

MONOCACY RIVER STORM WATER MANAGEMENT  
ORDINANCE

ORDINANCE NO. 2006-1 (37)

TOWNSHIP OF GERMANY

ADAMS COUNTY, PENNSYLVANIA

Adopted at a Public Meeting Held on

June 12, 2006

**MONOCACY RIVER WATERSHED  
ACT 167 - STORM WATER MANAGEMENT ORDINANCE**

**ARTICLE I - GENERAL PROVISIONS**

**SECTION 101. STATEMENT OF FINDINGS**

The governing body of the Municipality finds that:

- A. Inadequate management of accelerated storm water runoff resulting from development throughout a watershed increases flood flows and velocities, contributes to erosion and sedimentation, overtaxes the carrying capacity of existing streams and storm sewers, greatly increases the cost of public facilities to convey and manage storm water, undermines floodplain management and flood reduction efforts in upstream and downstream communities, reduces groundwater recharge, and threatens public health and safety.
- B. A comprehensive program of storm water management, including reasonable regulation of development and activities causing accelerated erosion, is fundamental to the public health, safety, welfare, and the protection of the people of the Municipality and all the people of the Commonwealth, their resources, and the environment.
- C. Storm water can be an important resource by providing groundwater recharge for water supplies and baseflow of streams, which also protects and maintains surface water quality.

**SECTION 102. PURPOSE**

The purpose of this Ordinance is to promote health, safety, and welfare within the Municipality by minimizing the damages described in Section 101.A of this Ordinance through provisions designed to:

- A. Manage accelerated runoff and erosion and sedimentation problems at their source by regulating activities that cause these problems.
- B. Utilize and preserve the existing natural drainage systems.
- C. Encourage infiltration of storm water, where appropriate, to maintain groundwater recharge, to prevent degradation of surface and groundwater quality, and to otherwise protect water resources.
- D. Maintain existing flows and quality of streams and watercourses in the Municipality and the Commonwealth.

- E. Preserve and restore the flood-carrying capacity of streams.
- F. Provide proper maintenance of all permanent storm water management facilities that are constructed in the Municipality.
- G. Provide performance standards and review procedures for watershed-wide storm water management planning and design.
- H. Manage storm water impacts close as possible to the runoff source with a minimum use of structures and a maximum use of natural processes.
- I. Meet legal water quality requirements under state law, including regulations at 25 Pa. Code Chapter 93.4a to protect and maintain “existing uses” and maintain the level of water quality to support those uses in all streams and to protect and maintain water quality in “special protection” streams.
- J. Prevent, to the extent possible, scour and erosion of streambanks and streambeds.

### **SECTION 103. STATUTORY AUTHORITY**

#### **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 (appropriate municipal code).

#### **Secondary Authority:**

The Municipality also 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 by Act 170 of December 21, 1988 and Act 131 of December 14, 1992.

### **SECTION 104. APPLICABILITY**

This Ordinance shall apply only to permanent storm water management facilities constructed as part of any of the Regulated Activities listed in this Section. Erosion and sedimentation control during construction activities are not regulated specifically by this Ordinance, but shall continue to be regulated under existing laws and Ordinances.

Except for inconsistent Ordinances and Practices that are repealed by Section 105 of this Ordinance, local storm water management design criteria (e.g. inlet spacing, inlet type, collection system design and details, outlet structure design, etc.) shall continue to be regulated by the applicable Municipal Ordinances or at the Municipality's discretion.

The following activities are defined as "Regulated Activities" and shall be regulated by this Ordinance:

1. Land development.
2. Subdivision.
3. Construction of new or additional impervious or semi-pervious surfaces (driveways, parking lots, etc.).
4. Construction of new buildings or additions to existing buildings.
5. Diversion or piping of any natural or man-made stream channel.
6. Installation of storm water management facilities or appurtenances thereto.
7. Earth Disturbance Activities.

### **SECTION 105. REPEALER**

Any ordinance or ordinance provision of the Municipality inconsistent with any of the provisions of this Ordinance is hereby repealed to the extent of the inconsistency only. All new development approved and occurring after the effective date of this Ordinance shall be subject to this Ordinance, and prior ordinances regulating storm water management shall be superceded by this Ordinance for such new development.

### **SECTION 106. SEVERABILITY**

Should any section or provision of this Ordinance be declared invalid by a court of competent jurisdiction, such decision shall not affect the validity of any of the remaining provisions of this Ordinance.

### **SECTION 107. COMPATIBILITY WITH OTHER ORDINANCE REQUIREMENTS**

Approvals issued pursuant to this Ordinance does not relieve the Applicant of the responsibility to comply with or to secure required permits or approvals for activities regulated by any other applicable code, rule, statutes, regulation, or ordinance.

### **SECTION 108. DUTY OF PERSONS ENGAGED IN THE DEVELOPMENT OF LAND**

Notwithstanding any provisions of this Ordinance, including exemptions and waivers, any landowner and any person engaged in the alteration or development of land which may affect storm water runoff characteristics shall implement such measures as are reasonably necessary to prevent injury to health, safety or other property. Such measures also shall include such actions as are required to manage the rate, volume, direction and

quality of resulting storm water runoff in a manner which otherwise adequately protects health, property, and water quality from possible injury.

## ARTICLE II - DEFINITIONS

For the purposes of this chapter, 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 word "person" includes an individual, firm, association, organization, partnership, trust, company, corporation, or any other similar entity.
- D. The words "shall" and "must" are mandatory; the words "may" and "should" are permissive.
- E. The words "used or occupied" include the words "intended, designed, maintained, or arranged to be used, occupied or maintained".

**Accelerated Erosion** - The removal of the surface of the land through the combined action of human activity and the natural processes of a rate greater than would occur because of the natural process alone.

**Agricultural Activities** - The work of producing crops and raising livestock including tillage, plowing, disking, harrowing, pasturing and installation of conservation measures. Construction of new buildings or impervious area is not considered an agricultural activity.

**Alteration** - As applied to land, a change in topography as a result of the moving of soil and rock from one location or position to another; also the changing of surface conditions by causing the surface to be more or less impervious; land disturbance.

