C. Stormwater is an important water resource, which provides groundwater recharge for water supplies and base flow of streams, which also protects and maintains surface water quality.
- D. Federal and state regulations require certain municipalities to implement a program of stormwater controls. These municipalities are required to obtain a permit for stormwater discharges from their separate storm sewer systems under the National Pollutant Discharge Elimination System (NPDES).

Section 103. Purpose

The purpose of this Ordinance is to promote health, safety, and welfare within the Municipality and its watershed by minimizing the harms and maximizing the benefits described in Section 102 of this Ordinance, through provisions designed to:

- A. Meet legal water quality requirements under state law, including regulations at 25 Pa. Code Chapter 93 to protect, maintain, reclaim and restore the existing and designated uses of the waters of this Commonwealth.
- B. Preserve the natural drainage systems as much as possible.
- C. Manage stormwater runoff close to the source.
- D. Provide procedures and performance standards for stormwater planning and management.
- E. Maintain groundwater recharge, to prevent degradation of surface and groundwater quality and to otherwise protect water resources.
- F. Prevent scour and erosion of stream banks and streambeds.
- G. Provide proper operation and maintenance of all permanent Stormwater Management (SWM) Best Management Practices (BMPs) that are implemented within the Municipality.
- H. Provide standards to meet NPDES permit requirements.

Section 104. Statutory Authority

A. Primary Authority:

The municipality is empowered to regulate these activities by the authority of the Act of October 4, 1978, P.L. 864 (Act 167), 32 P.S. Section 680.1, et seq., as amended, the "Storm Water Management Act" and the Borough Code.

B. Secondary Authority:

The Borough of Berlin is empowered to regulate land use activities that affect runoff by the authority of the Act of July 31, 1968, P.L. 805, No. 247, The Pennsylvania Municipalities

Planning Code, as amended, and the Borough Code, Act 1966, Feb. 1, P.L. (1965) 1656, No. 581, 53 P.S. §§ 46201, et seq.

Section 105. Applicability

All Regulated Activities and all activities that may affect stormwater runoff, including Land Development and Earth Disturbance Activity, whether or not located within the Stonycreek River Watershed, are subject to regulation by this Ordinance.

Section 106. Repealer

Any other ordinance provision(s) or regulation of Berlin Borough inconsistent with any of the provisions of this Ordinance is hereby repealed to the extent of the inconsistency only.

Section 107. Severability

In the event that a court of competent jurisdiction declares any section or provision of this Ordinance invalid, such decision shall not affect the validity of any of the remaining provisions of this Ordinance.

Section 108. Compatibility with Other Requirements.

Approvals issued and actions taken under this Ordinance do not relieve the Applicant of the responsibility to secure required permits or approvals for activities regulated by any other code, law, regulation or ordinance.

ARTICLE II - DEFINITIONS

For the purposes of this Ordinance, certain terms and words used herein shall be interpreted as follows:

- A. Words used in the present tense include the future tense; the singular number includes the plural, and the plural number includes the singular; words of masculine gender include feminine gender; and words of feminine gender include masculine gender.
- B. The word "includes" or "including" shall not limit the term to the specific example but is intended to extend its meaning to all other instances of like kind and character.
- C. The words "shall" and "must" are mandatory; the words "may" and "should" are permissive.

Agricultural Activity - Activities associated with agriculture such as agricultural cultivation, agricultural operations, and animal heavy use areas. This includes the work of producing crops including tillage, land clearing, plowing, disking, harrowing, planting, harvesting crops, or pasturing and raising of livestock and installation of conservation measures. Construction of new buildings or impervious area is not considered an Agricultural Activity.

Applicant - A landowner, developer or other person who has filed an application to the Municipality for approval to engage in any Regulated Activity at a project site in the Municipality.

Best Management Practice (BMP) - Activities, facilities, designs, measures or procedures used to manage stormwater impacts from Regulated Activities, to meet State Water Quality Requirements, to promote groundwater recharge and to otherwise meet the purposes of this Ordinance. Stormwater BMPs are commonly grouped into one of two broad categories or measures: "structural" or "non-structural". In this Ordinance, non-structural BMPs or measures refer to operational and/or behavior-related practices that attempt to minimize the contact of pollutants with stormwater runoff whereas structural BMPs or measures are those that consist of a physical device or practice

that is installed to capture and treat stormwater runoff. Structural BMPs include, but are not limited to, a wide variety of practices and devices, from large-scale retention ponds and constructed wetlands, to small-scale underground treatment systems, infiltration facilities, filter strips, low impact design, bioretention, wet ponds, permeable paving, grassed swales, riparian or forested buffers, sand filters, detention basins, and manufactured devices. Structural Stormwater BMPs are permanent appurtenances to the project site.

Capture - Collecting runoff to be stored for reuse or allowed to slowly infiltrate into the ground.

Conservation District - A conservation district, as defined in Section 3 (c) of the Conservation District Law (3 P.S. § 851 (c)), as amended, that has the authority under a delegation agreement executed with the Department to administer and enforce all or a portion of the regulations promulgated under 25 Pa. Code 102.

Design Storm - The magnitude and temporal distribution of precipitation from a storm event measured in probability of occurrence (e.g. a 5-year-storm) and duration (e.g. 24 hours), used in the design and evaluation of stormwater management systems. Also see Return Period.

Detention Volume - The volume of runoff that is captured and released into the waters of this Commonwealth at a controlled rate.

DEP - The Pennsylvania Department of Environmental Protection.

Development Site (Site) - See Project Site.

Disconnected Impervious Area (DIA) - An impervious or impermeable surface which is disconnected from any stormwater drainage or conveyance system and is redirected or directed to a pervious area which allows for infiltration, filtration, and increased time of concentration as specified in Appendix B, Disconnected Impervious Area.

Disturbed Area - An unstabilized land area where an Earth Disturbance Activity is occurring or has occurred.

Earth Disturbance Activity - A construction or other human activity which disturbs the surface of the land, including, but not limited to, clearing and grubbing; grading; excavations; embankments; road maintenance; building construction; the moving, depositing, stockpiling, or storing of soil, rock or earth materials.

Erosion - The natural process by which the surface of the land is worn away by water, wind or chemical action.

Existing Condition - The dominant land cover during the five (5) year period immediately preceding a proposed Regulated Activity.

FEMA - Federal Emergency Management Agency.

Floodplain - Any land area susceptible to inundation by water from any natural source or delineated by applicable FEMA maps and studies as being a special flood hazard area. Also includes areas that comprise Group 13 Soils, as listed in Appendix A of the Pennsylvania DEP Technical Manual for Sewage Enforcement Officers (as amended or replaced from time to time by PADEP).

Floodway - The channel of the watercourse and those portions of the adjoining floodplains that are reasonably required to carry and discharge the 100-year flood. Unless otherwise specified, the boundary of the floodway is as indicated on maps and flood insurance studies provided by FEMA. In an area where no FEMA maps or studies have defined the boundary of the 100-year floodway, it is assumed, absent evidence to the contrary, that the floodway extends from the stream to 50 feet from the top of the bank of the stream.

Forest Management/Timber Operations - Planning and activities necessary for the management of forestland. These include conducting a timber inventory, preparation of forest management plans, silvicultural treatment, cutting budgets, logging road design and construction, timber harvesting, site preparation and reforestation.

Geotextile - A fabric manufactured from synthetic fiber that is used to achieve specific objectives, including infiltration, separation between different types of media (i.e., between soil and stone), 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 and recycling facilities, vehicle fueling stations, fleet storage areas, vehicle equipment and cleaning facilities, and vehicle service and maintenance facilities).

Hydrologic Soil Group (HSG) - Infiltration rates of soils vary widely and are affected by subsurface permeability as well as surface intake rates. Soils are classified into four HSG's (A, B, C, and D) according to their minimum infiltration rate, which is obtained for bare soil after prolonged wetting. The NRCS defines the four groups and provides a list of most of the soils in the United States and their group classification. The soils in the area of the development site may be identified from a soil survey report that can be obtained from local NRCS offices or

conservation district offices. Soils become less pervious as the HSG varies from A to D (NRCS^{3,4}).

Impervious Surface (Impervious Area) - A surface that prevents the infiltration of water into the ground. Impervious surfaces (or areas) shall include, but not be limited to, roofs, additional indoor living spaces, patios, garages, storage sheds and similar structures, and any new streets or sidewalks. Decks, parking areas, and driveway areas are not counted as impervious areas if they do not prevent infiltration.

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

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

Land Development (Development) - Inclusive of any or all of the following meanings: (i) the improvement of one lot or two or more contiguous lots, tracts, or parcels of land for any purpose involving (a) a group of two or more buildings, or (b) the division or allocation of land or space between or among two or more existing or prospective

occupants by means of, or for the purpose of streets, common areas, leaseholds, condominiums, building groups, or other features; (ii) any subdivision of land; (iii) development in accordance with Section 503 (1.1) of the PA Municipalities Planning Code.

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.

Municipality - Borough of Berlin, Somerset County, Pennsylvania.

NRCS - USDA Natural Resources Conservation Service (previously SCS).

Peak Discharge - The maximum rate of stormwater runoff from a specific storm event.

Pervious Surface (Pervious Area) - Any area not defined as impervious.

Project Site - The specific area of land where any Regulated Activities in the Borough of Berlin are planned, conducted or maintained.

Qualified Professional - Any person licensed by the Pennsylvania Department of State or otherwise qualified by law to perform the work required by the Ordinance.

Regulated Activities - Any Earth Disturbances Activities or any activities that involve the alteration or development of land in a manner that may affect stormwater runoff.

Regulated Earth Disturbance Activity - Activity involving Earth Disturbance subject to regulation under 25 Pa. Code Chapter 92, Chapter 102, or the Clean Streams Law.

Retention Volume/Removed Runoff - The volume of runoff that is captured and not released directly into the surface waters of this Commonwealth during or after a storm event.

Return Period - The average interval, in years, within which a storm event of a given magnitude can be expected to occur one time. For example, the 25-year return period rainfall would be expected to occur on average once every 25 years; or stated in another way, the probability of a 25-year storm occurring in any one year is 0.04 (i.e. a 4% chance).

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

Sediment - Soils or other materials transported by surface water as a product of erosion.

Small Project - A small project is defined as a regulated activity that creates disconnected impervious areas equal to or greater than 500 sq. ft. and less than 5,000 sq. ft.

State Water Quality Requirements - The regulatory requirements to protect, maintain, reclaim, and restore water quality under Pennsylvania Code Title 25 and the Clean Streams Law.

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

Stormwater Management Facility - Any structure, natural or man-made, that, due to its condition, design, or construction, conveys, stores, or otherwise affects stormwater runoff. Typical stormwater management facilities include, but are not limited to, detention and retention basins, open channels, storm sewers, pipes, and infiltration facilities.

Stormwater Management Plan - The Stonycreek River Watershed Stormwater Management Plan for managing stormwater runoff adopted by the County of Somerset as required by the Act of October 4, 1978, P.L. 864, (Act 167), as amended, and known as the "Storm Water Management Act".

Stormwater Management Best Management Practices - Is abbreviated as BMPs or SWM BMPs throughout this Ordinance.

Stormwater Management Site Plan - The plan prepared by the Developer or his representative indicating how storm water runoff will be managed at the development site in accordance with this Ordinance. **Stormwater Management Site Plan** will be designated as **SWM Site Plan** throughout this Ordinance.

Subdivision - As defined in The Pennsylvania Municipalities Planning Code, Act of July 31, 1968, P.L. 805, No. 247.

USDA - United States Department of Agriculture.

Void Ratio - The ratio of the volume of void space to the volume of solid substance in any material.

Waters of this Commonwealth - Any and all rivers, streams, creeks, rivulets, impoundments, ditches, watercourses, storm sewers, lakes, dammed water, wetlands, pond, springs and all other bodies or channels of conveyance of surface and underground water, or parts thereof, whether natural or artificial, within or on the boundaries of this Commonwealth.

Watershed - Region or area drained by a river, watercourse or other surface water of the Commonwealth.

Wetland - Areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions, including swamps, marshes, bogs, and similar areas.

