

**ARTICLE III
STORMWATER MANAGEMENT**

Section 301. General Requirements

All regulated activities in the Municipality, which do not fall under the exemption criteria shown below, shall submit a drainage plan consistent with this ordinance to the Municipality for review.

- A. Stormwater Management Exemption Criteria – Any regulated activity that meets the following exception criteria is exempt from the provisions of this Ordinance. Exemption shall not relieve the applicant from implementing such measures as are necessary to protect health, safety and property.

1. Impervious Area Exemption:

Impervious cover shall include, but not be limited to, any roof, parking or driveway areas and any new streets and sidewalks. Any areas designed to initially be gravel or crushed stone shall be assumed to be impervious for the purposes of comparison to the waiver criteria. These criteria shall apply to the total development even if development is to take place in phases. The date of the Municipal Ordinance adoption shall be the starting point from which to consider tracts as "parent tracts" in which future subdivisions and respective impervious area computations shall be cumulatively considered.

Impervious Area Exemption

| Total Parcel size | Exemption (sq. ft.) |
|--------------------------|----------------------------|
| 0.5 – 1 acre | 5,000 |
| > 1 –2 acres | 10,000 |
| > 2 – 5 acres | 15,000 |
| > 5 acres | 20,000 |

2. Use of land for gardening for home consumption.
3. Agriculture when operated in accordance with a conservation plan or erosion and sedimentation control plan found adequate by the Conservation District. The agricultural activities such as growing crops, rotating crops, tilling of soil, grazing animals and other such activities are specifically exempt from complying with the requirements of this Ordinance. Installation of new or expansion of existing farmsteads and production areas having impervious surfaces shall be subject to the provisions of this ordinance.
4. Forest Management operations, which are following the Department of Environmental Protections' management practices, contained in its publication "Soil Erosion and Sedimentation Control Guidelines for Forestry" and are operating under an erosion and sedimentation control plan.

No exemption shall be provided for Regulated Activities as defined in Section 104.E and 104.F of this Ordinance.

- B. Stormwater drainage systems shall be provided in order to permit unimpeded flow along natural watercourses, except as modified by stormwater management facilities or open channels consistent with this Ordinance.

- C. The existing points of concentrated or diffused drainage that discharge onto adjacent property shall not be altered without permission of the adjacent property owner(s) and shall be subject to any applicable discharge criteria specified in this Ordinance.
- D. Areas of existing diffused drainage discharge shall be subject to any applicable discharge criteria in the general direction of existing discharge, whether proposed to be concentrated or maintained as diffused drainage areas, except as otherwise provided by this ordinance. If diffused flow is proposed to be concentrated and discharged onto adjacent property, the Developer must document that adequate downstream conveyance facilities exist to safely transport the concentrated discharge, or otherwise prove that no erosion, sedimentation, flooding or other harm will result from the concentrated discharge.
- E. Where a development site is traversed by watercourses drainage easements shall be provided conforming to the line of such watercourses. The terms of the easement shall prohibit excavation, the placing of fill or structures, and any alterations that may adversely affect the flow of stormwater within any portion of the easement. Also, maintenance, including mowing of vegetation within the easement shall be required, except as approved by the appropriate governing authority.
- F. When it can be shown that, due to topographic conditions, natural drainage ways on the site cannot adequately provide for drainage, open channels may be constructed conforming substantially to the line and grade of such natural drainage ways. Work within natural drainage ways shall be subject to approval by PADEP through the Joint Permit Application process, or, where deemed appropriate by PADEP, through the General Permit process.
- G. Any stormwater management facilities regulated by this Ordinance that would be located in or adjacent to waters of the Commonwealth or wetlands shall be subject to approval by PA DEP through the Joint Permit Application process, or, where deemed appropriate by PA DEP, the General Permit process. When there is a question whether wetlands may be involved, it is the responsibility of the Developer or his agent to show that the land in question cannot be classified as wetlands, otherwise approval to work in the area must be obtained from PA DEP.
- H. Any stormwater management facilities regulated by this Ordinance that would be located on State highway rights-of-way shall be subject to approval by the Pennsylvania Department of Transportation (PENNDOT).
- I. Roof drains should not be connected to streets, sanitary or storm sewers or roadside ditches. Roof drains should outlet to vegetated areas or to infiltration facilities or detention/retention structures. When it is more advantageous to connect directly to streets or storm sewers, then it shall be permitted on a case-by-case basis by the Municipality.
- J. "Downstream Hydraulic Capacity Analysis" - Any downstream capacity hydraulic analysis conducted in accordance with this Ordinance shall use the following criteria for determining adequacy for accepting increased peak flow rates:
 - 1. Natural channels must be able to convey the increased runoff associated with a 2-year return period event within their banks at velocities consistent with protection of the channels from erosion. Man made channels shall be designed in accordance with the municipal ordinance and as a minimum will meet Chapter 104 or 105 regulations. Acceptable velocities shall be based upon criteria included in the DEP "Erosion and Sediment Pollution Control Program Manual".