**Applicant** - A landowner or developer who has filed an application for approval to engage in any Regulated Activities as defined in Section 104 of this Ordinance.

**BMP (Best Management Practice)** - Storm water structures, facilities and techniques to maintain or improve the water quality of surface runoff.

**Channel Erosion** - The widening, deepening, and headward cutting of small channels and waterways, due to erosion.

**Cistern** - A reservoir or tank for storing rainwater, commonly underground.

**Conservation District** - The Adams County Conservation District.

**Conservation Plan** - A plan, as defined in and regulated by 25 Pa.Code Chapter 102, that identifies conservation practices and includes site specific BMPs that minimize the potential for accelerated erosion and sedimentation from agricultural plowing or tilling activities.

**Culvert** - A structure with appurtenant works which carries a stream under or through an embankment or fill.

**Dam** - An artificial barrier, together with its appurtenant works, constructed for the purpose of impounding or storing water or another fluid or semifluid, or a refuse bank, fill or structure for highway, railroad or other purposes which does or may impound water or another fluid or semi-fluid.

**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 storm water management systems.

**Designee** - The agent of the Municipality involved with the administration, review or enforcement of any provisions of this ordinance by contract or memorandum of understanding.

**Detention Basin** - An impoundment structure designed to manage storm water runoff by temporarily storing the runoff and releasing it at a predetermined rate.

**Developer** - A person, partnership, association, corporation, or other entity, or any responsible person therein or agent thereof, that undertakes any Regulated Activity of this Ordinance.

**Development Site** - The specific tract of land for which a Regulated Activity is proposed.

**Drainage Conveyance Facility** - A Storm Water Management Facility designed to transmit storm water runoff and shall include streams, channels, swales, pipes, conduits, culverts, storm sewers, etc.

**Drainage Easement** - A right granted by a landowner to a grantee, allowing the use of private land for storm water management purposes.

**Drainage Permit** - A permit issued by the Municipality after the Drainage Plan has been approved. Said permit is issued prior to or with the final municipal approval.

**Drainage Plan** - The documentation of the storm water management system, if any, to be used for a given development site, the contents of which are established in Article IV.

**Earth Disturbance Activity** – See 25 Pa.Code Chapter 102, except that this Ordinance does not further regulate agricultural plowing or tilling.

**Erosion** – See 25 Pa. Code Chapter 102.

**Erosion and Sediment Pollution Control Plan** - A plan, which is designed to minimize, accelerated erosion and sedimentation pursuant to 25 Pa. Code, Chapter 102.

**Existing Conditions** - The initial condition of a project site prior to the proposed construction. If the initial condition of the site is undeveloped land, the land use shall be considered as "meadow" unless the natural land cover is proven to generate lower curve numbers or Rational "C" value, such as forested lands.

**Flood** - A general but temporary condition of partial or complete inundation of normally dry land areas from the overflow of streams, rivers, and other waters of this Commonwealth.

**Floodplain** - Any land area susceptible to inundation by water from any natural source or delineated by applicable Department of Housing and Urban Development, Federal Insurance Administration Flood Hazard Boundary - Mapped as being a special flood hazard area. Also included are areas that comprise Group 13 Soils, as listed in Appendix A of the Pennsylvania Department of Environmental Protection (PADEP) 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 frequency 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 frequency 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 forest land. These include timber inventory and preparation of forest management plans, silvicultural treatment, cutting budgets, logging road design and construction, timber harvesting, site preparation and reforestation.

**Freeboard** - A vertical distance between the elevation of the design high water and the top of a dam, levee, tank, basin, or diversion ridge. The space is required as a safety margin in a pond or basin.

**Grade** - A slope, usually of a road, channel or natural ground specified in percent and shown on plans as specified herein. (To) Grade - to finish the surface of a roadbed, top of embankment or bottom of excavation.

**Grassed Waterway** - A natural or constructed waterway, usually broad and shallow, covered with erosion-resistant grasses, used to conduct surface water from cropland.

**Groundwater Recharge** - Replenishment of existing natural underground water supplies.

**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 Natural Resources Conservation Service (NRCS) of the US Department of Agriculture 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 as the HSG varies from A to D.

**Impervious Surface (Impervious Area)** - A surface that prevents the infiltration of water into the ground. Impervious surfaces (or cover) shall include, but not be limited to, roofs, additional indoor living spaces, decks, patios, garages, storage sheds and similar structures, parking or driveway areas and any new streets or sidewalks. Any area initially designated to be gravel or crushed stone shall be assumed to be an impervious surface.

**Impoundment** - A retention or detention basin designed to retain storm water runoff and release it at a controlled rate.

**Infiltration Structures** - A structure designed to direct runoff into the ground (e.g. french drains, seepage pits, seepage trench).

**Inlet** - A surface connection to an enclosed drain. A structure at the upstream end of a conduit. The upstream end of any structure through which water may flow.

**Karst** - A type of topography or landscape characterized by depressions, sinkholes, limestone towers and steep-sided hills, underground drainage and caves. Karst is formed on carbonate rocks, such as limestones or dolomites and sometimes gypsum.

**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.

**Land/Earth Disturbance** - Any activity involving removing, grading, tilling, digging, or filling of ground or stripping of vegetation or any other activity that causes an alteration to the natural condition of the land.

**Main Stem (Main Channel)** - Any stream segment or other runoff conveyance facility used as a reach in the stream.

**Manning Equation in (Manning formula)** - A method for calculation of velocity of flow (e.g. feet per second) and flow rate (e.g. cubic feet per second) in open channels based upon channel shape, roughness, depth of flow and slope. "Open channels" may include closed conduits so long as the flow is not under pressure.

**Municipality** –Germany Township, Adams County, Pennsylvania.

**Non-point Source Pollution** - Pollution that enters a water body from diffuse origins in the watershed and does not result from discernible, confined, or discrete conveyances or origin.

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

**Open Channel** - A drainage element in which storm water flows with an open surface. Open channels include, but shall not be limited to, natural and man-made drainage ways, swales, streams, ditches, canals, and pipes flowing partly full (for computational purposes).

**Outfall** - Point where water flows from a conduit, stream, or drain.

**Outlet** - Points of water disposal from a stream, river, lake, tidewater or artificial drain.

**Parking Lot Storage** - The use of impervious parking areas for temporary impoundment of storm water with controlled release rates during rainstorms.