ARTICLE III - STORMWATER MANAGEMENT STANDARDS

Section 301. General Requirements

- A. For all Regulated Activities, unless preparation of an SWM Site Plan is specifically exempted in Section 302:
1. Preparation and implementation of an approved SWM Site Plan is required.
 2. No Regulated Activities shall commence until the Municipality issues written approval of an SWM Site Plan, which demonstrates compliance with the requirements of this Ordinance.
- B. SWM Site Plans approved by the Municipality, in accordance with Section 406, shall be on site throughout the duration of the Regulated Activity.
- C. The Municipality may, after consultation with DEP, approve measures for meeting the State Water Quality Requirements other than those in this Ordinance, provided that they meet the minimum requirements of, and do not conflict with, State law including but not limited to the Clean Streams Law.
- D. For all Regulated Earth Disturbance Activities, erosion and sediment control BMPs shall be designed, implemented, operated, and maintained during the Regulated Earth Disturbance Activities (e.g., during construction) to meet the purposes and requirements of this Ordinance and to meet all requirements under the Pennsylvania Code Title 25 and the Clean Streams Law. Various BMPs and their design standards are listed in the *Erosion and Sediment Pollution Control Program Manual (E&S Manual)*⁵, Commonwealth of Pennsylvania, Department of Environmental Protection, No. 363-2134-008 (2000), as amended and updated.
- E. For all Regulated Activities, implementation of the Volume Controls in Section 303 is required with the exception of regulated activities that meet the exemption criteria found in Section 302.A of this Ordinance.
- F. Impervious Areas:
1. The measurement of impervious areas shall include all of the impervious areas in the total proposed development even if development is to take place in stages.
 2. For development taking place in stages, the entire development plan must be used in determining conformance with this Ordinance.
 3. For projects that add impervious area to a parcel, the total impervious area on the parcel is subject to the requirements of this Ordinance.
- G. Stormwater flows onto adjacent property shall not be created, increased, decreased, relocated, or otherwise altered without written permission of the adjacent property owner(s). Such stormwater flows shall be subject to the requirements of this Ordinance.
- H. All regulated activities shall include such measures as necessary to:
1. Protect health, safety, and property;
 2. Meet State Water Quality Requirements as defined in Article II;
 3. Meet the water quality goals of this Ordinance by implementing measures to:

- a. Minimize disturbance to floodplains, wetlands, natural slopes over 8%, and existing native vegetation.
 - b. Preserve and maintain trees and woodlands. Maintain or extend riparian buffers and protect existing forested buffer. Provide trees and woodlands adjacent to impervious areas whenever feasible.
 - c. Establish and maintain non-erosive flow conditions in natural flow pathways.
 - d. Minimize soil disturbance and soil compaction. Over disturbed areas, replace topsoil to a minimum depth equal to the original depth or 4 inches, whichever is greater. Use tracked equipment for grading when feasible.
 - e. Disconnect impervious surfaces by directing runoff to pervious areas, wherever possible.
4. To the maximum extent practicable, incorporate the techniques for Low Impact Development Practices described in "The Pennsylvania Stormwater Best Management Practices manual" (SWM Manual)⁶.
- I. The design of all facilities over Karst shall include an evaluation of measures to minimize adverse effects.
 - J. Infiltration BMPs should be spread out, made as shallow as practicable, and located to maximize use of natural on-site infiltration features while still meeting the other requirements of this Ordinance.
 - K. Storage facilities should completely drain both the volume control and rate control capacities over a period of time not less than 24 and not more than 72 hours from the end of the design storm.
 - L. For all Regulated Activities, SWM BMPs shall be designed, implemented, operated, and maintained to meet the purposes and requirements of this Ordinance and to meet all requirements under Pennsylvania Code Title 25, the Clean Streams Law, and the Storm Water Management Act.
 - M. The design storm volumes to be used in the analysis of peak rates of discharge should be obtained from the Precipitation-Frequency Atlas of the United States, Atlas 14, Volume 2, U.S. Department of Commerce, National Oceanic and Atmospheric Administration (NOAA), National Weather Service, Hydrometeorological Design Studies Center, Silver Spring, Maryland, 20910. NOAA's Atlas 14⁷ can be accessed at Internet address: <http://hdsc.nws.noaa.gov/hdsc/pfds/>.
 - N. Various BMPs and their design standards are listed in the SWM Manual.¹
 - O. The applicant may meet the Rate Controls criteria in Section 304 through off-site stormwater management measures as long as the proposed measures are in the same subwatershed as shown in Ordinance Appendix D. Off-site stormwater control measures may only be sought if it is shown that on-site stormwater control measures cannot be physically accomplished. This does not relieve the applicant from meeting the Volume Controls criteria in Section 303 on-site.

Section 302. Exemptions

- A. Regulated Activities that create Disconnected Impervious Area smaller than 500 sq. ft. are exempt from the requirements of Section 303, Section 304 and Article IV of this Ordinance.
- B. Regulated Activities that create impervious areas equal to or greater than 500 sq. ft. and less than 5,000 sq. ft. are exempt from the Peak Rate Control and the SWM Site Plan preparation requirement of this Ordinance, but should comply with the small project requirements found in Appendix C of the Ordinance.
- C. Regulated Activities that create impervious areas equal to or greater than 5,000 sq. ft. and less than 10,000 sq. ft. are exempt only from the peak rate control requirement of this Ordinance.
- D. Agricultural activity is exempt from the rate control and SWM Site Plan preparation requirements of this Ordinance provided the activities are performed according to the requirements of 25 Pa. Code Chapter 102.
- E. Forest management and timber operations are exempt from the rate control and SWM Site Plan preparation requirements of this Ordinance provided the activities are performed according to the requirements of 25 Pa. Code Chapter 102.

Additional Exemption Criteria

1. Exemption Responsibilities - An exemption shall not relieve the Applicant from implementing such measures as are necessary to protect public health, safety, and property.
2. HQ and EV Streams - An exemption shall not relieve the Applicant from meeting the special requirements for watersheds draining to identified high quality (HQ) or exception value (EV) waters and Source Water Protection Areas (SWPA) and requirements for non-structural project design sequencing.
3. Drainage Problems - If a drainage problem is documented or known to exist downstream of or is expected from the proposed activity, then the Municipality may require the Applicant to comply with the Ordinance.
4. Even though the developer is exempt, he is not relieved from complying with other regulations.

Exemptions from any provisions of this Ordinance shall not relieve the Applicant from the requirements in Sections 301.D. through L.

Section 303. Volume Controls

The low impact development practices provided in the SWM Manual¹ shall be utilized for all Regulated Activities to the maximum extent practicable.

Water volume controls shall be implemented using the *Design Storm Method* in Subsection 1 or the *Simplified Method* in Subsection 2 below. For Regulated Activities that create 10,000 square feet or less of impervious cover that do not require hydrologic routing to design the stormwater facilities, this Ordinance establishes no preference for either methodology; therefore, the Applicant may select either methodology on the basis of economic considerations, the intrinsic limitations on applicability of the analytical procedures associated with each methodology, and other factors.

1. *The Design Storm Method* (CG-1 in the SWM Manual¹) is applicable to any size of Regulated Activity. This method requires detailed modeling based on site conditions.
 - a. Do not increase the post-development total runoff volume for all storms equal to or less than the 2-year, 24-hour duration precipitation.
 - b. For modeling purposes:
 - i. Existing (pre-development) non-forested pervious areas must be considered meadow or its equivalent.
 - ii. Twenty (20) percent of existing impervious area, when present, shall be considered meadow in the model for existing conditions.
2. *The Simplified Method* (CG-2 in the SWM Manual¹) provided below is independent of site conditions and should be used if the Design Storm Method is not followed. This method is not applicable to Regulated Activities greater than 10,000 square feet or for projects that require design of stormwater storage facilities. For new impervious surfaces:
 - a. Stormwater facilities shall capture at least the first two inches (2") of runoff from all new impervious surfaces.
 - b. At least the first one inch (1.0") of runoff from new impervious surfaces shall be permanently removed from the runoff flow (i.e., it shall not be released into the surface waters of this Commonwealth). Removal options include reuse, evaporation, transpiration, and infiltration.
 - c. Wherever possible, infiltration facilities should be designed to accommodate infiltration of the entire permanently removed runoff; however, in all cases at least the first one-half inch (0.5") of the permanently removed runoff should be infiltrated.
 - d. This method is exempt from the requirements of Section 304, Rate Controls.

Section 304. Rate Controls

- A. Areas not covered by a Release Rate Map from an approved Act 167 Stormwater Management Plan:

Post-development discharge rates shall not exceed the pre-development discharge rates for the 1-, 2-, 5-, 10-, 25-, 50-, and 100-year storms. If it is shown that the peak rates of discharge indicated by the post-development analysis are less than or equal to the peak rates of discharge indicated by the pre-development analysis for 1-, 2-, 5-, 10-, 25-, 50-, and 100-year, 24-hour storms, then the requirements of this section have been met. Otherwise, the Applicant shall provide additional controls as necessary to satisfy the peak rate of discharge requirement.

B. Areas covered by a Release Rate Map from an approved Act 167 Stormwater Management Plan:

For the 1-, 2-, 5-, 10-, 25-, 50-, and 100-year storms, the post-development peak discharge rates will follow the applicable approved management district or release rate map. The approved management district map for the Stonycreek River watershed is found in Appendix D. The stormwater management district criteria for the Stonycreek River watershed is found in Table 1. For any areas now shown on the release rate maps or management district maps, the post-development discharge rates shall not exceed the pre-development discharge rates.

**TABLE 1
Stormwater Management Districts in the Stonycreek River Watershed**

District	Proposed Condition Design Storm	(reduce to)	Existing Condition Design Storm
A	2-year		1-year
	5-year		5-year
	10-year		10-year
	25-year		25-year
	50-year		50-year
	100-year		100-year
B-1	5-year		2-year
	10-year		5-year
	25-year		10-year
	50-year		25-year
	100-year		100-year
B-2	2-year		2-year
	25-year		10-year
	50-year		25-year
	100-year		100-year

ARTICLE IV - STORMWATER MANAGEMENT (SWM) SITE PLAN REQUIREMENTS

Section 401. Plan Requirements

The following items shall be included in the SWM Site Plan:

- A. Appropriate sections from the Municipal Subdivision and Land Development Ordinance, and other applicable local ordinances, shall be followed in preparing the SWM Site Plans. In instances

where the Municipality lacks Subdivision and Land Development regulations, the content of SWM Site Plans shall follow the County's Subdivision and Land Development Ordinance.

- B. The Municipality shall not approve any SWM Site Plan that is deficient in meeting the requirements of this Ordinance. At its sole discretion and in accordance with this Article, when a SWM Site Plan is found to be deficient, the Municipality may either disapprove the submission and require a re-submission, or in the case of minor deficiencies the Municipality may accept submission of modifications.

- C. Provisions for permanent access or maintenance easements for all physical SWM BMPs, such as ponds and infiltration structures, as necessary to implement the operation and maintenance plan discussed in item E.9 below.

- D. The following signature block for the Municipality:

“(Municipal Official or designee), on this date (date of signature), has reviewed and hereby

certifies that the SWM Site Plan meets all design standards and criteria of the Municipal Ordinance No. (Number assigned to the Ordinance).”

- E. The SWM Site Plan shall provide the following information:
1. The overall stormwater management concept for the project.
 2. A determination of Site Conditions in accordance with the SWM Manual¹. A detailed site evaluation shall be completed for projects proposed in areas of carbonate geology or karst topography, and other environmentally sensitive areas such as brownfields.
 3. Stormwater runoff design computations, and documentation as specified in this Ordinance, or as otherwise necessary to demonstrate that the maximum practicable measures have been taken to meet the requirements of this Ordinance, including the recommendations and general requirements in Section 301.
 4. Expected project time schedule.
 5. A soil erosion and sediment control plan, where applicable, as prepared for and submitted to the approval authority.
 6. The effect of the project (in terms of runoff volumes, water quality, and peak flows) on surrounding properties and aquatic features and on any existing stormwater conveyance system that may be affected by the project.
 7. Plan and profile drawings of all SWM BMPs including drainage structures, pipes, open channels, and swales.
 8. SWM Site Plan shall show the locations of existing and proposed on-lot wastewater facilities and water supply wells.
 9. The SWM Site Plan shall include an operation and maintenance (O&M) plan for all existing and proposed physical stormwater management facilities. This plan shall address long-term ownership and responsibilities for operation and maintenance as well as schedules and costs for O&M activities.

Section 402. Plan Submission

- A. Five (5) copies of the SWM Site Plan shall be submitted as follows:
1. Two (2) copies to the Municipality.
 2. One (1) copy to the Municipal Engineer (when applicable).
 3. One (1) copy to the County Conservation District (optional).
 4. One (1) copy to the County Planning Commission/Office.
- B. Additional copies shall be submitted as requested by the Municipality or DEP.

Section 403. Plan Review

- A. The SWM Site Plan shall be reviewed by a Qualified Professional for the Municipality for consistency with the provisions of this Ordinance. Review by the County Conservation District is optional. After review, the Qualified Professional shall provide a written recommendation for the municipality to approve or disapprove the SWM Site Plan. If it is recommended to disapprove the SWM Site Plan, the Qualified Professional shall state the reasons for the disapproval in writing. The Qualified Professional also may recommend approval of the SWM Site Plan with conditions and, if so, shall provide the acceptable conditions for approval in writing. The SWM Site Plan review and recommendations shall be completed within the time allowed by the Municipalities Planning Code for reviewing subdivision plans.
- B. The Municipality shall notify the Applicant in writing within 45 calendar days whether the SWM Site Plan is approved or disapproved. If the SWM Plan involves a Subdivision and Land Development Plan, the notification period is 90 days. If a longer notification period is provided by other statute, regulation, or ordinance, the Applicant will be so notified by the Municipality. If the Municipality disapproves the SWM Plan, the Municipality shall cite the reasons for disapproval in writing.