2. Natural or man-made channels or swales must be able to convey the required return period runoff without creating any hazard to persons or property. Where channels or swales are constructed within the boundaries of the 100-year flood plain they shall be designed so that the flood plain boundaries are not widened or its depth increased.
3. Culverts, bridges, storm sewers or any other facilities which must pass or convey flows from the tributary area must be designed in accordance with DEP, Chapter 105 regulations (if applicable) and, at a minimum, pass the increased 25-year return period runoff.

Section 302. Stormwater Management Districts Susquehanna River Tributaries

- A. The Susquehanna River Tributaries Watershed has been divided into stormwater management Districts as defined in Table 302-1. The sub area boundaries are shown on Plates 2-1 through 2-7 in Appendix A of the Susquehanna River Tributaries Management Plan.

Standards for managing runoff from each sub area in Susquehanna River Tributaries Watershed for the 2, 5, 10, 25, 50 and 100-year design storms is shown below. Development sites located in each of the release rate Districts must control post-development runoff rates to pre-development runoff rates, as adjusted for the required release rate, for the design storms as follows:

Table 302-1
Design Release Rate

*(To be completed for local municipalities subwatersheds
in accordance with the Susquehanna River Tributaries Stormwater Management Plan)*

| *District | Sub areas | Design Storm Release Rate As a Percent of Existing 2, 5, 10, 25, 50 & 100-year 24-Hour Storms |
|-----------|-----------|--|
| C | SC-28 | 100% |
| | | |
| | | |
| | | |
| | | |
| | | |

- * EXPLANATION OF DISTRICT: A District is an area within whose boundaries all new development will be designed to the specified post development storm runoff for the 2 through 100-year 24-hour storms reduced to the required percentage of the predevelopment runoff for those storms. Infiltration and water quality BMP affects in reducing the post development storm shall be included in designing stormwater controls to meet the District requirements.

In addition to the requirements specified above, the Erosion and Sedimentation Control Requirements (Section 307), Ground Water Recharge (Section 308) and Water Quality Requirements (Section 309) shall be implemented.

Section 303. Stormwater Management District Implementation Provisions (Performance Standards)