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

**Penn State Runoff Model** - A computer-based hydrologic modeling technique.

**Pipe** - A culvert, closed conduit, or similar structure (including appurtenances) that conveys storm water.

**Planning Commission** - The planning commission of Germany Township, Adams County, Pennsylvania.

**PMF - Probable Maximum Flood** - The flood that may be expected from the most severe combination of critical meteorological and hydrologic conditions that are reasonably possible in any area. The PMF is derived from the probable maximum precipitation (PMP) as determined on the basis of data obtained from the National Oceanographic and Atmospheric Administration (NOAA).

**Qualified Professional** – A Professional Engineer licensed by the Pennsylvania Department of State, and other persons licensed or otherwise qualified by law to perform the work required by the Ordinance.

**Rational Formula** - A rainfall-runoff relation used to estimate peak flow.

**Regulated Activities** - Actions or proposed actions that impact upon proper management of storm water runoff and that are governed by this Ordinance as specified in Section 104 of this Ordinance.

**Retention Basin** - An impoundment in which storm water is stored and not released during the storm event. Stored water may be released from the basin at some time after the end of the storm.

**Return Period** - The average interval, in years, within which a storm event of a given magnitude can be expected to recur. For example, the 25-year return period rainfall would be expected to recur on the average once every twenty-five years.

**Riser** - A vertical pipe extending from the bottom of a pond that is used to control the discharge rate from the pond for a specified design storm.

**Rooftop Detention** - Temporary ponding and gradual release of storm water falling directly onto flat roof surfaces by incorporating controlled-flow roof drains into building designs.

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

**Runoff Capture Volume (RCV)** – The volume of runoff that is captured (retained) and not released into surface waters of the Commonwealth during or after a storm event.

**Sediment Basin** - A barrier, dam, retention or detention basin designed to retain rock, sand, gravel, silt, or other material transported by water.

**Sediment Pollution** - The placement, discharge or introduction of sediment into the waters of the Commonwealth.

**Sedimentation** - The process by which mineral or organic matter is accumulated or deposited by the movement of water.

**Seepage Pit/Seepage Trench** - An area of excavated earth filled with loose stone or similar coarse material, into which surface water is directed for infiltration into the ground.

**Sheet Flow** - Runoff that flows over the ground surface as a thin, even layer, not concentrated in a channel.

**Site (Development Site)** - The specific tract of land for which a Regulated Activity is proposed.

**Soil-Cover Complex Method** - A method of runoff computation developed by the NRCS that is based on relating soil type and land use/cover to a runoff parameter called Curve Number (CN).

**Spillway** - A depression in the embankment of a pond or basin that is used to pass peak discharge greater than the maximum design storm controlled by the pond.

**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."

**Storage Indication Method** - A reservoir routing procedure based on solution of the continuity equation (inflow minus outflow equals the change in storage) with outflow defined as a function of storage volume and depth.

**Storm Frequency** - The number of times that a given storm "event" occurs or is exceeded on the average in a stated period of years. See "Return Period".

**Storm Sewer** - A system of pipes and/or open channels that convey intercepted runoff and storm water from other sources, but excludes domestic sewage and industrial wastes.

**Storm Water** - The total amount of precipitation reaching the ground surface.

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

**Storm Water Management Plan** - The plan for managing storm water runoff adopted by the County of Adams for the Monocacy River Watershed as required by the Act of October 4, 1978, P.L. 864, (Act 167), as amended, and known as the "Storm Water Management Act".

**Storm Water 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.

**Stream Enclosure** - A bridge, culvert, or other structure that encloses a regulated water of this Commonwealth.

**Subarea** - The smallest unit of watershed breakdown for hydrologic modeling purposes for which the runoff control criteria have been established in the adopted Storm Water Management Plan.

**Subdivision** - The division or re-division of a lot, tract, or parcel of land by any means into two or more lots, tracts, parcels or other divisions of land including changes in existing lot lines for the purpose, whether immediate or future, of lease, transfer of ownership, or building or lot development: Provided, however, that the subdivision by lease of land for agricultural purposes into parcels of more than ten acres, not involving any new street or easement of access or any residential dwellings, shall be exempt.

**Swale** - A low-lying stretch of land that gathers or carries surface water runoff.

**Timber Operations** - See Forest Management.

**Time of Concentration (Tc)** - The time for surface runoff to travel from the hydraulically most distant point of the watershed to a point of interest within the watershed. This time is the combined total of overland flow time and flow time in pipes or channels, if any.

**Watercourse** – A channel or conveyance of surface water having defined bed and banks, whether natural or artificial, with perennial or intermittent flow.

**Waters of the Commonwealth** - Any and all rivers, streams, creeks, rivulets, ditches, watercourses, storm sewers, lakes, dammed water, wetlands, ponds, 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** –The entire region or area drained by a river or other body of water, whether natural or artificial.

**Wetland** - Those 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, fens, and similar areas.

## **ARTICLE III - STORM WATER MANAGEMENT**

### **SECTION 301. EXEMPTIONS**

A. A Regulated Activity that meets the exemption criteria shown in Table 1 is exempt from the storm water peak discharge control requirement and from the Drainage Plan preparation requirement of this Ordinance. A Regulated Activity that meets the exemption criteria shown in Table 1.A is exempt only from the peak discharge control requirement of this Ordinance.

B. As of the date of Ordinance adoption, if a subdivision or land development is submitted that addresses peak rate control and includes a Drainage Plan, then the impervious exemption is calculated from the date of approval of that subdivision/land development plan, based upon the impervious area shown on the subdivision/land development plan.

C. Any activity that constitutes normal farming or agricultural practices including, but not limited to, land clearing, plowing, planting or harvesting crops, or pasturing of livestock is exempt from the peak rate discharge, water quality, and Drainage Plan preparation requirements of this ordinance provided that the agriculturist is operating according to an approved Conservation Plan pursuant to 25 Pa.Code Chapter 102. The creation of additional impervious cover is subject to the requirements and exemptions of this Ordinance.