Section 404. Modification of Plans

A modification to a submitted SWM Site Plan that involves a change in SWM BMPs or techniques, or that involves the relocation or redesign of SWM BMPs, or that is necessary because soil or other conditions are not as stated on the SWM Site Plan as determined by the Municipality, shall require a resubmission of the modified SWM Site Plan in accordance with this Article.

Section 405. Resubmission of Disapproved Storm Water Management Site Plans

A disapproved SWM Site Plan may be resubmitted, with the revisions addressing the Municipality's concerns, to the Municipality in accordance with this Article. The applicable review fee must accompany a resubmission of a disapproved SWM Site Plan.

Section 406. Authorization to Construct and Term of Validity

The Municipality's approval of an SWM Site Plan authorizes the Regulated Activities contained in the SWM Site Plan for a maximum term of validity of five years following the date of approval. The Municipality may specify a term of validity shorter than five years in the approval for any specific SWM Site Plan. Terms of validity shall commence on the date the Municipality signs the approval for an SWM Site Plan. If an approved SWM Site Plan is not completed according to Section 407 within the term of validity, then the Municipality may consider the SWM Site Plan disapproved and may revoke any and all permits. SWM Site Plans that are considered disapproved by the Municipality shall be resubmitted in accordance with Section 405 of this Ordinance.

Section 407. As-Built Plans, Completion Certificate and Final Inspection

- A. The Developer shall be responsible for providing as-built plans of all SWM BMPs included in the approved SWM Site Plan. The as-built plans and an explanation of any discrepancies with the construction plans shall be submitted to the Municipality.
- B. The as-built submission shall include a certification of completion signed by a Qualified Professional verifying that all permanent SWM BMPs have been constructed according to the approved plans and specifications. If any licensed Qualified Professionals contributed to the construction plans, then a licensed Qualified Professional must sign the completion certificate.
- B. After receipt of the completion certification by the Municipality, the Municipality may conduct a final inspection.

ARTICLE V - OPERATION AND MAINTENANCE**Section 501. Responsibilities of Developers and Landowners**

- A. The Municipality shall make the final determination on the continuing maintenance responsibilities prior to final approval of the SWM Site Plan. The Municipality may require a dedication of such facilities as part of the requirements for approval of the SWM Site Plan. Such a requirement is not an indication that the Municipality will accept the facilities. The Municipality reserves the right to accept or reject the ownership and operating responsibility for any portion of the stormwater management controls.
- B. Facilities, areas, or structures used as Stormwater Management BMPs shall be enumerated as permanent real estate appurtenances and recorded as deed restrictions or conservation easements that run with the land.
- C. The Operation and Maintenance Plan shall be recorded as a restrictive deed covenant that runs with the land.
- D. The Municipality may take enforcement actions against an owner for any failure to satisfy the provisions of this Article.

Section 502. Operation and Maintenance Agreements

The owner is responsible for Operation and Maintenance of the SWM BMPs. If the owner fails to adhere to the Operation and Maintenance Agreement, the Municipality may perform the services required and charge the owner appropriate fees. Non-payment of fees may result in a lien against the property.

Section 503. Stormwater Management Easements

- A. Stormwater management easements are required for all areas used for off-site stormwater control,

unless a waiver is granted by the Municipality.

- B. Stormwater management easements shall be provided by the Applicant or property owner if necessary for access for inspections and maintenance or the preservation of stormwater runoff conveyance, infiltration, and detention areas and other stormwater controls and BMPs by person other than the property owner. The purpose of the easement shall be specified in any agreement under Section 502.

ARTICLE VI - FEES AND EXPENSES

Section 601. General

The Municipality may include all costs incurred in the review fee charged to an Applicant.

The review fee may include but not be limited to costs for the following:

- A. Administrative/clerical processing.
- B. Review of the SWM Site Plan.
- C. Attendance at meetings.
- D. Inspections.

ARTICLE VII - PROHIBITIONS

Section 701. Prohibited Discharges and Connections

- A. Any drain or conveyance, whether on the surface or subsurface, which allows any non-stormwater discharge including sewage, process wastewater, and wash water to enter the waters of this Commonwealth is prohibited.
- B. No person shall allow, or cause to allow, discharges into surface waters of this Commonwealth which are not composed entirely of stormwater, except (1) as provided in subsection C below, and (2) discharges allowed under a state or federal permit.
- C. The following discharges are authorized unless they are determined to be significant contributors to pollution to the waters of this Commonwealth:

- Discharges from fire fighting activities	- Flows from riparian habitats and wetlands
- Potable water sources including water line flushing	- Uncontaminated water from foundations or from footing drains
- Irrigation drainage	- Lawn watering
- Air conditioning condensate	- Dechlorinated swimming pool discharges
- Springs	- Uncontaminated groundwater
- Water from crawl space pumps	- Water from individual residential car washing
- Pavement wash waters where spills or leaks of toxic or hazardous materials have not occurred (unless all spill material has been removed) and where detergents are not used	- Routine external building wash down (which does not use detergents or other compounds)

- D. In the event that the Municipality or DEP determines that any of the discharges identified in Subsection C, significantly contribute to pollution of the waters of this Commonwealth, the Municipality or DEP will notify the responsible person(s) to cease the discharge.

Section 702. Roof Drains

Roof drains and sump pumps shall discharge to infiltration or vegetative BMPs and to the maximum extent practicable satisfy the criteria for Disconnected Impervious Areas.

Section 703. Alteration of SWM BMPs

No person shall modify, remove, fill, landscape, or alter any SWM BMPs, facilities, areas, or structures, without the written approval of the Municipality.

ARTICLE VIII - ENFORCEMENT AND PENALTIES**Section 801. Right-of-Entry**

Upon presentation of property credentials, the Municipality may enter at reasonable times upon any property within the Municipality to inspect the condition of the stormwater structures and facilities in regard to any aspect regulated by this Ordinance.

Section 802. Inspection

SWM BMPs should be inspected by the landowner, or the owner's designee (including the Municipality for dedicated and owned facilities) according to the following list of minimum frequencies:

1. Annually for the first 5 years.
2. Once every 3 years thereafter.
3. During or immediately after the cessation of a 10-year or greater storm.

Section 803. Enforcement

- A. It shall be unlawful for a person to undertake any Regulated Activity except as provided in an approved SWM Site Plan, unless specifically exempted in Section 302.
- B. It shall be unlawful to violate Section 703 of this Ordinance.
- C. Inspections regarding compliance with the SWM Site Plan are a responsibility of the Municipality

Section 804. Suspension and Revocation

- A. Any approval or permit issued by the Municipality may be suspended or revoked for:
 1. Non-compliance with or failure to implement any provision of the approved SWM Site Plan or Operation and Maintenance Agreement.
 2. A violation of any provision of this Ordinance or any other applicable law, Ordinance, rule or regulation relating to the Regulated Activity.
 3. The creation of any condition or the commission of any act during the Regulated Activity which constitutes or creates a hazard or nuisance, pollution, or which endangers the life or property of others.
- B. A suspended approval may be reinstated by the Municipality when:
 1. The Municipality has inspected and approved the corrections to the violations that caused the suspension.
 2. The Municipality is satisfied that the violation has been corrected.
- C. An approval that has been revoked by the Municipality cannot be reinstated. The Applicant may apply for a new approval under the provisions of this Ordinance.
- D. If a violation causes no immediate danger to life, public health, or property, at its sole discretion, the Municipality may provide a limited time period for the owner to correct the violation. In these cases, the Municipality will provide the owner, or the owner's designee, with a written notice of the violation and the time period allowed for the owner to correct the violation. If the owner does not correct the violation within the allowed time period, the Municipality may revoke or suspend any, or all, applicable approvals and permits pertaining to any provision of this Ordinance.

Section 805. Penalties

- A. Anyone violating the provisions of this Ordinance shall be guilty of a summary offense, and upon

conviction shall be subject to a fine of not more than \$1,000.00 for each violation, recoverable with costs. Each day that the violation continues shall be a separate offense and penalties shall be cumulative.

- B. In addition, the Municipality, may institute injunctive, mandamus or any other appropriate action or proceeding at law or in equity for the enforcement of this Ordinance. Any court of competent jurisdiction shall have the right to issue restraining orders, temporary or permanent injunctions, mandamus or other appropriate forms of remedy or relief.

Section 806. Appeals

- A. Any person aggrieved by an action of the Municipality or its designee, relevant to the provisions of this Ordinance, may appeal to the Municipality within thirty (30) days of that action.
- B. Any person aggrieved by any decision of the Municipality, relevant to the provisions of this Ordinance, may appeal to the County Court of Common Pleas in the county where the activity has taken place within thirty (30) days of the Municipality's decision.

ARTICLE IX - REFERENCES

1. Pennsylvania Department of Environmental Protection (DEP). No. 363-0300-002 (2006), as amended and updated. *Pennsylvania Stormwater Best Management Practices Manual*. Harrisburg, PA.
2. The Pennsylvania Department of Environmental Protection (DEP), 363-2134-008 (2000), as amended and updated. *Erosion and Sediment Pollution Control Program Manual*. Harrisburg, PA.
3. United States Department of Agriculture (USDA), National Resources Conservation Service (NRCS). *National Engineering Handbook*. Part 630: Hydrology, 1969-2001. Originally published as the *National Engineering Handbook*, Section 4: Hydrology. Available online at: <http://www.wcc.nrcs.usda.gov/hydro/hydro-techref-neh-630.html>.
4. United States Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS). 1986. *Technical Release 55: Urban Hydrology for Small Watersheds*, 2nd Edition. Washington, D.C.
5. US Department of Commerce (USDC), National Oceanic and Atmospheric Administration (NOAA), National Weather Service (NWS), Hydrometeorological Design Studies Center. 2004-2006. *Precipitation-Frequency Atlas of the United States, Atlas 14, Volume 2*, Silver Spring, Maryland, 20910. Internet address: <http://hdsc.nws.noaa.gov/hdsc/pfds/>.

**Stonycreek River Watershed Stormwater
Management Ordinance**

Ordinance No. 332

ENACTED and **ORDAINED** at a regular meeting of the

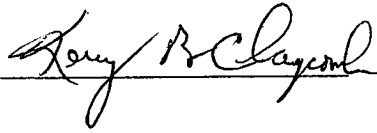
Berlin Borough Council

on this 7th day of April , 2011.

This Ordinance shall take effect immediately.

John F. Long  President of Council

ATTEST:

Kerry B. Claycomb 
Secretary

APPROVED, this 7th day of April, 2011.

Lester Coslic 
Mayor, Borough of Berlin

APPENDIX A

**OPERATION AND MAINTENANCE AGREEMENT
STORMWATER MANAGEMENT BEST MANAGEMENT PRACTICES
(SWM BMPs)**

THIS AGREEMENT, made and entered into this _____ day of _____, 20____, by and between _____, (hereinafter the "Landowner"), and _____, _____ County, Pennsylvania, (hereinafter "Municipality");

WITNESSETH

WHEREAS, the Landowner is the owner of certain real property as recorded by deed in the land records of _____ County, Pennsylvania, Deed Book _____ at Page _____, (hereinafter "Property").

WHEREAS, the Landowner is proceeding to build and develop the Property; and

WHEREAS, the SWM BMP Operation and Maintenance Plan approved by the Municipality (hereinafter referred to as the "Plan") for the property identified herein, which is attached hereto as Appendix A and made part hereof, as approved by the Municipality, provides for management of stormwater within the confines of the Property through the use of BMPs; and

WHEREAS, the Municipality, and the Landowner, his successors and assigns, agree that the health, safety, and welfare of the residents of the Municipality and the protection and maintenance of water quality require that on-site SWM BMPs be constructed and maintained on the Property; and

WHEREAS, the Municipality requires, through the implementation of the SWM Site Plan, that SWM BMPs as required by said Plan and the Municipal Stormwater Management Ordinance be constructed and adequately operated and maintained by the Landowner, successors and assigns.

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

1. The Landowner shall construct the BMPs in accordance with the plans and specifications identified in the SWM Site Plan.
2. The Landowner shall operate and maintain the BMPs as shown on the Plan in good working order in accordance with the specific maintenance requirements noted on the approved SWM Site Plan.
3. The Landowner hereby grants permission to the Municipality, its authorized agents and employees, to enter upon the property, at reasonable times and upon presentation of proper

credentials, to inspect the BMPs whenever necessary. Whenever possible, the Municipality shall notify the Landowner prior to entering the property.