- A. General – Post-Development rates of runoff within subwatersheds from any regulated activity shall meet the peak release rates of runoff prior to development for the design storms specified in Table V-3 of the Susquehanna River Tributaries Stormwater Management Plan and Section 302, of this Ordinance.
- B. District Boundaries - The boundaries of the Stormwater Management Districts are the sub area boundaries shown on an official map that is available for inspections at the municipal office. A copy of the official map at a reduced scale is included in the Ordinance Appendix A. The exact location of the Stormwater Management District boundaries as they apply to a given development site shall be determined by mapping the boundaries using the two-foot topographic contours (or most accurate data required) provided as part of the Drainage Plan.
- C. Sites Located in More Than 1 District – For a proposed development site located within two or more stormwater management district category sub areas, the peak discharge rate from any sub area shall be the pre-development peak discharge as adjusted for the required release rate for that sub area as indicated in Section 302. The calculated peak discharges shall apply regardless of whether the grading plan changes the drainage area by sub area.
- D. Off-Site Areas – Off-site Areas that drain through a proposed development site are not subject to release rate criteria when determining allowable peak runoff rates. However, on-site drainage facilities shall be designed to safely convey off-site flows through the development site.
- E. Site Areas – Where the site area to be impacted by a proposed development activity differs significantly from the total site area, only the proposed development area shall be subject to the Management District Criteria. In other words, stormwater runoff from undeveloped areas of the site bypassing the developed portion of the site's stormwater management facilities would not be subject to the Management District Criteria.
- F. "No Harm" Option – For any proposed development site the developer has the option of using a less restrictive runoff control (including no detention) if the developer can prove that "no harm" would be caused by discharging at a higher runoff rate than that specified by the Plan. The "no-harm" Option is used when a developer can prove that the post-development hydrographs can match pre-development hydrographs, or if it can be proved that the post-development conditions will not cause increases in peaks at all points downstream. Proof of "no-harm" would have to be shown based upon the following "Downstream Impact Evaluation" to determine if adequate hydraulic capacity exists. The land developer shall submit to the Municipality this evaluation of the impacts due to increased downstream stormwater flows in the watershed.
 - 1. The "Downstream Impact Evaluation" shall include hydrologic and hydraulic calculations necessary to determine the impact of hydrograph timing modifications due to the proposed development upon a dam, highway, structure, natural point of restricted stream flow or any stream channel section, established with the concurrence of the Municipality.
 - 2. The evaluation shall continue downstream until the increase in flow diminishes due to additional flow from tributaries and/or stream attenuation.

3. The peak flow values to be used for downstream areas for the design return period storms 2, 5, 10, 25, 50, and 100-years shall be the values from the calibrated model for Susquehanna River Tributaries Watershed. These flow values can be obtained from Volume III of the watershed plan.
 4. Developer-proposed runoff controls, which would generate increased peak flow rates at storm drainage problem areas would, by definition, be precluded from successful attempts to prove "no-harm", except in conjunction with proposed capacity improvements for the problem areas consistent with Section 303.G.
 5. A financial distress shall not constitute grounds for granting a no-harm exemption.
 6. Capacity improvements may be provided as necessary to implement the "no-harm" option, which proposes specific capacity improvements to provide that a less stringent discharge control would not create any harm downstream.
 7. Any "no-harm" justifications shall be submitted by the developer as part of the Drainage Plan submission per Article IV.
- G. "Downstream Hydraulic Capacity Analysis" – Any downstream capacity hydraulic analysis conducted in accordance with this Ordinance shall be consistent with Section 301.J.
- H. Regional Detention Alternatives – For certain areas within the study area, it may be more cost-effective to provide one control facility for more than one development site than to provide an individual control facility for each development site. The initiative and funding for any regional runoff control alternatives are the responsibility of prospective developers. The design of any regional control basins must incorporate reasonable development of the entire upstream watershed. The peak outflow of a regional basin would be determined on a case-by-case basis using the hydrologic model of the watershed consistent with protection of the downstream watershed areas. "Hydrologic model" refers to the calibrated model as developed for the Stormwater Management Plan.
- I. Existing Stormwater Storage Areas – For certain areas within the watershed, identified on the existing stormwater storage areas shown on Plates 2-1 through 2-7, in Appendix A, special requirements will apply. Stormwater is impounded in this area due to either natural or man-made features i.e., road construction acting as a dam, or a combination of both. Some of these areas are identified as being within the FEMA 100-year flood plain or floodway and some area outside of the present FEMA designation.
1. Development in these areas is subject to potential flooding.
 2. Placement of fill for raising buildings above flood levels in these areas will reduce the available stormwater storage volume and increase downstream peak discharges. This increase in discharge downstream will occur unless measures are taken to replace the lost stormwater storage volume. Therefore development in these areas should be limited to open space uses where no earth fill is placed and with minimal building construction permitted.
 3. Any development in these areas will be permitted only by replacing the lost storage volume within the watershed sub area at a location upstream from the first obstruction downstream from the area proposed for development. Analysis would have to be provided to show proof of "no-harm" to downstream areas.