D. Subdivision plans for three lots or fewer are exempt from the requirement to submit a Drainage Plan at the time of subdivision; however, development of the individual lots created by the subdivision is subject to all other provisions of this Ordinance.

TABLE 1: STORM WATER MANAGEMENT PLANNING  
 IMPERVIOUS AREA EXEMPTIONS  
 PEAK RATE CONTROLS AND DRAINAGE PLAN PREPARATION  
 PARCEL SIZES LESS THAN 3 ACRES

<u>Total Parcel size</u> (acres)	Exemption from Peak Rate Controls and From Drainage Plan Preparation (sq. ft.)
<0.125 acre	1000
0.2	1400
0.3	1900
0.4	2300
0.5	2700
0.6	3100
0.7	3500
0.8	3900
0.9	4200
1.0	4600
1.1	4900
1.2	5200
1.3	5500
1.4	5900
1.5	6200
1.6	6500
1.7	6800
1.8	7100
1.9	7300
2.0	7600
2.1	7900
2.2	8200
2.3	8400
2.4	8700
2.5	9000
2.6	9200
2.7	9500
2.8	9800
2.9	10000

TABLE 1.A: STORM WATER MANAGEMENT IMPERVIOUS  
 AREA EXEMPTIONS  
 PEAK RATE CONTROLS (ONLY)  
 PARCEL SIZES 3.0 ACRES AND GREATER

<u>Total Parcel Size</u> (acres)	Exemption from Peak Rate Controls ONLY (sq. ft.)
3	10300
3.1	10500
3.2	10800
3.3	11000
3.4	11300
3.5	11500
3.6	11700
3.7	12000
3.8	12200
3.9	12500
4	12700
4.1	12900
4.2	13200
4.3	13400
4.4	13600
4.5	13800
4.6	14100
4.7	14300
4.8	14500
4.9	14700
5	15000
>5	15000

Notes: Exemption areas are computed using the following approximate equation:

$$Exempt\ Area(sq.ft.) = 4575 * A^{0.736}$$

Where A is the parcel size in acres.

## **SECTION 302. GENERAL REQUIREMENTS**

- A. All Regulated Activities in the Municipality shall be subject to the storm water management requirements of this Ordinance.
- B. The measurement of Impervious Area shall include the total proposed development even if development is to take place in stages.

For development taking place in stages, the entire development plan must be used in determining conformance with this Ordinance. Additional impervious cover shall include, but not be limited to, additional indoor living spaces, decks, patios, garages, driveways, storage sheds and similar structures, any roof, parking or driveway areas and any new streets and sidewalks constructed as part of or for the proposed Regulated Activity. Gravel, crushed stone, and porous pavement shall be assumed to be impervious.

- C. For projects that add impervious area to a parcel, the total impervious area on the parcel is subject to the stormwater management requirements of this ordinance.
- D. Storm water drainage systems shall be provided in order to permit unimpeded flow along natural watercourses, except as modified by storm water management facilities or open channels consistent with this Ordinance.
- E. The existing points of concentrated 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.
- F. Areas of existing sheet flow shall be subject to any applicable discharge criteria in the general direction of existing discharge, whether proposed to be concentrated or maintained as areas of sheet flow, except as otherwise provided by this ordinance. If sheet 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.
- G. 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 storm water 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.

- H. Post-construction BMPs shall be designed, installed, operated and maintained to meet the requirements of the Clean Streams Law and implementing regulations, including the established practices in 25 Pa. Code Chapter 102 and the specifications of this ordinance, so as to prevent accelerated erosion in watercourse channels and at all points of discharge.
- I. No Earth Disturbance activities associated with any Regulated Activities shall commence until approval by the municipality of a plan which demonstrates compliance with the requirements of this Ordinance.
- J. Techniques described in Appendix B (Low Impact Development) of this Ordinance are encouraged because they reduce the costs of complying with the requirements of this Ordinance and the State Water Quality Requirements.
- K. Infiltration for storm water management is encouraged where soils and geology permit, consistent with the provisions of this Ordinance and, where appropriate, infiltration is encouraged for capturing and treating the Water Quality Volume (as calculated in Section 304), any part of the Water Quality Volume or for otherwise meeting the purposes of this Ordinance.
- L. Roof drains shall not connect to streets, sanitary or storm sewers, or roadside ditches, whenever conditions allow. Overland flow is encouraged to promote infiltration and recharge of ground water.
- M. Exemption from any provisions of this Ordinance shall not relieve the applicant from the responsibility to:
  - 1. Protect health, safety, and property;
  - 2. Meet State Water Quality Requirements;
  - 3. Meet the requirements of Sections 303E of this Ordinance;
  - 4. Secure required permits or approvals for activities regulated by any other applicable code, rule, act or Ordinance.
  - 5. Meet the water quality goals of this ordinance to:
    - a. Minimize disturbance to floodplains, wetlands, natural slopes over 15%, and existing native vegetation.
    - b. Maintain or extend riparian buffers adjacent to any stream banks and protect existing forested buffers.
    - c. Establish and maintain non-erosive flow conditions in natural flow pathways.
    - d. Preserve and maintain trees and woodlands. Provide trees and woodlands wherever feasible.

- e. Minimize soil disturbance and soil compaction. Cover disturbed areas with topsoil having a minimum depth of 4 inches. Use tracked equipment for grading when feasible.
- f. Disconnect impervious surfaces by directing runoff to pervious areas.
- g. Locate discharge points to avoid causing basement seepage or other damage to adjoining properties.

**SECTION 303. GENERAL STORM WATER MANAGEMENT REQUIREMENTS**

The following general standards shall be applied to all development within Germany Township to control storm water runoff.