4. In the event the Landowner fails to operate and maintain the BMPs per paragraph 2, the Municipality or its representatives may enter upon the Property and take whatever action is deemed necessary to maintain said BMP(s). It is expressly understood and agreed that the Municipality is under no obligation to maintain or repair said facilities, and in no event shall this Agreement be construed to impose any such obligation on the Municipality.
5. In the event the Municipality, pursuant to this Agreement, performs work of any nature, or expends any funds in performance of said work for labor, use of equipment, supplies, materials, and the like, the Landowner shall reimburse the Municipality for all expenses (direct and indirect) incurred within 10 days of receipt of invoice from the Municipality.
6. The intent and purpose of this Agreement is to ensure the proper maintenance of the onsite BMPs by the Landowner; provided, however, that this Agreement shall not be deemed to create or affect any additional liability of any party for damage alleged to result from or be caused by stormwater runoff.
7. The Landowner, its executors, administrators, assigns, and other successors in interests, shall release the Municipality from all damages, accidents, casualties, occurrences or claims which might arise or be asserted against said employees and representatives from the construction, presence, existence, or maintenance of the BMP(s) by the Landowner or Municipality.
8. The Municipality shall inspect the BMPs at a minimum of once every three years to ensure their continued functioning.

This Agreement shall be recorded at the Office of the Recorder of Deeds of _____ County, Pennsylvania, and shall constitute a covenant running with the Property and/or equitable servitude, and shall be binding on the Landowner, his administrators, executors, assigns, heirs and any other successors in interests, in perpetuity.

ATTEST:

WITNESS the following signatures and seals:

(SEAL)

For the Municipality:

For the Landowner:

ATTEST:

_____ (City, Borough, Township)

County of _____, Pennsylvania

I, _____, a Notary Public in and for the County and State aforesaid, whose commission expires on the _____ day of _____, 20____, do hereby certify that _____ whose name(s) is/are signed to the foregoing Agreement bearing date of the _____ day of _____, 20____, has acknowledged the same before me in my said County and State.

GIVEN UNDER MY HAND THIS _____ day of _____, 20_____.

NOTARY PUBLIC

(SEAL)

APPENDIX B

DISCONNECTED IMPERVIOUS AREA (DIA)

B.1. Rooftop Disconnection

When rooftop downspouts are directed to a pervious area that allows for infiltration, filtration, and increased time of concentration, the rooftop may qualify as completely or partially Disconnected Impervious Area (DIA) and a portion of the impervious rooftop area may be excluded from the calculation of total impervious area.

A rooftop is considered to be completely or partially disconnected if it meets the requirements listed below:

- The contributing area of rooftop to each disconnected discharge is 500 square feet or less, and
- The soil, in proximity of the roof water discharge area, is not designated as hydrologic soil group "D" or equivalent, and
- The overland flow path from roof water discharge area has a positive slope of 5% or less.

For designs that meet these requirements, the portion of the roof that may be considered disconnected depends on the length of the overland path as designated in Table B.1.

Table B.1: Partial Rooftop Disconnection	
Length of Pervious Flow Path *	Roof Area Treated as Disconnected
(ft)	(% of contributing area)
0 – 14	0
15 – 29	20
30 – 44	40
45 – 59	60
60 – 74	80
75 or more	100

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

B.2. Pavement Disconnection

When pavement runoff is directed to a pervious area that allows for infiltration, filtration, and increased time of concentration, the contributing pavement area may qualify as a DIA that may be excluded from the calculation of total impervious area. This applies generally only to small or narrow pavement structures such as driveways and narrow pathways through otherwise pervious areas (e.g., a walkway or bike path through a park).

Pavement is disconnected if the pavement, or area adjacent to the pavement, meets the requirements below:

- The contributing flow path over impervious area is not more than 75 feet, and
- The length of overland flow is greater than or equal to the contributing length, and
- The soil is not designated as hydrologic soil group "D" or equivalent, and
- The slope of the contributing impervious area is 5% or less, and
- The slope of the overland flow path is 5% or less.

If the discharge is concentrated at one or more discrete points, no more than 1,000 square feet may discharge to any one point. In addition, a gravel strip or other spreading device is required for concentrated discharges. For non-concentrated discharges along the edge of the pavement, this requirement is waived; however, there must be a provision for the establishment of vegetation along the pavement edge and temporary stabilization of the area until vegetation becomes stabilized.

REFERENCE

Philadelphia Water Department. 2006. *Stormwater Management Guidance Manual*. Section 4.2.2: *Integrated Site Design*. Philadelphia, PA.

APPENDIX C**Optional Stormwater Management
for Small Projects**

Applicability: Stormwater management procedures for projects with between five hundred (500) square feet and (4,999) square feet of proposed impervious area. All of the proposed impervious area that is created by a regulated activity must be disconnected impervious area, otherwise the Applicant cannot use this document to meet stormwater management requirements, and is therefore responsible for meeting all stormwater management requirements of the Ordinance. Disconnected impervious area and regulated activities are defined in Section C.2 of this document.

Note: This small projects document is not to be used to plan for multiple lots without obtaining prior written approval from the Municipality. Approvals and actions associated with this document do not relieve the Applicant of the responsibility to secure required permits or approvals for activities regulated by any other code, law or ordinance.

STORMWATER MANAGEMENT PROCEDURES FOR SMALL PROJECTS

Introduction

This handbook has been developed to allow homeowners to comply with stormwater management criteria for new projects to meet the requirements of the Act 167 Stormwater Management Ordinance of the Municipality including sizing, designing, locating, and installing on-lot measures, referred to herein as "Best Management Practices" (BMPs). Pennsylvania Act 167 was authorized on October 4, 1978 (32 P.S., P.L. 864) and gave Pennsylvania municipalities the power to regulate activities that affect stormwater runoff and surface and groundwater quantity and quality.

Individual home construction projects on single-family lots which result in between 500 square feet and 4,999 square feet of proposed impervious area (including the building footprint, driveway, sidewalks, and parking areas) are not required to submit formal stormwater management (SWM) site plans to the Municipality or County; however, they are still required to address water quality and infiltration goals as outlined in this small projects document. If the guidelines presented in this brochure are followed, the individual homeowner will not require professional services to comply with these water quality and infiltration goals.

Section C.1 describes requirements and outlines the method for designing a suitable BMP, and a description of what needs to be included on the simple sketch plan. Section C.2 presents definitions of key terms. Section C.3 presents options of BMPs that can be considered for on-lot stormwater management. An example of how to obtain the size and dimensions of a BMP is explained in Section C.4.

The stormwater management method for small projects requires:

- The first 1" of rainfall runoff from proposed impervious surfaces to be captured (see definition of captured in Section C.2).

The purpose of this small projects document 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 sent to the Municipality?

Even though a formal SWM site plan is not required for individual lot owners, the small projects worksheet found in Table C-4 and a simple sketch plan containing the features described in Step 4 of Section C.1 needs to be submitted to the Municipality, and if applicable, the contractor prior to construction.

C.1 Determination of Simplified Approach Volume Requirements

All proposed impervious areas must be included in the determination of the amount of new impervious areas and the size of proposed BMPs needed to control stormwater. Proposed impervious areas on an individual residential lot include: roof area, pavement, sidewalks, driveways, patios, porches, permanent pools, or parking areas. Sidewalks, driveways, or patios that are constructed with gravel or pervious pavers that will not be converted to an impervious surface in the future need not be included in this calculation. Therefore, the amount of proposed impervious area can be reduced for proposed driveways, 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; no runoff can be directed to storm sewers, inlets, or other impervious areas (i.e., street).

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 impervious cover, disconnecting gutters and directing runoff to vegetated areas to infiltrate, and redirecting the flow of runoff from impervious driveways to vegetated areas instead of to the street or gutter.

The amount of impervious area that needs to be controlled may be reduced by disconnecting impervious areas as discussed below as a BMP and as found in Ordinance Appendix B.

Below are the steps that must be undertaken to meet the Ordinance requirements. The results obtained for each step must be included in the Small Projects Worksheet found in Table C-4:

STEP 1 – Determine the total area of all proposed impervious surfaces that will need to drain to one or more BMPs. Determine locations where BMPs need to be placed so that runoff from all of the proposed impervious surfaces can be captured. Select the BMPs to be used and determine the requirements of each from Section C.3. For instance, the back half of a garage may drain 200 square feet of roof to a rain barrel, and the front half of a garage may drain 200 square feet of roof and 540 square feet of driveway to an infiltration trench. Then, obtain the required storage volume and surface area needed for each of the proposed BMPs from the appropriate heading below.

For Rain Barrels/Cisterns

STEP 2 – Select the proposed impervious area value in Column 1 of Table C-1 that is closest to, but not less than, the determined value.

STEP 3 – 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 C-1.

Table C-1: Calculating Rain Barrel/Cistern Storage Volume for 1" Rainfall¹

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>I</i>	$V_{RB} = \frac{I \times 0.0123 \text{ ft}^3}{12 \text{ in}} = \frac{I \times 0.001025 \text{ ft}^3}{12 \text{ in}}$	$V_{RB} \times 7.48 = V_{RB} \times 7.48$
50	6	42
100	11	83
200	22	166
300	33	249
400	44	332
500	56	416
600	67	499
700	78	582
800	89	665
900	100	748
1,000	111	831
1,100	122	914
1,200	133	997
1,300	144	1,081
1,400	156	1,164
1,500	167	1,247
1,600	178	1,330
1,700	189	1,413
1,800	200	1,496
1,900	211	1,579
2,000	222	1,662
2,100	233	1,745
2,200	244	1,829
2,300	256	1,912
2,400	267	1,995
2,500	278	2,078
2,600	289	2,161
2,700	300	2,244
2,800	311	2,327
2,900	322	2,410
3,000	333	2,494
3,100	344	2,577
3,200	356	2,660
3,300	367	2,743
3,400	378	2,826
3,500	389	2,909
3,600	400	2,992
3,700	411	3,075
3,800	422	3,158
3,900	433	3,242
4,000	444	3,325
4,100	456	3,408
4,200	467	3,491
4,300	478	3,574
4,400	489	3,657
4,500	500	3,740
4,600	511	3,823
4,700	522	3,906
4,800	533	3,990
4,900	544	4,073
4,999	556	4,155

¹The typical volume of a rain barrel is between 50-200 gallons, so more than 1 rain barrel may be needed. Larger volumes may require a cistern.

²Assume that the rain barrel/cistern is 25% full

For Rain Gardens/Bioretenention or Dry Well #1:

STEP 2 – Select the proposed impervious area value in Column 1 of Table C-2 that is closest to, but not less than, the determined value.

STEP 3 – Using the value from Column 1 determined in Step 2, select the depth (D) of the proposed BMP, and then simply determine the surface area needed for that depth from Column 2 of Table C-2.

Note: The arrows under Column 2 in Table C-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 value in Column 1 that 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.

Table C-2: Calculating Rain Garden/Bioretenion and Dry Well #1 Storage Volume and Surface Area for 1" Rainfall

Column 1	Column 2							
Proposed Impervious Area (square feet)	Surface Area of Rain Garden/Bioretenion 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	A(sf)							
Sum of all Proposed Impervious Areas	A = Volume/D, where Volume = (I)(2.31)							
100	17	8	6	4	3	3	2	2
200	33	17	11	8	7	6	5	4
300	50	25	17	13	10	8	7	6
400	67	33	22	17	13	11	10	8
500	83	42	28	21	17	14	12	10
600	100	50	33	25	20	17	14	13
700	117	58	39	29	23	19	17	15
800	133	67	44	33	27	22	19	17
900	150	75	50	38	30	25	21	19
1,000	167	83	56	42	33	28	24	21
1,100	183	92	61	46	37	31	26	23
1,200	200	100	67	50	40	33	29	25
1,300	217	108	72	54	43	36	31	27
1,400	233	117	78	58	47	39	33	29
1,500	250	125	83	63	50	42	36	31
1,600	267	133	89	67	53	44	38	33
1,700	283	142	94	71	57	47	40	35
1,800	300	150	100	75	60	50	43	38
1,900	317	158	106	79	63	53	45	40
2,000	333	167	111	83	67	56	48	42
2,100	350	175	117	88	70	58	50	44
2,200	367	183	122	92	73	61	52	46
2,300	383	192	128	96	77	64	55	48
2,400	400	200	133	100	80	67	57	50
2,500	417	208	139	104	83	69	60	52
2,600	433	217	144	108	87	72	62	54
2,700	450	225	150	113	90	75	64	56
2,800	467	233	156	117	93	78	67	58
2,900	483	242	161	121	97	81	69	60
3,000	500	250	167	125	100	83	71	63
3,100	517	258	172	129	103	86	74	65
3,200	533	267	178	133	107	89	76	67
3,300	550	275	183	138	110	92	79	69
3,400	567	283	189	142	113	94	81	71
3,500	583	292	194	146	117	97	83	73
3,600	600	300	200	150	120	100	86	75
3,700	617	308	206	154	123	103	88	77
3,800	633	317	211	158	127	106	90	79
3,900	650	325	217	163	130	108	93	81
4,000	667	333	222	167	133	111	95	83
4,100	683	342	228	171	137	114	98	85
4,200	700	350	233	175	140	117	100	88
4,300	717	358	239	179	143	119	102	90
4,400	733	367	244	183	147	122	105	92
4,500	750	375	250	188	150	125	107	94
4,600	767	383	256	192	153	128	110	96
4,700	783	392	261	196	157	131	112	98
4,800	800	400	267	200	160	133	114	100
4,900	817	408	272	204	163	136	117	102
4,999	833	417	278	208	167	139	119	104

¹ Assume that the rain garden/bioretenion or the dry well #1 are 0% full

For Infiltration Trench or Dry Well #2:

STEP 2 – Select the proposed impervious area value in Column 1 of Table C-3 that is closest to, but not less than, the determined value.