Proof of "no-harm" would have to be shown based upon the "Downstream Impact Evaluation" which shall include a "downstream hydraulic capacity analysis" consistent with Section 303.F to determine if adequate hydraulic capacity exists. The land developer shall submit to the Municipality this evaluation of the impacts due to increased downstream stormwater flows in the watershed.

J. Special Requirements for EV and HQ Subwatersheds

Special requirements for areas falling within defined Exceptional Value and High Quality Sub-watersheds: The temperature and quality of water and streams that have been declared as exceptional value and high quality is to be maintained as defined in Chapter 93, Water Quality Standards, Title 25 of Pennsylvania Department of Environmental Protection Rules & Regulations. Temperature sensitive BMPs and stormwater conveyance systems are to be used and designed with storage pool areas and supply outflow channels and should be shaded with trees. This will require modification of berms for permanent ponds and the relaxation of restrictions on planting vegetation within the facilities, provided that capacity for volumes and rate control is maintained. At a minimum, the southern half on pond shorelines shall be planted with shade or canopy trees within ten (10) feet of the pond shoreline. In conjunction with this requirement, the maximum slope allowed on the berm area to be planted is 10 to 1. This will lessen the destabilization of berm soils due to root growth. A long term maintenance schedule and management plan for the thermal control BMPs is to be established and recorded for all development sites.

Section 304. Stormwater Management Standards for Portions of Municipality Not Within the Susquehanna Tributaries Districts

A. General Standards

The following general standards shall be applied to all development within Briar Creek Township to promote flow attenuation, erosion and sediment control and flood control.

1. All site development in the Municipality creating impervious area in excess of the amounts specified in Section V.J. of the Susquehanna River Tributaries Watershed Act 167 Stormwater Management Plan shall submit a drainage plan consistent with the provisions of this ordinance to the Municipality for review and approval. These criteria shall apply to the total proposed development even if the development is to take place in stages. Impervious cover shall include, but not be limited to, any roof, parking or driveway area and any new street or sidewalk. Any area initially designated to be gravel or crushed stone shall be assumed to be impervious.
2. Roof drains must not be connected to streets, sanitary or storm sewers or roadside ditches.
3. Runoff from the site shall not be concentrated or increased runoff discharged onto adjacent property without the written consent of the adjacent Landowners in the form of a drainage easement.

B. Detention / Infiltration Standards

1. Minimization of impervious surfaces and infiltration of runoff through seepage beds, infiltration trenches, etc. are encouraged, where soil conditions permit, to reduce the size or eliminate the need for detention facilities.

2. Post-development rates of runoff from any regulated activity shall not exceed the peak rates of runoff prior to development for the 2, 10, 25, 50 and 100-year 24-hour frequency storms.