- A. Except for the exemptions in Section 301, no Regulated Activities or Regulated Earth Disturbance Activities within the municipality shall commence until approval by the municipality of a Drainage Plan / Site Plan that demonstrates compliance with this Ordinance.
- B. DEP has determined that this Ordinance meets State Water Quality Requirements. Therefore, any approvals under this Ordinance would satisfy the post construction storm water management requirements associated with an NPDES Permit for Storm Water Discharges Associated with Construction Activities.
- C. The requirement to submit a Drainage Plan applies to the total proposed development and for developments that occur in stages the requirement applies to every stage of the development.
- D. Impervious surfaces 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 an impervious surface.
- E. The volume and rate of any net increases in storm water runoff from Regulated Activities must be managed to prevent the physical degradation of receiving waters from such effects as scour and streambank destabilization, to satisfy State Water Quality Requirements.
- F. The municipality may, after consultation with DEP, approve alternative methods for meeting the State Water Quality Requirements other than those in Article III, provided that they meet the minimum requirements of, and do not conflict with, State law including but not limited to the Clean Streams Law.
- G. To the maximum extent practical accepted best management practices as outlined in the adopted Act 167 Watershed Storm Water Management Plan(s) for the minimization of generating storm water runoff, avoiding detrimental effects of storm

water runoff and the protection of environment (Low Impact Development Techniques) should be used.

- H. 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.
- I. The Drainage Plan for all developments that create impervious surface or change the existing topography, except for exemptions provided in Section 301, shall demonstrate that adequate capacity will be provided to treat the “Water Quality Volume” and contain the “Runoff Capture Volume”, as described under sections 304 and 305.
- J. Special requirements for areas falling within defined Exceptional Value and High Quality Sub-watersheds may include the following: 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 and Regulations. Temperature control BMP’s are to be designed and used with storage pool areas and stormwater conveyance channels. At a minimum, the shoreline on ponds and channels should be shaded or planted with shade trees; however, under no circumstances should trees be planted on either the upstream or downstream slopes of dam embankments, regardless of the steepness of the slopes. A long term maintenance schedule and management plan for the thermal control BMP’s is to be established and recorded for all development sites.

## **SECTION 304. RUNOFF CAPTURE VOLUME REQUIREMENTS**

### **A. General Requirements**

- 1) The Runoff Capture Volume (RCV) shall be infiltrated unless the applicant demonstrates that it is infeasible to infiltrate the RCV for reasons of
  - a) seasonal high water table,
  - b) permeability rate,
  - c) soil depth or,
  - d) isolation distances;
  - e) or except as provided in Section 303.E.
- 2) Site investigation shall continue on different areas of the site until a suitable infiltration location is found or the entire site is determined to be infeasible for infiltration.
- 3) The municipality may determine infiltration to be infeasible if there are known existing conditions or problems that may be worsened by the use of infiltration.
- 4) The following site conditions generally are suitable for infiltration:
  - a) Depth to bedrock below the invert of the BMP greater than or equal to 2 feet
  - b) Depth to seasonal high water table below the invert of the BMP greater than or equal to 3 feet (If the depth to bedrock is between 2 and 3 feet and the

evidence of the seasonal high water table is not found in the soil, no further testing to locate the depth to seasonal high water table is required)

- c) Soil permeability greater than or equal to 0.5 inches/hour and less than or equal to 12 inches per hour
- d) Setback distances or buffers as follows:
  - i) 100 feet from water supply wells
  - ii) 10 feet down-gradient or 100 feet up-gradient from building foundations
  - iii) 50 feet from septic system drain fields
  - iv) 50 feet from a geologic contact with carbonate bedrock unless a preliminary site investigation is done in the carbonate bedrock to show the absence of special geologic features within 50 feet of the proposed infiltration area.
  - v) 100 feet from the property line unless documentation is provided to show that all setbacks from wells, foundations and drain fields on neighboring properties will be met.
- 5) If it is not feasible to infiltrate the full RCV, the applicant shall infiltrate that portion of the RCV that is feasible based on the site characteristics.

B. The post-development Runoff Capture Volume (RCV) for a site shall equal or exceed the pre-development Runoff Capture Volume for the site.

C. Compliance with the Runoff Capture Volume requirement shall be demonstrated using the procedure described below unless the Drainage Plan demonstrates that the procedure is that an alternative methodology is necessary. Alternative methodologies may be necessary when storm water runoff at a project site is affected by such basin features as swamps, lakes, wetlands, and karst geology.

- a. Calculate the pre-development Runoff Capture Volume using the following equation.

$$P = \text{Runoff Capture Volume} = \frac{200}{CN} - 2 \quad \text{Equation 1}$$

Where: P = volume of rainfall captured (inches)  
S = potential maximum retention after runoff begins (inches)  
CN = predevelopment runoff curve number

An example of this calculation is provided in Example 1, located in Appendix A of this ordinance.

- b. Calculate the post-development runoff volume using the following procedure.

***Step 1: Determine the percentage of each land use/cover type***

In conventional site development, the designer would refer to Table 2.2a in TR-55 (SCS, 1986) to select the CN that represents the proposed land use of the overall development (i.e., residential, commercial) without checking the overall percentages of impervious area, grass areas, semi-pervious areas, etc. Because the BMPs emphasize minimal site disturbance, reduce impervious surfaces below conventional amounts, and employ semi-pervious pavements, the CNs for these types of land uses/land covers are less than those for the conventional developments reflected in the CNs contained in Table 2.2a in TR-55. Therefore, it is appropriate to analyze the BMP site as discrete units to determine the CN that most accurately reflects actual conditions.

***Step 2: Calculate the composite BMP CN***

The initial composite CN is calculated using a weighted approach based on individual land covers *without* considering the disconnectivity of the site impervious surfaces. This is done using the following Equation 2:

$$CN_c = \frac{CN_1 A_1 + CN_2 A_2 \dots + CN_j A_j}{A_1 + A_2 \dots + A_j} \quad \text{Equation 2}$$

Where:  $CN_c$  = composite curve number  
 $A_j$  = area of each land cover  
 $CN_j$  = curve number for each land cover

Overlays of SCS hydrologic soil group boundaries onto homogeneous land cover areas are used to develop the BMP CN. What is unique about this BMP custom-made CN technique is the way that this overlaid information is analyzed as small discrete units that represent the true hydrologic conditions, rather than the conventional TR-55 approach that is based upon representative national averages that do not incorporate BMP techniques.

***Step 3: Calculate the BMP CN based on the connectivity of site impervious area***

Disconnected impervious areas are impervious areas without any direct connection to a drainage system or other impervious surface.