STEP 3 – Using the value from Column 1 determined in Step 2, select the depth (D) of the proposed BMP, and then simply determine the surface area needed from Column 2 of Table C-3.

Note: The arrows under Column 2 in Table C-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 value in Column 1 that 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.

Table C-3: Calculating Infiltration Trench and Dry Well #2 Storage Volume and Surface Area for 1" Rainfall

Column 1	Column 2							
Total Proposed Impervious Area (square 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'
	← Dry Well #2 (1.5'-4.0') →				← Infiltration Trench (2.0'-5.0') →			
I	A(sf)							
Sum of all Proposed Impervious Areas	A = Volume/D, where Volume = (I/12)*1/0.4							
100	14	10	8	7	6	5	5	4
200	28	21	17	14	12	10	9	8
300	42	31	25	21	18	16	14	13
400	56	42	33	28	24	21	19	17
500	69	52	42	35	30	26	23	21
600	83	63	50	42	36	31	28	25
700	97	73	58	49	42	36	32	29
800	111	83	67	56	48	42	37	33
900	125	94	75	63	54	47	42	38
1,000	139	104	83	69	60	52	46	42
1,100	153	115	92	76	65	57	51	46
1,200	167	125	100	83	71	63	56	50
1,300	181	135	108	90	77	68	60	54
1,400	194	146	117	97	83	73	65	58
1,500	208	156	125	104	89	78	69	63
1,600	222	167	133	111	95	83	74	67
1,700	236	177	142	118	101	89	79	71
1,800	250	188	150	125	107	94	83	75
1,900	264	198	158	132	113	99	88	79
2,000	278	208	167	139	119	104	93	83
2,100	292	219	175	146	125	109	97	88
2,200	306	229	183	153	131	115	102	92
2,300	319	240	192	160	137	120	106	96
2,400	333	250	200	167	143	125	111	100
2,500	347	260	208	174	149	130	116	104
2,600	361	271	217	181	155	135	120	108
2,700	375	281	225	188	161	141	125	113
2,800	389	292	233	194	167	146	130	117
2,900	403	302	242	201	173	151	134	121
3,000	417	313	250	208	179	156	139	125
3,100	431	323	258	215	185	161	144	129
3,200	444	333	267	222	190	167	148	133
3,300	458	344	275	229	196	172	153	138
3,400	472	354	283	236	202	177	157	142
3,500	486	365	292	243	208	182	162	146
3,600	500	375	300	250	214	188	167	150
3,700	514	385	308	257	220	193	171	154
3,800	528	396	317	264	226	198	176	158
3,900	542	406	325	271	232	203	181	163
4,000	556	417	333	278	238	208	185	167
4,100	569	427	342	285	244	214	190	171
4,200	583	438	350	292	250	219	194	175
4,300	597	448	358	299	256	224	199	179
4,400	611	458	367	306	262	229	204	183
4,500	625	469	375	313	268	234	208	188
4,600	639	479	383	319	274	240	213	192
4,700	653	490	392	326	280	245	218	196
4,800	667	500	400	333	286	250	222	200
4,900	681	510	408	340	292	255	227	204
4,999	694	521	417	347	298	260	231	208

Assume a void ratio of 40%.

For Disconnected Rooftop Areas:

STEP 2 – Select the proposed impervious area value in Column 1 of Table C-4 that is closest to, but not less than, the determined value. Using the value from Column 1, select the corresponding soil group in column 2 determined from Map III-4, and corresponding slope in column 3 which is the slope of the path the stormwater from the roof travels along, from Table C-4.

STEP 3 – Using the value from Column 3 determined in Step 2, use column 4 to select the length of the flow path that is closest to, but not less than the value, and then simply determine the roof area treated as disconnected from Column 5 of Table C-4. Therefore, the value from Column 5 is the percentage of the total impervious area that can be excluded.

Table C-4: Calculating Rooftop Disconnected Impervious Area Percentage

Impervious Rooftop Area (Square feet)	Soil Group	Slope (%)	Length of Flow Path (ft)*	Roof Area Treated as Disconnected (% of Contributing Area)
0-500	A, B, or C or equivalent	0-5	0-14	0
			15-29	20
			30-44	40
			45-59	60
			60-74	80
			≥75	100
	≥5	≥0	0	
0-500	D	≥0	≥0	0
	A, B, C, D, or equivalent Soils	≥0	≥0	0
≥500	A, B, C, D, or equivalent Soils	≥0	≥0	0

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

For Pavement Disconnection:

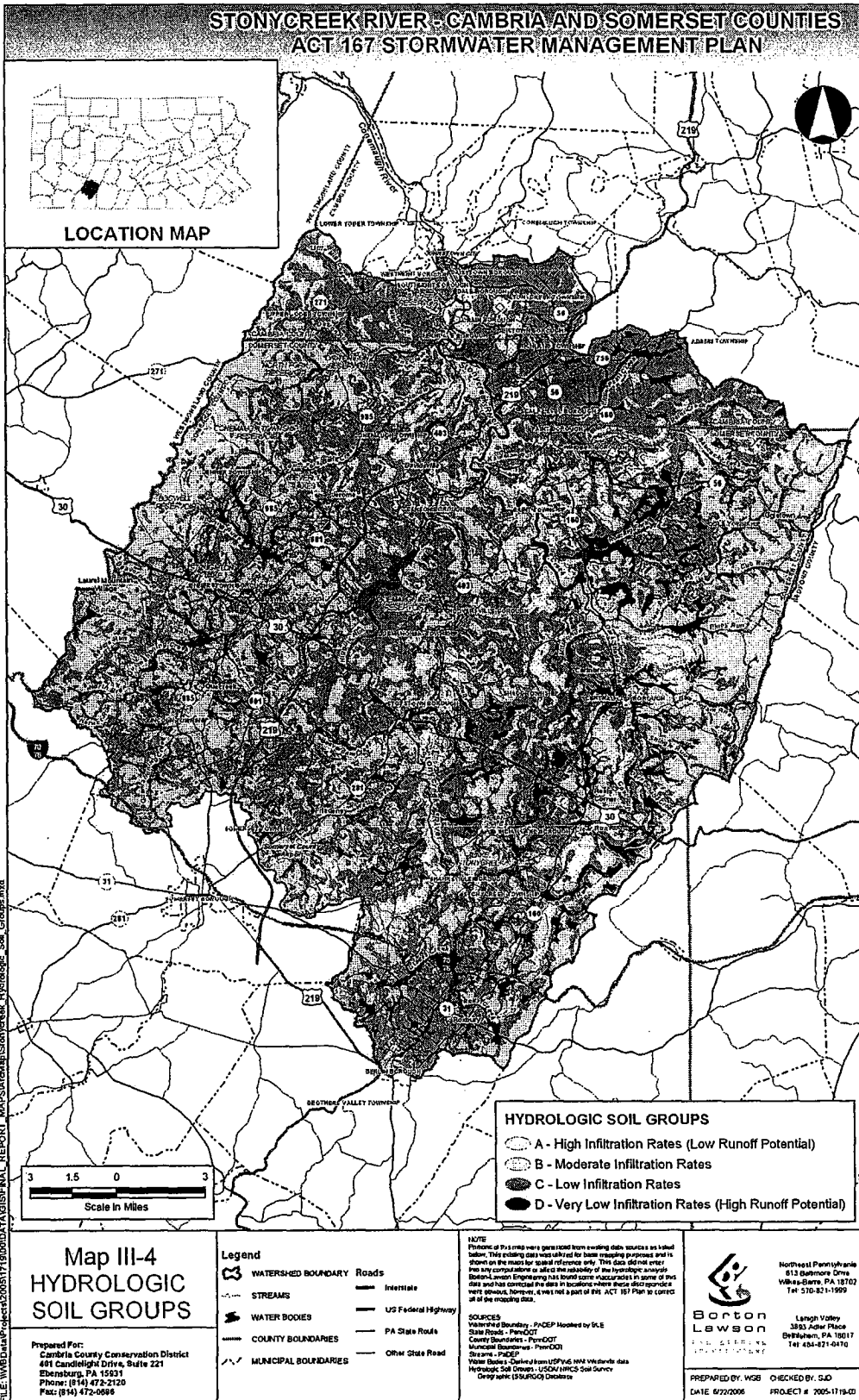
STEP 2 – Select the contributing flow path value, which is the length of the impervious portion of the flow path that stormwater runoff from pavement travels along, in Column 1 of Table C-5 and the corresponding length of overland flow which is the total length that the stormwater runoff travels along the flow path, and the soil group determined from Map III-4, located in columns 2 and 3 respectively, from Table C-5.

STEP 3 – Using the value from Column 3 determined in Step 2, select the slope of the contributing impervious area and slope of the overland flow path in Columns 4 and 5, respectively, and then simply determine if the pavement section is eligible for disconnection from Column 6. If the pavement is eligible for disconnection, then the area of the pavement may be excluded from the total impervious area.

Note: If the discharge is concentrated at one or more discrete points, no more than 1,000 square feet may discharge to any one point. In addition, a gravel strip or other spreading device is required for concentrated discharges. For non-concentrated discharges along the edge of the pavement, this requirement is waived; however, there must be a provision for the establishment of vegetation along the pavement edge and temporary stabilization of the area until vegetation becomes stabilized.

Table C-5: Calculating Pavement Disconnection Eligibility

Contributing Flow Path (feet)	Length of Overland Flow (feet)	Soil Group	Slope of Contributing Impervious Area (%)	Slope of Overland Flow Path (%)	Eligible for Pavement Disconnection (Yes/No)
0-75	Length of Overland Flow Equal to or Greater Than Contributing Flow Path	A, B, or C or equivalent	0-5	0-5	Yes
			5+	5+	No
	Length of Overland Flow less than Contributing Flow Path	D	0+	0+	No
		A, B, C, D, or equivalent Soils	0+	0+	No
75+	0+	A, B, C, D, or equivalent Soils	0+	0+	No



STEP 4 - Sketch a simple site plan as shown in Figure C-1 that includes:

- Name and address of the owner of the property, and or name and address of the individual preparing the plan, along with the date of submission.
- Location of proposed structures, driveways, or other paved areas with approximate size in square feet.
- 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-site septic system and/or potable water wells showing rough proximity to infiltration facilities.
- Location of any existing waterbodies such as; streams, lakes, ponds, wetlands, or other waters of the Commonwealth within fifty (50) feet of the project site, and the distance to the project site and/or BMPs. It is recommended that the project or BMPs be located at least than fifty (50) feet away from a perennial or intermittent stream. If an existing buffer is legally prescribed (i.e., deed, covenant, easement, etc.), the existing buffer shall be maintained.
- Location of all existing structures including buildings, driveways, and roads within fifty (50) feet of the project site.

Fill in the small projects worksheet found in Table C-4, then submit the worksheet and the simple site sketch to the Municipality.

Figure C-1: Typical Dry Well Configuration filled with Stone Fill (Left) and Structural Prefabricated Chamber (Right)