Section 305. Design Criteria for Stormwater Management Facilities

- A. Any stormwater facility located on State highway rights-of-way shall be subject to review and approval by the Pennsylvania Department of Transportation.
- B. Any stormwater management facility (i.e. detention basin) designed to store runoff and requiring a berm or earthen embankment required or regulated by this ordinance shall be designed to provide an emergency spillway to handle flow up to and including the 100-year 24-hour post-development conditions. The height of embankment must be set as to provide a minimum 1.0 foot of freeboard above the maximum pool elevation computed when the facility functions for the 100-year post-development inflow. Should any stormwater management facility require a dam safety permit under PADEP Chapter 105, the facility shall be designed in accordance with Chapter 105. In order to meet the regulations of Chapter 105 concerning dam safety the dam spillways may be required to pass storms larger than 100-year event.
- C. Any facilities that constitute water obstructions (e.g., culverts, bridges, outfalls, or stream enclosures), and any work involving wetlands as directed in PA DEP Chapter 105 regulations (as amended or replaced from time to time by PADEP), shall be designed in accordance with Chapter 105 and will require a permit from PADEP. Any other drainage conveyance facility that doesn't fall under Chapter 105 regulations must be able to convey, without damage to the drainage structure or roadway, runoff from the 25-year design storm with a minimum 1.0-foot of freeboard measured below the lowest point along the top of the roadway. Roadway crossings located within designated floodplain areas must be able to convey runoff from a 100-year design storm with a minimum 1.0-foot of freeboard measured below the lowest point along the top of roadway. Any facility that constitutes a dam as defined in PADEP chapter 105 regulations may require a permit under dam safety regulations. Any facility located within a PENNDOT right of way must meet PENNDOT minimum design standards and permit submission requirements.
- D. Any drainage conveyance facility and/or channel that don't fall under Chapter 105 Regulations, must be able to convey, without damage to the drainage structure or roadway, runoff from the 25-year design storm. Conveyance facilities to or exiting from stormwater management facilities (i.e. detention basins) shall be designed to convey the design flow to or from that structure. Roadway crossings located within designated floodplain areas must be able to convey runoff from a 100-year design storm. Any facility located within a PENNDOT right-of-way must meet PENNDOT minimum design standards and permit submission requirements.
- E. Storm sewers must be able to convey post-development runoff from a 10-year design storm without surcharging inlets, where appropriate.
- F. Adequate erosion protection shall be provided along all open channels, and at all points of discharge.
- G. The design of all stormwater management facilities shall incorporate sound engineering principles and practices. The Municipality shall reserve the right to disapprove any design that would result in the occupancy or continuation of an adverse hydrologic or hydraulic condition within the watershed.

- H. Extreme caution shall be exercised where infiltration is proposed in geologically susceptible areas such as deep mined, strip mined, or limestone geology areas. Extreme caution shall also be exercised where salt or chloride would be a pollutant since soils do little to filter this pollutant and it may contaminate the groundwater. It is also extremely important that the design professional evaluate the possibility of groundwater contamination from the proposed infiltration/recharge facility and recommend a hydrogeologic justification study be performed if necessary. Whenever a basin will be located in an area underlain by limestone, a geological evaluation of the proposed location shall be conducted to determine susceptibility to sinkhole formations. The design of all facilities over limestone formations shall include measures to prevent ground water contamination and, where necessary, sinkhole formation. The infiltration requirement in the High Quality / Exceptional Waters shall be subject to the Department's Chapter 93 and Antidegradation Regulations. The municipality may require the installation of an impermeable liner in detention basins. A detailed hydrogeologic investigation may be required by the municipality.

It shall be the developer's responsibility to verify if the site is underlain by limestone. The following note shall be attached to all drainage plans and signed and sealed by the developer's engineer/surveyor/landscape architect/architect:

_____, Certify that the proposed detention basin
(circle one) is/is not underlain by limestone.

Section 306. Calculation Methodology

Stormwater runoff from all development sites shall be calculated using either the rational method or a soil-cover-complex methodology.

- A. Any stormwater runoff calculations involving drainage areas greater than 20 acres, including on and off-site areas, shall use generally accepted calculation technique that is based on the NRCS soil cover complex method. Table VIII-1 summarizes acceptable computation methods. It is assumed that all methods will be selected by the design professional based on the individual limitations and suitability of each method for a particular site.

The Municipal Engineer may approve the use of the Rational Method to estimate peak discharges from drainage areas that contain less than 20 acres.