For example, roof drains from houses that are directed onto lawn areas where sheet flow occurs, instead of onto a driveway that is drained into a curb, gutter, and storm sewer system are considered to be disconnected. Such direction of runoff from impervious to pervious surfaces increases the opportunity for infiltration. By increasing the ratio of disconnected impervious areas to pervious areas on the site, the CN and calculated resultant runoff can be reduced. When the total impervious area is less than 30 percent of the total area, the percentage of the unconnected impervious areas within the area influences the calculation of the CN. If the total impervious area is equal to or greater than 30 percent, no adjustment to the CN is warranted because the absorptive capacity of the remaining pervious surfaces will not significantly affect runoff (TR-55, SCS, 1986).

The following Equation 3 is used to calculate the CN for areas with less than 30 percent impervious area.

$$CN_c = CN_p + \left( \frac{P_{imp}}{100} \right) \times (98 - CN_p) \times (1 - 0.5R) \quad \text{Equation 3}$$

- Where: R = ratio of unconnected impervious area to total impervious area
- CN<sub>c</sub> = composite CN (adjusted for disconnected impervious areas)
- CN<sub>p</sub> = composite pervious CN
- P<sub>imp</sub> = percent of impervious site area

Example 1 in Appendix A illustrates the use of steps 1 through 3 to calculate the runoff curve number using the BMP development technique outlined above for a hypothetical 1-acre residential lot designed to incorporate BMP techniques.

***Step 4: Calculate the BMP CN based on the connectivity of site impervious area***

Once the runoff CN has been calculated, the NRCS (formerly SCS) Runoff Curve Number Method (TR-55, SCS, 1989) can be used to estimate the runoff volume that will occur during the runoff capture design storm using Equation IV-3 and Equation IV-4. The design

storm volume is the volume calculated for the site using Equation 1, presented previously).

$$S = \frac{1000}{CN} - 10 \quad \text{Equation 4}$$

Where: CN = post-development composite runoff curve number calculated as described above

$$Q = \frac{(P - 0.2S)^2}{(P + 0.8S)}$$

Equation 5

Where: Q = runoff (inches)  
P = runoff capture rainfall volume (as calculated in Equation 1, presented previously)  
S = potential maximum retention after runoff begins (inches)

#### ***Step 5: Check the Runoff Capture Volume Requirement***

If the runoff volume calculated in this manner is negligible (e.g. 0.02”), the runoff capture standard has been met. Otherwise, appropriate additional structural retention storage facilities must be used to provide the additional retention volume required to retain the excess runoff volume. The calculations of the post-development runoff CN and resulting runoff volume during the runoff volume rain event are illustrated in Examples 2 and 3 contained Appendix A.

D. The following BMPs are effective in achieving compliance with the Runoff Capture Volume requirement.

1. Minimization of disturbed areas
2. Minimization of impervious surfaced areas
3. Disconnection of impervious surfaces
4. Use of permeable paving systems
5. Use of infiltration trenches and pits
6. Use of bioretention areas
7. Use of cisterns and rain barrels

- E. The Runoff Capture Volume provided at the site should be directed to the most permeable Hydrologic Soil Group (HSG) available.
- F. The recharge facility should be designed to completely infiltrate required volume recharge water within 48 hours.
- G. Drainage Plans shall include a detailed soils evaluation of the project site to determine the feasibility of recharge facilities. The evaluation shall be performed by a qualified professional, and at a minimum, address soil permeability, depth to bedrock, susceptibility to sinkhole formation, and subgrade stability. The general process for designing an infiltration BMP shall be:
  - 1. Analyze hydrologic soil groups as well as natural and man-made features within watershed to determine general areas of suitability for infiltration practices.
  - 2. Provide field test to determine appropriate percolation rate.
  - 3. Design infiltration structures for required storm volume based on field-determined capacity at the level of the proposed infiltration surface.
  - 4. Caution should be exercised where infiltration is proposed in geologically susceptible areas such as strip mine areas or limestone areas.
  - 5. Whenever a basin is proposed over an area underlain by limestone, the Drainage Plan shall include an evaluation of the susceptibility to sinkhole formation.
  - 6. The design of all facilities over limestone formations shall include measures to prevent ground water contamination and, where necessary, to prevent sinkhole formation. In sensitive areas, use of impermeable liners in detention basins should be considered.
  - 7. The developer is responsible to provide adequate measures to protect the quality of water resources.
  - 8. The developer is responsible to determine whether or not the site is underlain by limestone.
  - 9. The following note shall be attached to all Drainage Plans and signed and sealed by the developer's qualified professional:
- I, \_\_\_\_\_ certify that the proposed detention basin (circle one) is/is not underlain by limestone.

- H. Where pervious pavement is proposed for parking lots, recreational facilities, non-dedicated streets, or other areas, the pavement construction specifications shall be indicated on the plans.
- I. In selecting the appropriate BMPs or combinations thereof, the land developer shall consider the following:
1. Permeability and infiltration rate of the site soils.
  2. Slope and depth to bedrock.
  3. Seasonal high water table.
  4. Proximity to building foundations and wellheads.
  5. Erodibility of soils.
  6. Land availability and topography.
- J. When infiltration structures are used, the area where the structure is to be constructed and associated soils shall be protected from compaction.
- K. Permit applications for regulated activities shall be submitted to the municipality, except for activities covered by the exemptions provided in Section 301.