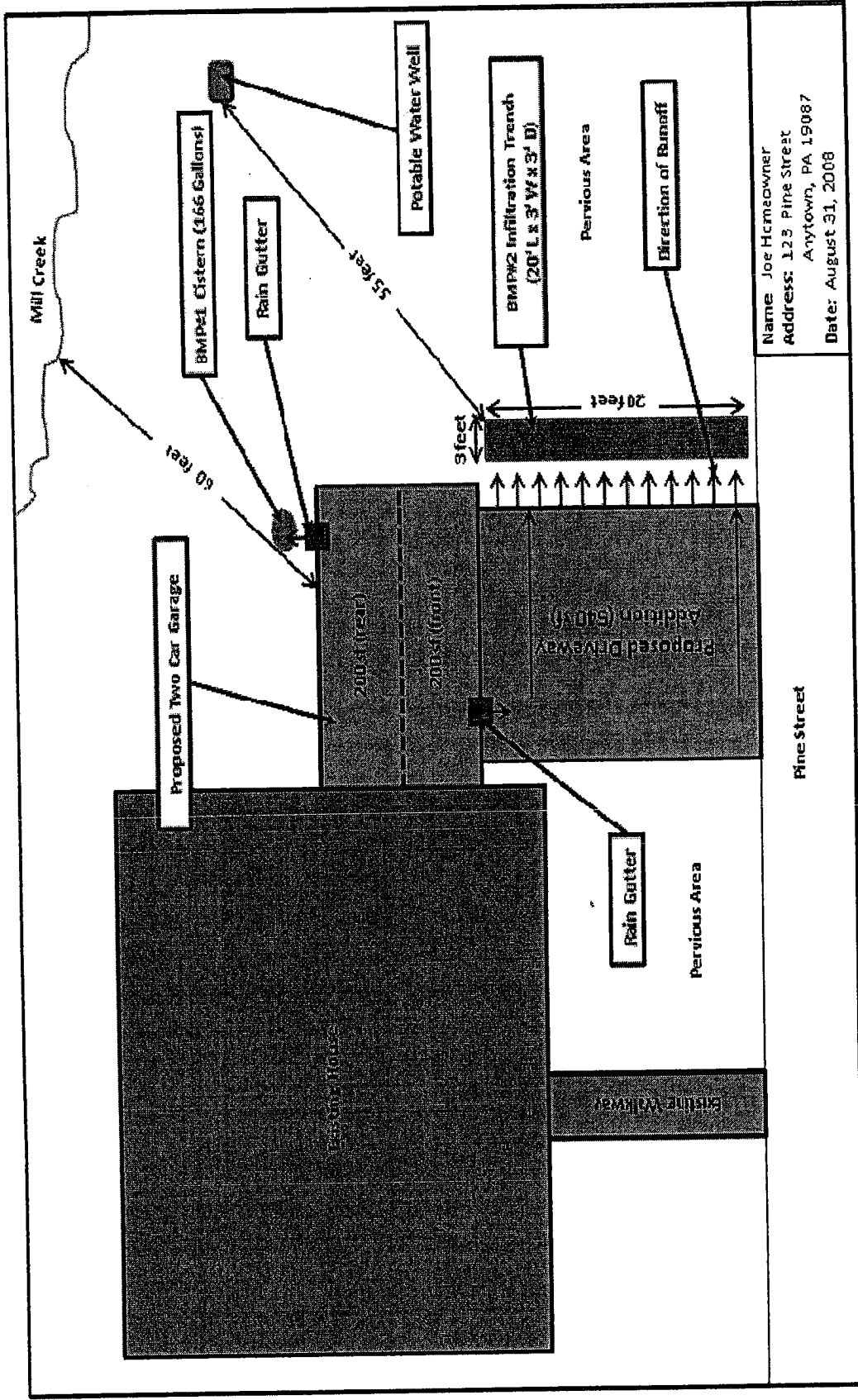


Table C-4: Small Projects Worksheet

Small Projects Worksheet			
STEP 1			
Proposed Impervious Surface for BMP #1	Proposed Impervious Surface for BMP #2	Proposed Impervious Surface for BMP #3	
STEPS 2&3			
Rain Barrel or Cistern			
Proposed Impervious Surface from Column 1 in Table C-1	Volume from Column 2 or 3 in Table C-1		
Rain Garden/Bioretenion or Dry Well #1			
Proposed Impervious Surface from Column 1 in Table C-2	Area of BMP from Column 2 in Table C-2	Depth of BMP from Column 2 in Table C-2	Types of Material to Be Used
Infiltration Trench or Dry Well #2			
Proposed Impervious Surface from Column 1 in Table C-3	Area of BMP from Column 2 in Table C-3	Depth of BMP from Column 2 in Table C-3	Types of Material to Be Used

Note: For additional BMPs, use additional sheets

C.2 Definitions

Best Management Practice (BMP) - Activities, facilities, designs, measures or procedures used to manage stormwater impacts from Regulated Activities, to meet State Water Quality Requirements, to promote groundwater recharge and to otherwise meet the purposes of this Ordinance. Stormwater BMPs are commonly grouped into one of two broad categories or measures: "structural" or "non-structural". In this Ordinance, non-structural BMPs or measures refer to operational and/or behavior-related practices that attempt to minimize the contact of pollutants with stormwater runoff whereas structural BMPs or measures are those that consist of a physical device or practice that is installed to capture and treat stormwater runoff. Structural BMPs include, but are not limited to, a wide variety of practices and devices, from large-scale retention ponds and constructed wetlands, to small-scale underground treatment systems, infiltration facilities, filter strips, low impact design, bioretention, wet ponds, permeable paving, grassed swales, riparian or forested buffers, sand filters, detention basins, and manufactured devices. Structural Stormwater BMPs are permanent appurtenances to the project site.

Capture - Collecting runoff to be stored for reuse or allowed to slowly infiltrate into the ground.

Disconnected Impervious Area (DIA) - An impervious or impermeable surface which is disconnected from any stormwater drainage or conveyance system and is redirected or directed to a pervious area which allows for infiltration, filtration, and increased time of concentration as specified in Appendix B, Disconnected Impervious Area.

Earth Disturbance Activity - A construction or other human activity which disturbs the surface of the land, including, but not limited to, clearing and grubbing; grading; excavations; embankments; road maintenance; building construction; the moving, depositing, stockpiling, or storing of soil, rock or earth materials.

Geotextile - A fabric manufactured from synthetic fiber that is used to achieve specific objectives, including infiltration, separation between different types of media (i.e., between soil and stone), 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 and recycling facilities, vehicle fueling stations, fleet storage areas, vehicle equipment and cleaning facilities, and vehicle service and maintenance facilities).

Impervious Surface (Impervious Area) - A surface that prevents the infiltration of water into the ground. Impervious surfaces (or areas) shall include, but not be limited to, roofs, additional indoor living spaces, patios, garages, storage sheds and similar structures, and any new streets or sidewalks. Decks, parking areas, and driveway areas are not counted as impervious areas if they do not prevent infiltration.

Infiltration - Movement of surface water into the soil, where it is absorbed by plant roots, 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.

Pervious Surface (Pervious Area) - Any area not defined as impervious.

Regulated Activities - Any Earth Disturbances Activities or any activities that involve the alteration or development of land in a manner that may affect stormwater runoff.

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

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

Void Ratio - The ratio of the volume of void space to the volume of solid substance in any material.

C.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 Chapter 6 of the PA BMP Manual which can be found on the PA Department of Environmental Protection's website for specifications and steps for construction for the following BMPs. A list of routine maintenance for each of the BMPs described below is also included at the end of this section.

Disconnected Impervious Area (DIA)

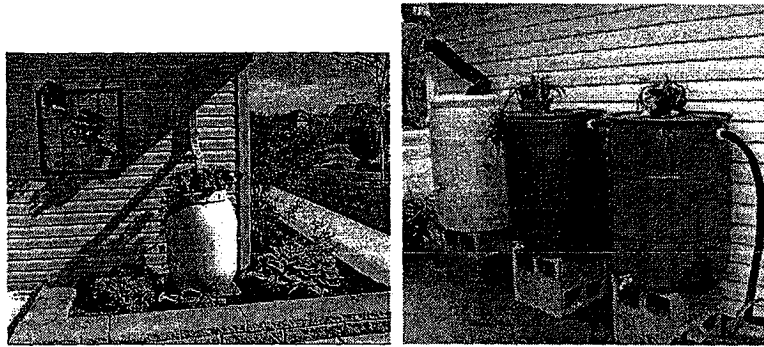
Disconnected Impervious Area (DIA) may be used as a stormwater BMP for certain situations. When stormwater is disconnected from a rooftop by allowing the roof to drain to a pervious surface, and it meets certain conditions, then the initial impervious area may not be subtracted from the total impervious area. This applies specifically to rooftops and pavement. Reference Ordinance Appendix B for a more detailed description, and the requirements and applicability of DIA as a BMP.

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 and 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 on the surface or underground. Figures C-2 and C-3 show examples of rain barrels and cisterns, respectively, that could be used. 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 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 with an overflow pipe to divert flow away from structures.
- Use screens to filter debris, and covers (lids) to prevent mosquitoes.
- 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.*

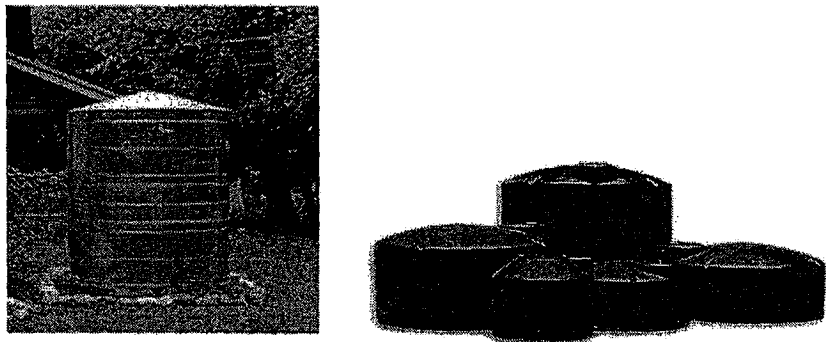
Figure C-2: Rain Barrels



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

*This 25% has already been taken into account in Table 3.

Figure C-3: Cisterns



Source (for both pics): Pennsylvania Stormwater BMP Manual (2006)

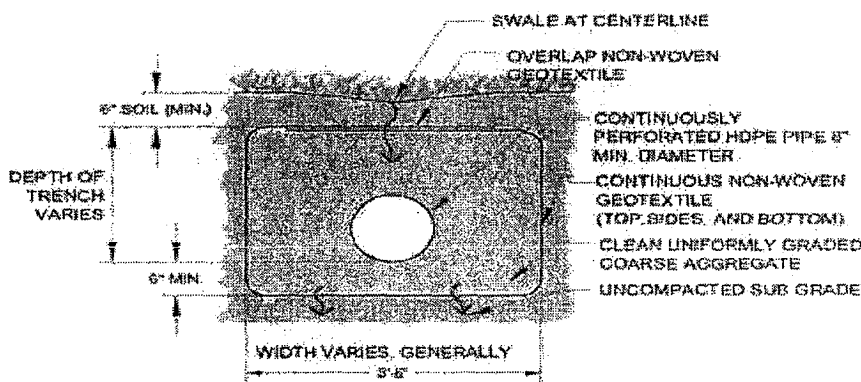
Infiltration Trench

An infiltration trench is a long, narrow, rock-filled trench with or without a perforated pipe 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 and into the underlying soil matrix. Infiltration trenches perform well for removal of fine sediment and associated pollutants. Figure C-4 shows a typical infiltration trench configuration. Infiltration trenches shall incorporate or make provisions for the following elements:

- Perforated pipe is to be set level.
- The width is limited to between **3 and 8 feet**, and the depth ranges from **2 to 5 feet**.
- Trench should be wrapped in nonwoven geotextile (see definition in Section C.2) on the 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 that the soil is capable of infiltrating stormwater. A description of how an infiltration test is performed is found in Appendix C of the *Pennsylvania Stormwater Best Management Practices Manual* (Document No. 363-0300-002), December 30, 2006.
- It is recommended that there be a 2-foot clearance above the regularly occurring seasonal high water table and 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 hotspots (see definition in Section C.2).
- 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.
- The ratio of the collected area to the footprint of the facility should be as small as possible with a ratio of less than 5:1 preferred.

Figure C-4: Typical Infiltration Trench



Source: Pennsylvania Stormwater BMP Manual (2006)

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 below the surface where plants can use the water to grow. Bioretention also improves water quality, vegetation filters the water, and the root systems encourage or promote infiltration. Figure C-5 shows a typical rain garden. Key elements of a rain garden include:

- Ponding depths of **1 foot** or less (recommended).
- A combination of native shrubs, grasses or mulch, trees, and flowers that can tolerate dry and wet weather also known as facultative plants (FAC). A list of

types of plants to use in the bioretention area is shown below in Table C-5. The plants shown below are taken from the PA Wildlands Conservancy plant list, and the plant list found in Appendix B of the PA BMP Manual. The PA Wildlands Conservancy plant list is found at:

http://www.wildlandspa.org/TDE_CMS/database/UserFiles/File/weblast%202008.pdf, and the PA BMP Manual is found at:

<http://www.depweb.state.pa.us/watershedmgmt/cwp/view.asp?a=1437&q=529063&watershedmgmtNav=%7C>. When using the PA BMP Manual plant list, check the Wetland indicator column for plants with a FAC designation. When using the PA Wildlands Conservancy list check the culture column for plants that can tolerate both wet and dry conditions, denoted by the abbreviations W and DR.

- Only shrubs, grasses, trees, and flowers should be used; vegetables should not be planted in the bioretention area.
- An overflow area where, if the bioretention area were to overflow, the water would flow over pervious area (i.e., grass, meadow), and would not cause harm to property
- An overflow such as a domed riser to allow excess flow from large storms to travel to other substantial infiltration areas or pervious areas.
- Typical side slopes of 3:1 are recommended, with 2:1 being the maximum.
- The soil/planting mix depth should be between 1.5 feet and 6 feet deep.