- B. All calculations consistent with this Ordinance using the soil cover complex method shall use the appropriate design rainfall depths for the various return period storms presented in Table B-1 in Appendix B of this Ordinance. If a hydrologic computer model such as PSRM or HEC-1, TR-55 or TR-20 is used for stormwater runoff calculations, then the duration of rainfall shall be 24 hours. The NRCS Type II curve shown in Figure B-1, Appendix B of this Ordinance shall be used for the rainfall distribution. As an alternative the rainfall depth presented in Table B-2 in Appendix B of this Ordinance from the "Field Manual of Pennsylvania Department of Transportation Storm Intensity – Duration Frequency charts PDT IDF" (1986) Region IV may be used if the precipitation distribution method recommended for that storm is also used. Each storm frequency has a different distribution curve and must be developed for each storm being evaluated. Whichever method is used for the existing conditions shall also be used for the proposed conditions.
- C. For the purposes of predevelopment flow rate determination, undeveloped land including farmland shall be considered as "meadow" good condition, unless the natural ground cover generates a lower curve number or Rational 'C' value (i.e. forest). For these areas

that have existing imperious areas within the planned development area the existing imperious area may be included in determination of the predevelopment flow rate.

- D. All calculations using the Rational Method shall use rainfall intensities consistent with appropriate times of concentration for overland flow and return periods from the Design Storm Curves from PA Department of Transportation Design Rainfall Curves (1986) (Figure B-2). Times of concentration for overland flow shall be calculated using the methodology presented in Chapter 3 of Urban Hydrology for Small Watersheds, NRCS, TR-55, (as amended or replaced from time to time by NRCS). Times of concentration for channel and pipe flow shall be computed using Manning's equation. Time of concentration may also be computed using the procedure contained in the Federal Transportation publication HEC-22. If the watershed areas involved in the analysis are undeveloped the NRCS "Lag Equation" procedure may be used for the predevelopment condition, while using the TR-55 or HEC-22 method for the planned development condition.
- E. Runoff Curve Numbers (CN) for both existing and proposed conditions to be used in the soil cover complex method shall be obtained from Table B-3 in Appendix B of this Ordinance.
- F. Runoff coefficient (c) for both existing and proposed conditions for use in the rational method shall be obtained from Table B-4 in Appendix B of this Ordinance.
- G. Where uniform flow is anticipated, the Manning equation shall be used for hydraulic computations, and to determine the capacity of open channels, pipes, and storm sewers. Values for Manning's roughness coefficient (n) shall be consistent with Table B-5 in Appendix B of the Ordinance. For grass lined swales or channels the procedures contained in the NRCS publication TP-61 "Handbook of Channel design for Soil and Water Conservation" shall be used.

Outlet structures for stormwater management facilities shall be designed to meet the performance standards of this Ordinance using any generally accepted hydraulic analysis technique or method.

- H. The design of any stormwater detention facilities intended to meet the performance standards of this Ordinance shall be verified by routing the design storm hydrograph through these facilities using the Storage-Indication Method. For all drainage areas the design storm hydrograph shall be computed using a calculation method that produces a full hydrograph. The Municipality may approve the use of any generally accepted full hydrograph approximation technique, which shall use a total runoff volume that is consistent with the volume from a method that produces a full hydrograph.
- I. The Municipality has the authority to require that computed existing runoff rates be reconciled with field observations and conditions. If the designer can substantiate through actual physical calibration that more appropriate runoff and time-of-concentration values should be utilized at a particular site, then appropriate variations may be made upon review and recommendations of the Municipal Engineer. Calibration shall require detailed gauge and rainfall data for the particular site in question.

TABLE 306-1
ACCEPTABLE COMPUTATION METHODOLOGIES FOR STORMWATER
MANAGEMENT PLANS

| METHOD | METHOD DEVELOPED BY | APPLICABILITY |
|--|------------------------------|--|
| TR-20 or commercial Package Based on TR-20 | USDA - NRCS | When use of full model is desirable or necessary |
| Tr-55 OR Commercial Package Based on TR-55 | USDA - NRCS | Applicable for plans within the models limitations |
| HEC – 1 | U.S. Army Corps of Engineers | When full model is desirable or necessary |
| HEC-HMS | U.S. Army Corps of Engineers | When full model is desirable or necessary |
| PSRM | Penn State University | When full model is desirable or necessary |
| Rational Method or commercial package based on Rational Method | Emil Kuiching (1889) | For sites less than 20 acres |
| Other Methods | Various | As approved by the municipal engineer |