### **SECTION 305. WATER QUALITY REQUIREMENTS**

- A. Developed areas shall provide adequate storage and/or treatment facilities necessary to capture and treat the volume of runoff produced by 2.3 inches of rainfall over a 24-hour period. This runoff volume is the Water Quality Volume (WQv).
- B. Acceptable best management practices (BMPs) shall be used to treat the water quality volume (WQv).
- C. The water quality volume should be calculated using the NRCS soil-cover complex based methodology as described under Section 304 using post-development conditions composite runoff curve numbers.
- D. The Runoff Capture Volume computed under Section 304 may be a component of the Water Quality Volume (WQv). If the Runoff Capture Volume is less than the Water Quality Volume, the remaining Water Quality Volume may be captured and treated by methods other than recharge/infiltration BMP's.
- E. The following BMPs are acceptable for achieving compliance with the runoff Water Quality Volume (WQv) treatment requirement.
- Storm water ponds
  - Storm water wetlands
  - Infiltration practices
  - Filtering practices
  - Open channel practices

- Non-structural practices
- F. WQv shall be designed as part of a storm water management facility which incorporates water quality BMP's as a primary benefit of using that facility, in accordance with design guidance contained in the Monocacy River Watershed Storm Water Management Plan, the Pennsylvania Handbook of Best Management Practices for Developing Areas, and other references identified in the Monocacy River Watershed Storm Water Management Plan.
- G. The following factors should be considered when evaluating the suitability of BMPs used to control water quality at a given development site:
- Peak discharge and required volume control.
  - Stream bank erosion
  - Efficiency of the BMPs to mitigate water quality problems.
  - The volume of runoff that will be effectively treated.
  - The nature of the pollutant being removed.
  - Maintenance requirements.
  - Creation/protection of aquatic and wildlife habitat.
  - Recreational value.
  - Enhancement of aesthetic and property value.
- H. If an extended detention or a permanent pool type facility is selected for the treatment of water quality volume, the outlet should be designed such that the one-year 24-hour post-development runoff volume is released over a 24-hour period. The release of water begins at the start of the storm (i.e., the invert of the water quality orifice is at the invert of the facility).
- I. To reduce the risk of clogging, orifice diameters smaller than 3 inches should not be used without a debris screen or rack.

**SECTION 306. STORM WATER PEAK DISCHARGE RATE CONTROL REQUIREMENTS**

- A. Applicants shall provide a comparative pre- and post-construction storm water management hydrograph analysis for each direction of discharge and for the site overall to demonstrate compliance with the provisions of this Ordinance.
- B. Post-development peak discharge rates shall not exceed the predevelopment discharge rates for the 2-, 5-, 10-, 25-, 50-, and 100-year, 24-hour design storms. If it is shown, that the peak rates of discharge indicated by the post-development hydrographs are less than or equal to the peaks of discharge indicated by the pre-development hydrographs for 2-, 5-, 10-, 25-, 50-, and 100-year, 24-hour frequency design storms, then the requirements of this section have been met. Otherwise, the

developer shall provide such additional controls as are necessary to satisfy the peak rate of discharge requirement.

- C. 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, US Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service, Hydrometeorological Design Studies Center, Silver Spring, Maryland (2004). NOAA's Atlas 14 can be accessed at Internet address: <http://hdsc.nws.noaa.gov/hdsc/pfds/>.
- D. The design storm depths in Table 2 also may be used.

**Table 2: Design Storm and PDT-IDF Rainfall Depths**

<b>Return Period</b>	<b>24 Hour Rainfall Depth</b>
2-years	2.8 inches
5-years	3.6 inches
10-years	4.5 inches
25-years	5.5 inches
50-years	6.8 inches
100-years	7.8 inches

- E. Peak discharge rate should be calculated using methods based on the NRCS soil-cover complex based methodology as described under Section 304 and should reflect the effects of proposed runoff capture and water quality enhancement measures upon peak discharge rates.
- F. Peak discharge rates may be computed using the Rational Formula when the NRCS soil-cover complex method is not applicable.
- G. The following BMPs are effective in achieving compliance with the peak rate of discharge limit requirement.
  - a. Storm water ponds
  - b. Storm water wetlands
  - c. Swales
  - d. Runoff volume reduction BMPs such as infiltration and re-vegetation.

**SECTION 307. DESIGN CRITERIA FOR STORM WATER MANAGEMENT FACILITIES**

- A. General Criteria

1. Applicants may select runoff control techniques, or a combination of techniques, which are most suitable to control storm water runoff from the development site. All controls shall be subject to approval of the Municipality. The Municipality may request specific information on design and/or operating features of the proposed storm water controls in order to determine their suitability and adequacy in terms of the standards of this Section.
  - a. The applicant should consider the effect of the proposed storm water management techniques on any special soil conditions or geological hazards that may exist on the development site. In the event such conditions are identified on the site, the Municipality may require in-depth studies by a qualified professional. Not all storm water control methods may be advisable or allowable at a particular development site.
    - (a) In developing a storm water management plans for a particular site; storm water controls shall be selected according to the following order of preference:
      - (i) Infiltration of runoff on-site
      - (ii) Flow attenuation by use of open vegetated swales and natural depressions
      - (iii) Vegetative runoff treatment techniques
      - (iv) Structural storm water infiltration devices
      - (v) Storm water detention/retention structures
    - (b) Infiltration practices shall be used to the extent practicable to reduce volume increases and promote groundwater recharge. A combination of successive practices may be used to achieve the applicable minimum control requirements. Justification shall be provided by the applicant for rejecting each of the preferred practices based on actual site conditions.
    - (c) Open detention/retention facilities shall not be permitted within residential areas as part of an in-fill project.
      - (i) The applicant may request a waiver from this requirement. All such requests for waiver shall be submitted in writing.
      - (ii) It shall be the responsibility of the applicant for a waiver of this part to show that the modification will not create a safety risk and

that the modification is consistent with the Best Management Practices and current engineering design standards

- B. Any storm water 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 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 storm water management facility require a dam safety permit under PADEP Chapter 105, the facility shall be designed in accordance with Chapter 105 and meet the regulations of Chapter 105 concerning dam safety which 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 PA DEP), shall be designed in accordance with Chapter 105 and will require a permit from PA DEP. Any facility that constitutes a dam as defined in PA DEP chapter 105 regulations may require a permit under dam safety regulations.
- D. Any facility located within a PENNDOT right-of-way, or draining toward a PENNDOT right-of-way, must meet PENNDOT's minimum design standards and it must comply with PENNDOT's Highway Occupancy Permit requirements (67 Pa.Code Chapter 441).
- E. Any drainage conveyance facility and/or channel that does not 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 storm water 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 PADOT right-of-way must meet PADOT minimum design standards and permit submission requirements.
- F. Storm sewers must be able to convey post-development runoff from a 25-year design storm without surcharging inlets, where appropriate.
- G. Adequate erosion protection shall be provided along all open channels, and at all points of discharge.
- H. 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.

**SECTION 308. CALCULATION METHODOLOGY**

Storm water runoff from all development sites should be calculated using either the soil-cover-complex methodology or the rational formula (method).