Figure C-5: Typical Rain Garden/Bioretention Area

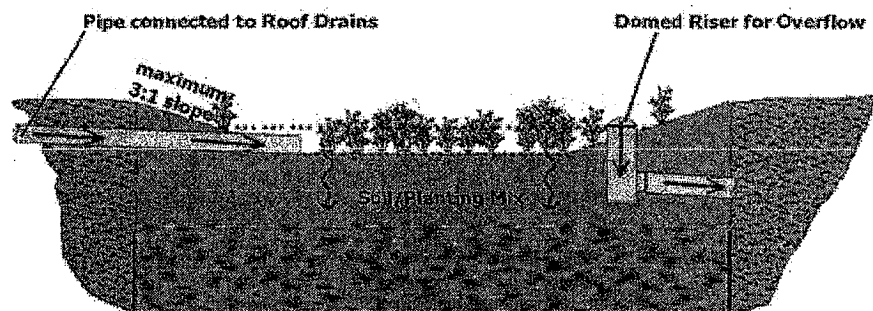




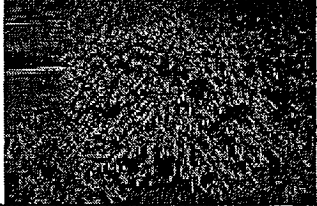
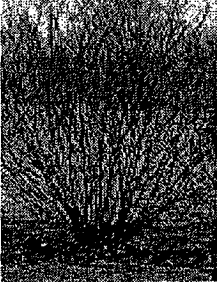

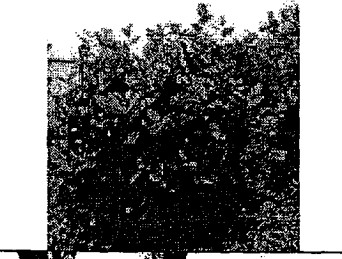
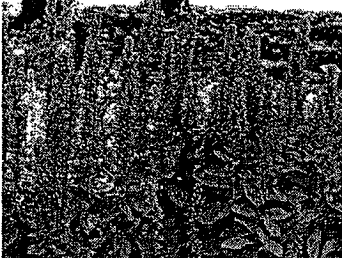
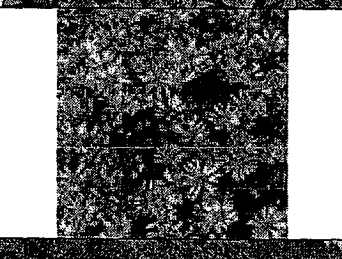

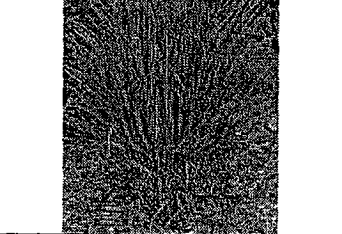


Table C-5: Plant List for Use in a Bioretention/Rain Garden

Common Name	Scientific Name	Plant Type	Photos
Red Maple	<i>Acer rubrum</i>	Tree	
Grey Birch	<i>Betula populifolia</i>	Tree	
Shadbush Serviceberry	<i>Amelanchier canadensis</i>	Tree	
Eastern Cottonwood	<i>Populus grandidentata</i>	Tree	
Virginia Sweetspire	<i>Itea virginica</i>	Shrub	
Red-Twig Dogwood	<i>Cornus sericea (stolonifera) 'Arctic Fire'</i>	Shrub	

Southern Arrow-wood	<i>Viburnum dentatum</i>	Shrub	
Black Choke Berry	<i>Aronia melanocarpa</i>	Shrub	
Great Blue Lobelia	<i>Lobelia siphilitica</i>	Perennial	
Dwarf Pink false aster	<i>Boltonia asteroides</i> 'Nana'	Perennial	
White false aster	<i>Boltonia asteroides</i> 'Snowbank'	Perennial	
Switchgrass	<i>Panicum virgatum</i>	Grass	

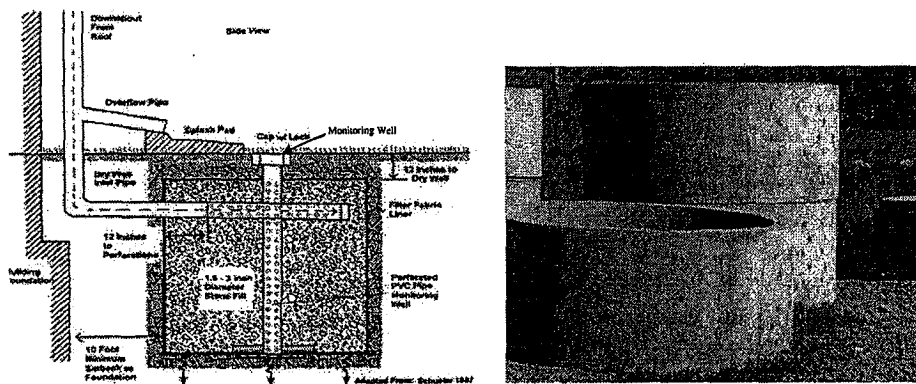
Source: Pennsylvania Stormwater BMP Manual (2006)

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 C-6 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 from the building foundation to avoid foundation seepage problems and are not recommended if their installation would create a risk for basement flooding.
- Construction of a dry well should be performed after surface soils in all other areas of the site are 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.
- Depth of a dry well should be between **1.5 feet and 4 feet**. Gravel fill should consist of stone of an average of one and one half to three (1.5 – 3.0) inches in diameter with the gravel fill wrapped in a nonwoven geotextile that separates the stone fill from the surrounding soil.
- At least 1 foot of soil needs to 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 connect to other on-site substantial infiltration areas or pervious areas.
- Every dry well needs to have at least one monitoring well.
- Infiltration testing is recommended to ensure that the underlying soil is capable of infiltrating the needed volume of stormwater.

Figure C-6: Typical Dry Well Configuration filled with Stone Fill (DRY WELL #2) (Left) and Structural Prefabricated Chamber (DRY WELL #1) (Right)



Source (for pic on left): <http://www.seagrant.sunysb.edu/pages/BMPsForMarinas.htm>

Source (for pic on right): <http://www.copelandconcreteinc.net/1800652.html>

Routine Maintenance for BMPs

- Vegetation along the surface of an infiltration trench should be maintained in good condition, and any bare spots should be revegetated as soon as possible.
- Vehicles shouldn't be parked or driven on an infiltration trench, and care should be taken to avoid excessive compaction by mowers.
- Any debris such as leaves blocking flow from reaching an infiltration trench or bioretention/rain garden should be routinely removed.
- While vegetation is being established, pruning and weeding may be required for a bioretention/rain garden.
- Mulch in a bioretention/rain garden needs to be re-spread when erosion is evident. Once every two to three years or after major storms the entire area may require mulch replacement.
- At least twice a year the landowner needs to inspect the bioretention/rain garden for sediment buildup and vegetative conditions.
- During periods of extended drought, the bioretention/rain garden requires watering.
- Trees and shrubs in a bioretention/rain garden need to be inspected at least twice per year by the landowner to evaluate their health. If they are in poor health, they need to be replaced.
- Dry wells need to be inspected by the landowner at least four times a year and after significant rainfalls, and debris/trash, sediment, and any other waste material need to be removed and disposed of at suitable disposal/recycling sites and in compliance with local, state, and federal waste regulations.
- For dry wells, gutters need to be regularly cleaned out, and proper connections must be maintained to facilitate the effectiveness of the dry well.
- The filter screen for the dry well that intercepts roof runoff must be replaced as necessary.
- Dry wells that are damaged need to be fixed or replaced within two weeks of being damaged.

- If an intermediate sump box exists in conjunction with a dry well, it must be cleaned out at least once per year.
- Rain barrels and cisterns need to be cleared of debris routinely at least every three months and after significant storms to allow stormwater from gutters to enter them.
- Gutters that directly convey rain water to dry wells, rain barrels, and cisterns need to be routinely cleared of trash and debris at least every three months and after significant storms.
- Rain barrels and cisterns must be kept covered.
- Rain barrels and cisterns should be routinely emptied so that they are only $\frac{1}{4}$ of the way full to allow for storage of additional rainwater.
- Overflow outlets from rain barrels and cisterns must be kept free and clear of debris.
- Rain barrels and cisterns that are damaged need to be fixed or replaced within two weeks of being damaged.

C.4 Example

Simplified Approach Volume Determination:

Joe Homeowner wants to build a 400 square foot two car garage, and a 540 square foot (30' L x 18' W) impervious driveway that is graded so that the stormwater runoff drains to the grassy area along one edge of the driveway. (A duplicate of Table C-1 is provided below in Table C-6, a duplicate of Table C-3 is provided below in Table C-7 and outlines the steps of this example) a duplicate of Figure C-1 (Figure C-7) and a duplicate of Table C-4 are provided in Table C-8.

STEP 1 - 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 (Front)	30 ft. x 18 ft.	=	540 sq. ft.

Total Proposed Impervious Surface			940 sq. ft.

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 driveway.

Select a BMP or combination of BMPs from Section C.3 to be used to satisfy the volume requirement. Determine the length, width, depth and other requirements for the BMPs in Section C.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 C-7 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.

STEP 2 and 3 for BMP #1 (Rain Barrel/Cistern)

STEP 2 - 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 C-6:

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

STEP 3 - Determine the volume that BMP #1 must be to satisfy the volume requirements using Columns 2 and 3 in Table C-6:

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 row in Column 3 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. A combination of rain barrels could be used in succession as shown in Figure C-2, or a cistern could be used.

Table C-6: Example – Calculating Storage Volume for Rain Barrel/Cistern¹

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>I</i>	$V_{RBar} = (I \times 1/42) \times 120 = V_{RBar}$	$V_{RBar} \times 7.48 = V_{RBar}$
50	6	42
100	11	83
2 200	22	3 166
300	33	249
400	44	332
500	56	416
600	67	499
700	78	582
800	89	665
900	100	748
1000	111	831
1100	122	914
1200	133	997
1300	144	1,081
1400	156	1,164
1500	167	1,247
1600	178	1,330
1700	189	1,413
1800	200	1,496
1900	211	1,579
2000	222	1,662
2100	233	1,745
2200	244	1,829
2300	256	1,912
2400	267	1,995
2500	278	2,078
2600	289	2,161
2700	300	2,244
2800	311	2,327
2900	322	2,410
3000	333	2,494
3100	344	2,577
3200	356	2,660
3300	367	2,743
3400	378	2,826
3500	389	2,909
3600	400	2,992
3700	411	3,075
3800	422	3,158
3900	433	3,242
4000	444	3,325
4100	456	3,408
4200	467	3,491
4300	478	3,574
4400	489	3,657
4500	500	3,740
4600	511	3,823
4700	522	3,906
4800	533	3,990
4900	544	4,073
4999	555	4,155

¹The typical volume of a rain barrel is between 50-200 gallons, so more than 1 rain barrel may be needed. Larger volumes may require a cistern.
²Assume that the rain barrel/cistern is 25% full

STEPS 2 and 3 for BMP #2 (Infiltration Trench)

STEP 2 - Select the proposed impervious area value for BMP #2, the infiltration trench, using Column 1 in Table C-7:

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 800.

STEP 3 - Utilizing the value from Column 1 determined above, and the surface area that the proposed BMP will occupy, identify the proposed depth and corresponding surface area needed using Column 2 in Table C-7:

Joe Homeowner would like to place the infiltration trench along the edge of the driveway that the runoff drains to, 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 C.3, is 3 feet. Therefore, the area of the infiltration trench is:

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

To find the minimum depth of the trench, move toward the right side of the table from 800 square feet in Column 1 to Column 2, and find the column with a value of as close to but not more than 60 square feet, which is 56 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 3.0 feet.

Selected BMPs: Rain barrel(s) \geq 166 gallons and a 20' L x 3' W x 3.0' D infiltration trench