Section 307. Erosion and Sedimentation Requirements

- A. Whenever the vegetation and topography are to be disturbed, such activity must be in conformance with Chapter 102, Title 25, Rules and Regulations, Part I, Commonwealth of Pennsylvania, Department of Environmental Protection, Subpart C, protection of Natural Resources, Article II, Water Resources, Chapter 102, "Erosion Control," and in accordance with the (Columbia, Luzerne or Montour) County Conservation District and the standards and specifications of the appropriate municipal government.
- B. Additional erosion and sedimentation control design standards and criteria that must be or are recommended to be applied where infiltration BMP's are proposed and include the following:
 1. Areas proposed for infiltration BMP's shall be protected from sedimentation and compaction during the construction phase, so as to maintain their maximum infiltration capacity.
 2. Infiltration BMP's shall not be constructed nor receive runoff until the entire contributory drainage area to the infiltration BMP has received final stabilization.

Section 308. Ground Water Recharge

- A. The ability to retain and maximize the ground water recharge capacity of the area being developed is required. Design of the stormwater management facilities shall give consideration to providing ground water recharge to compensate for the reduction in the percolation that occurs when the ground surface is paved and roofed over. A geologic evaluation of the project site shall be performed to determine the suitability of recharge facilities. The evaluation shall be performed by a qualified professional and as a minimum, address soil permeability, depth to bedrock, susceptibility to sinkhole formation, and sub grade stability. Where pervious pavement is permitted for parking lots, recreational facilities, non-dedicated streets, or other areas, pavement construction specifications shall be noted on the plan.

B. Infiltration BMPs shall meet the following minimum requirements:

1. When possible the ground water recharge facility should be located on soils having the most permeable Hydrologic Soil Group designation.
2. A minimum depth of 48-inches between the bottom of the facility and the seasonal high water table and/or bedrock (limiting zones).
3. An infiltration and/or percolation rate sufficient to accept the additional stormwater load and drain completely as determined by the Owner's qualified professional, where the professional will be either a geologist, soil scientist, landscape architect or engineer.
4. Infiltration BMPs receiving only roof runoff may be placed in soils having a minimum depth of 24-inches between the bottom of the facility and the limiting zone.
5. Infiltration BMPs shall be located a minimum of 10 feet away from the foundation wall of any building.
6. The recharge facility shall be capable of completely infiltrating the impounded water within 48-hours.

C. A detailed soils evaluation of the project site shall be performed to determine the suitability for installation of recharge facilities. The evaluation shall be performed by a qualified professional, and at a minimum, address soil permeability, depth to bedrock, depth to seasonal high water table, susceptibility to sinkhole formation, and subgrade stability. The general process for designing the infiltration BMP shall be:

1. Analyze hydrologic soil groups as well as natural and man-made features within the watershed and site to determine general areas of suitability for infiltration practices.
2. Conduct field tests to determine appropriate percolation rate and/or soil hydraulic conductivity.
3. Determine seasonal high water table for the infiltration site.
4. Design infiltration structure for the required storm volume based upon field determination capacity at the level of the proposed infiltration surface.

D. Whenever a basin will be located in an area underlain by limestone, a geological evaluation of the proposed location shall be conducted to determine susceptibility to sinkhole formations. The design of all facilities over limestone formations shall include measures to prevent ground water contamination and, where necessary, sinkhole formation.