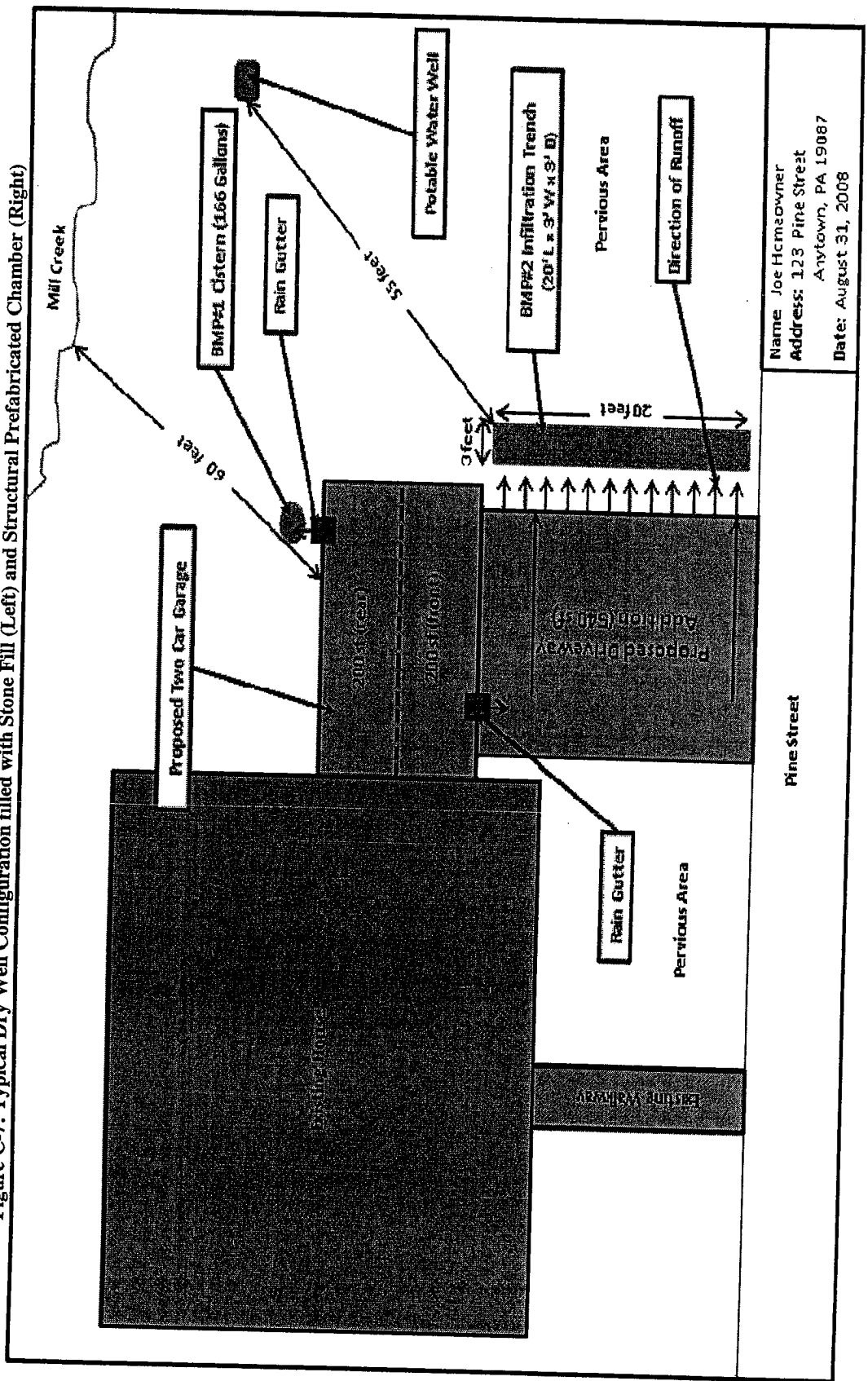
STEP 4 – Make a sketch of the site plan as shown in Figure C-7, and fill in the small projects worksheet found as shown in Table C-8.

Table C-7: Example - Calculating Storage Volume Surface Area and Depth for Infiltration Trench

Column 1	Column 2								
Total Proposed Impervious Area (square 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'	
	← Dry Well #2 (1.5'-4.0') →				← Infiltration Trench (2.0'-5.0') →				
I	A(sf)								
Sum of all Proposed Impervious Areas	A = Volume/D; Micro Volume = ((1/12)*V)/0.4								
100	14	10	8	7	6	5	5	4	
200	28	21	17	14	12	10	9	8	
300	42	31	25	21	18	16	14	13	
400	56	42	33	28	24	21	19	17	
500	69	52	42	35	30	26	23	21	
600	83	63	50	42	36	31	28	25	
700	97	73	58	49	42	36	32	29	
800	111	83	67	56	48	42	37	33	
900	125	94	75	63	54	47	42	38	
1000	139	104	83	69	60	52	46	42	
1100	153	115	92	76	65	57	51	46	
1200	167	125	100	83	71	63	56	50	
1300	181	135	108	90	77	68	60	54	
1400	194	146	117	97	83	73	65	58	
1500	208	156	125	104	89	78	69	63	
1600	222	167	133	111	95	83	74	67	
1700	236	177	142	118	101	89	79	71	
1800	250	188	150	125	107	94	83	75	
1900	264	198	158	132	113	99	88	79	
2000	278	208	167	139	119	104	93	83	
2100	292	219	175	146	125	109	97	88	
2200	306	229	183	153	131	115	102	92	
2300	319	240	192	160	137	120	106	96	
2400	333	250	200	167	143	125	111	100	
2500	347	260	208	174	149	130	116	104	
2600	361	271	217	181	155	135	120	108	
2700	375	281	225	188	161	141	125	113	
2800	389	292	233	194	167	146	130	117	
2900	403	302	242	201	173	151	134	121	
3000	417	313	250	208	179	156	139	125	
3100	431	323	258	215	185	161	144	129	
3200	444	333	267	222	190	167	148	133	
3300	458	344	275	229	196	172	153	138	
3400	472	354	283	236	202	177	157	142	
3500	486	365	292	243	208	182	162	146	
3600	500	375	300	250	214	188	167	150	
3700	514	385	308	257	220	193	171	154	
3800	528	396	317	264	226	198	176	158	
3900	542	406	325	271	232	203	181	163	
4000	556	417	333	278	238	208	185	167	
4100	569	427	342	285	244	214	190	171	
4200	583	438	350	292	250	219	194	175	
4300	597	448	358	299	256	224	199	179	
4400	611	458	367	306	262	229	204	183	
4500	625	469	375	313	268	234	208	188	
4600	639	479	383	319	274	240	213	192	
4700	653	490	392	326	280	245	218	196	
4800	667	500	400	333	286	250	222	200	
4900	681	510	408	340	292	255	227	204	
4999	694	521	417	347	298	260	231	208	

¹Assume a void ratio of 40%

Figure C-7: Typical Dry Well Configuration filled with Stone Fill (Left) and Structural Prefabricated Chamber (Right)



Name: Joe Hcmowner
 Address: 123 Pine Street
 Anytown, PA 19087
 Date: August 31, 2008

Pine Street

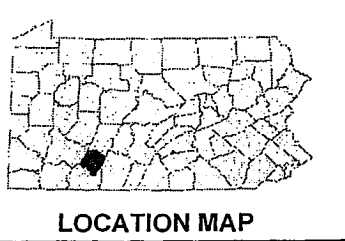
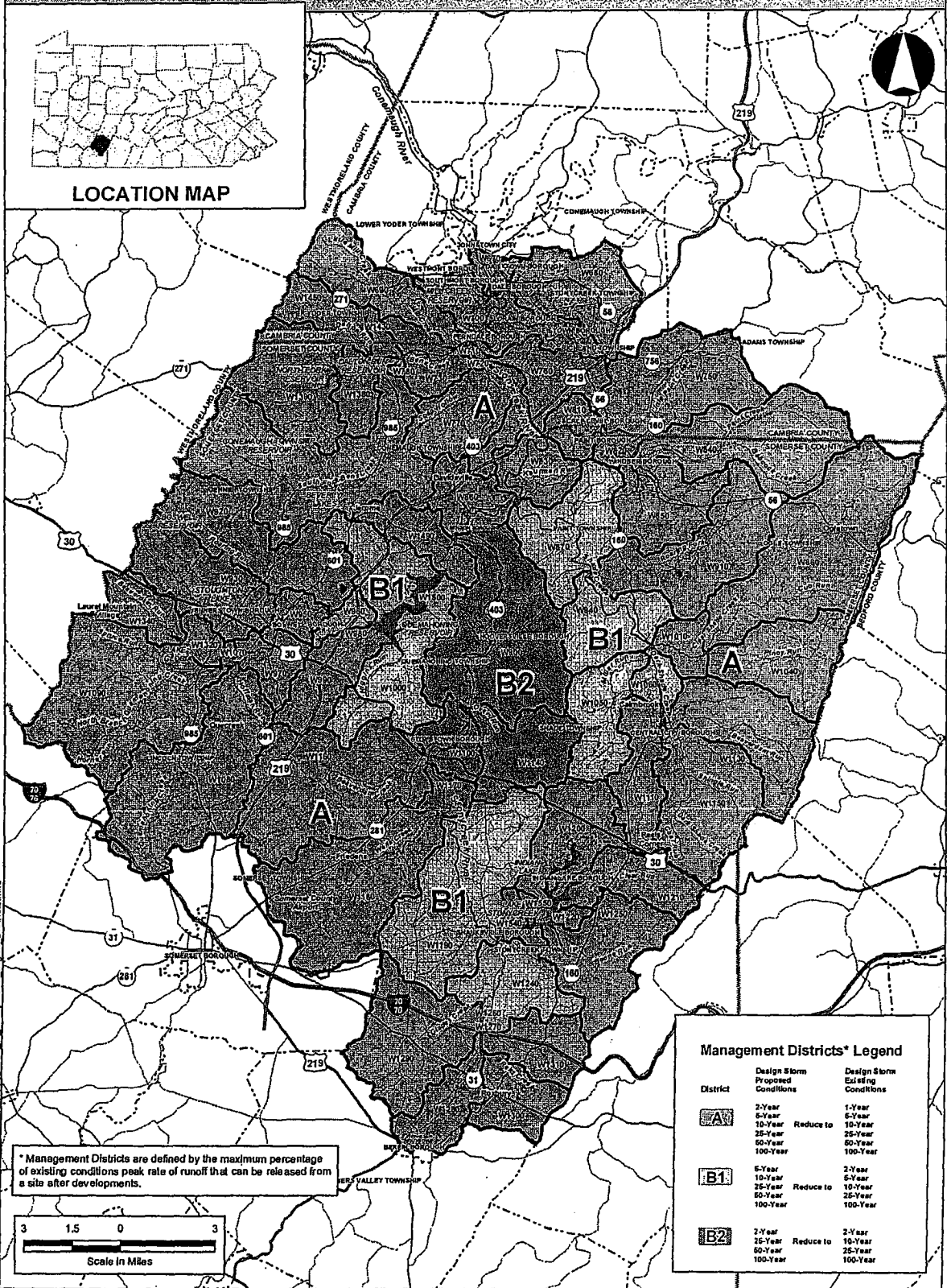
Table C-8: Example – Small Projects Worksheet with Results

Small Projects Worksheet			
STEP 1			
Proposed Impervious Surface for BMP #1	Proposed Impervious Surface for BMP #2	Proposed Impervious Surface for BMP #3	
200	740		
STEPS 2&3			
Rain Barrel or Cistern			
Proposed Impervious Surface from Column 1 in Table C-5	Volume from Column 2 or 3 in Table C-5		
200	166		
Rain Garden/Bioretentation or Dry Well #1			
Proposed Impervious Surface from Column 1 in Table C-2	Area of BMP from Column 2 in Table C-2	Depth of BMP from Column 2 in Table C-2	Types of Material to Be Used
Infiltration Trench or Dry Well #2			
Proposed Impervious Surface from Column 1 in Table C-6	Area of BMP from Column 2 in Table C-6	Depth of BMP from Column 2 in Table C-6	Types of Material to Be Used
800	56	3	Infiltration Trench, Uniformly Graded Aggregate, HDPE 8" pipe, Geotextile material, Grass planted on top

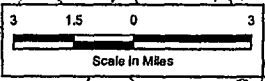
Note: For additional BMPs, use additional sheets

MANAGEMENT DISTRICTS MAP

STONYCREEK RIVER - CAMBRIA AND SOMERSET COUNTIES
ACT 167 STORMWATER MANAGEMENT PLAN



* Management Districts are defined by the maximum percentage of existing conditions peak rate of runoff that can be released from a site after developments.



District	Design Storm Proposed Conditions	Design Storm Existing Conditions
A	2-Year 5-Year 10-Year 25-Year 50-Year 100-Year	1-Year 5-Year 10-Year 25-Year 50-Year 100-Year
B1	5-Year 10-Year 25-Year 50-Year 100-Year	2-Year 5-Year 10-Year 25-Year 100-Year
B2	2-Year 25-Year 100-Year	2-Year 10-Year 100-Year

FILE: \\mathews\p\projects\051719\000\DATA\GIS\FINAL REPORT_MAPS\Map\Appendix_D_Stonycreek_Manm_Districts.mxd

Management Districts Map

Prepared For:
Cambria County Conservation District
401 Candlelight Drive, Suite 221
Ebensburg, PA 15931
Phone: (814) 472-2120
Fax: (814) 472-0886

- Legend**
- WATERSHED BOUNDARY
 - STREAMS
 - WATER BODIES
 - COUNTY BOUNDARIES
 - MUNICIPAL BOUNDARIES
 - SUBAREAS
 - Roads
 - Interstate
 - US Federal Highway
 - PA State Route
 - Other State Road
 - Local Road

NOTE:
Portions of this map were generated from existing data sources as listed below. This existing data was utilized for base mapping purposes and is shown on the maps for spatial reference only. This data did not enter into any computer editors or affect the reliability of the hydrologic analysis. (Sotol-Verdier Engineering) has found some inaccuracies in some of this data and has corrected the data in locations where these discrepancies were obvious, however, it was not a part of their ACT 167 Plan to correct all of the mapping data.

SOURCES:
Watershed Boundary - PADEP Modified by BLE
State and Local Roads - PennDOT
County Boundaries - PennDOT
Municipal Boundaries - PennDOT
Streams - PADEP
Water Bodies - Derived from USFWS 1:62,500 Wetlands data
Management Districtal Subareas - Derived by BLE

E O N
L O W E R
E N G I N E E R I N G
INC.

Northeast Pennsylvania
813 Baltimore Drive
Wilkes-Barre, PA 18702
Tel: 570-821-1999

Lehigh Valley
3833 Adler Place
Bathasheim, PA 18017
Tel: 484-821-0470

PREPARED BY: WGB CHECKED BY: SJD
Date: 5/15/2008 PROJECT #: 2005-1719-00