E. The groundwater infiltration volume shall be computed using the following procedure:
Groundwater Infiltration Computation Formula

$$Glv = [(S + 0.05)(PI)(A)] / 12 = \text{Cubic Feet (Groundwater Infiltration Volume)}$$

S = Infiltration Values for Existing Conditions Soil Hydrologic Group

PI = Percent Imperious Cover for Site as a Decimal

A = Area of Site in Square Feet

12 = Conversion Factor for Inches to Feet

Values for S based upon Soil Hydrologic Group

| Soil Hydrologic Group | Value of S in Inches |
|-----------------------|----------------------|
| A | 0.32 |
| B | 0.22 |
| C | 0.11 |
| D | 0.05 |

Section 309. Water Quality Requirements

- A. In addition to the performance standards and design criteria requirements of Article III of this Ordinance, the land developer SHALL comply with the following water quality requirements of this Article.
- B. Provisions shall be made so that the water quality volume storm takes a minimum of 24 hours to drain from the facility from a point where the maximum volume of water from the design storm is captured. (i.e., the maximum water surface elevation is achieved in the facility). Release of water can begin at the start of the storm (i.e., the invert of the water quality orifice is at the invert of the facility). The design of the facility shall consider and minimize the chances of clogging and sedimentation potential.

Recommended Procedure for Calculating Water Quality Treatment Volume is provided below for the Susquehanna Tributaries Watershed:

- Utilize the following Equation $WQv = [(1.95)(PI)(A)]/12 =$
 - Where:
 - WQv = Water Quality Treatment Volume in Cubic Feet
 - 1.95 = the inches of Stormwater Runoff from an Impervious Area
 - PI = The percent of Site Impervious Area as a Decimal
 - A = Drainage Area in Square Feet
 - 12 = Conversion Factor for Inches to Feet
- C. To accomplish A. and B. above, the land developer MAY submit original and innovative designs to the Municipal Engineer for review and approval. Such designs may achieve the water quality objectives through a combination of Best Management Practices (BMP's).
- D. In selecting the appropriate BMP's or combinations thereof, the land developer SHALL consider the following:
1. Total contributing area
 2. Permeability and infiltration rate of the site soils
 3. Slope
 4. Depth to bedrock
 5. Seasonal high water table
 6. Proximity to building foundations and well heads
 7. Erodibility of soils
 8. Land availability and configuration of the topography
- E. The following additional factors SHOULD be considered when evaluating the suitability of BMPs used to control water quality at a given development site:
1. Peak discharge and required volume control
 2. Stream bank erosion
 3. Efficiency of the BMP's to mitigate potential water quality problems
 4. The volume of runoff that will be effectively treated
 5. The nature of the pollutant being removed
 6. Maintenance requirements
 7. Creation/protection of aquatic and wildlife habitat
 8. Recreational value
 9. Enhancement of aesthetic and property value

Section 310. Redevelopment Activities

General. To the extent that site characteristics allow, it is recommended that proposed redevelopment project designs shall include practices that are designed to result in a net reduction in impervious area. Where site constraints prevent impervious area reduction or the implementation of stormwater management practices, practical alternatives may be used to result in an improvement to water quality. The following apply to all redevelopment projects:

- A. It is recommended that all redevelopment projects reduce existing site impervious area.
- B. Where there will be a net increase in impervious area after redevelopment, Ground Water Recharge, Water Quality Requirements and Stormwater Release Rate Requirements shall be required for the net increase in impervious area but not for the existing impervious area.
 - 1. The selected location of the facilities to meet the requirements shall be that which is most advantageous to provide the desired results. It shall be selected so that there is no net increase in peak discharge from any portion of the site to adjacent properties.
 - 2. Ground water recharge sites and BMPs shall be selected so that there will not be an introduction of pollutants to the ground water system.
- C. The redevelopment activities, with the approval of the municipal officials, may allow practical alternatives. Such practical alternatives may include, but not be limited to:
 - 1. Off site BMP implementation for a drainage area, in the same watershed, comparable to that of the increased impervious area for the project,
 - 2. Watershed or stream restoration, in the same watershed where the project is located,
 - 3. Retrofitting an existing stormwater facility or BMP, to improve water quality and groundwater recharge,
 - 4. Other practices recommended by the municipal engineer, or
 - 5. Fees paid in an amount specified by the approval authority to a stormwater fund specifically dedicated for stormwater improvements and maintenance purposes.