- A. Any storm water runoff calculations involving drainage areas greater than 200 acres, including on- and off-site areas, shall use generally accepted calculation techniques that are based on the NRCS soil cover complex method. Table 3 summarizes acceptable computation methods. It is assumed that all methods will be selected by a qualified professional based on the individual limitations and suitability of each method for a particular site.

The Municipality may approve the use of the Rational Method to estimate peak discharges from drainage areas that contain less than 200 acres.

**Table 3: Acceptable Computation Methods for Storm Water Management Plans**

<b>METHOD</b>	<b>METHOD DEVELOPED BY</b>	<b>APPLICABILITY</b>
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
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 200 acres with the approval of the Municipality
Other Methods	Various	As approved by the Municipality

Successors to the above methods also are acceptable. Such successors include HEC-HMS for HEC-1, WinTR55 for TR-55, and WinTR20 for TR-20.

- B. All calculations consistent with this Ordinance using the soil cover complex method should use rainfall depths for the various design storms from NOAA’s Atlas 14, Volume 2, or from the Pennsylvania Department of Transportation publication Design Manual Part 2 Highway Design Publication 13M, current edition. Calculations should utilize a 24-hour rainfall duration and the NRCS Type II rainfall distribution.

- C. For the purposes of predevelopment flow rate determination, undeveloped land shall be considered as "meadow" good condition, unless the natural ground cover generates a lower curve number or Rational 'C' value (i.e. forest).

All conveyance piping calculations performed using the Rational Method should use rainfall intensities consistent with appropriate times of concentration for overland flow and return periods. For undeveloped areas, times of concentration may be computed using the SCS equation for Lag Time ( $T_{LAG}$ ).

$$\text{Time of Concentration} = T_C = \frac{T_{LAG}}{0.6} * 60 \quad (\text{in minutes})$$

$$T_{lag} = L^{0.8} \frac{(S+1)^{0.7}}{1900\sqrt{Y}}$$

Where:

$T_{lag}$  = Lag time in hours

L = Hydraulic length of watershed in feet.

Y = Average overland slope of watershed in percent.

S = Maximum retention in watershed as defined by:

$$S = \frac{1000}{CN} - 10$$

CN = SCS Curve Number for watershed as defined by the SCS Loss Method.

For developed areas, times of concentration for overland flow should 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 (travel time) for channel and pipe flow shall be using flow velocity computed by the Manning's equation. Normally, pipes are assumed to be flowing full.

- D. Runoff Curve Numbers (CN) for both existing and proposed conditions to be used in the soil cover complex method shall be obtained from the publication Urban Hydrology for Small Watersheds, NRCS, TR-55, current edition.
- E. Runoff coefficient (c) for both existing and proposed conditions for use in the rational method shall be obtained from the Pennsylvania Department of Transportation publication Design Manual Part 2 Highway Design Publication 13M, current edition.
- F. 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 shall be obtained from the Pennsylvania Department of Transportation publication Design Manual Part 2 Highway Design Publication 13M, current edition.

- G. Outlet structures for storm water 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 storm water 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.
- I. For drainage areas greater than 20 acres in size, 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.
- J. The Municipality may require that computed existing runoff rates be reconciled (calibrated) with field observations and site history. Calibration should be based on detailed data, preferably rainfall and stream gage records, for the particular site in question.

**SECTION 309. 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 Adams 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 BMPs are proposed and include the following:
  - 1. Areas proposed for infiltration BMPs shall be protected from sedimentation and compaction during the construction phase, so as to maintain their maximum infiltration capacity.
  - 2. Infiltration BMPs shall not be constructed nor receive runoff until the entire contributory drainage area to the infiltration BMP has received final stabilization.

# ARTICLE IV - DRAINAGE PLAN REQUIREMENTS

## SECTION 401. GENERAL REQUIREMENTS

For any of the activities regulated by this Ordinance and not eligible for the exemptions provided in Section 301, the final approval of subdivision and/or land development plans, the issuance of any building or occupancy permit, or the commencement of any land disturbance activity may not proceed until the Property Owner or Developer or his/her agent has received written approval of a Drainage Plan from the Municipality.

The following items shall be included in the Drainage Plan:

- A. General
  - 1. Name and location address of the project site.
  - 2. General description of project.
  - 3. General description of permanent storm water management techniques, including construction specifications of the materials to be used for storm water management facilities.
  - 4. Complete hydrologic, hydraulic, and structural computations for all storm water management facilities.
  
- B. Map(s) of the project area shall be submitted on 24-inch x 36-inch or 30-inch x 42-inch sheets and shall be prepared in a form that meets the requirements for recording the offices of the Recorder of Deeds of Adams County. The contents of the maps(s) shall include, but not be limited to:
  - 1. The location of the project relative to highways, municipalities or other identifiable landmarks.
  - 2. Existing contours at intervals of two feet. In areas of steep slopes (greater than 15 percent), five-foot contour intervals may be used.
  - 3. Existing streams, lakes, ponds, or other bodies of water within the project area.
  - 4. Other physical features including flood hazard boundaries, sinkholes, streams, existing drainage courses, areas of natural vegetation to be preserved, and the total extent of the upstream area draining through the site.
  - 5. The locations of all existing and proposed utilities, sanitary sewers, and water lines within 50 feet of property lines.

6. An overlay showing soil names and boundaries.
7. Proposed changes to the land surface and vegetative cover, including the type and amount of impervious area that would be added.
8. Proposed structures, roads, paved areas, and buildings.
9. Final contours at intervals at two feet. In areas of steep slopes (greater than 15 percent), five-foot contour intervals may be used.
10. The name of the development, the name and address of the owner of the property, and the name of the individual or firm preparing the plan.
11. The date of submission.
12. A graphic and written scale of one (1) inch equals no more than fifty (50) feet; for tracts of twenty (20) acres or more, the scale shall be one (1) inch equals no more than one hundred (100) feet.
13. A North arrow.
14. The total tract boundary and size with distances marked to the nearest foot and bearings to the nearest degree.
15. Existing and proposed land use(s).
16. A key map showing all existing man-made features beyond the property boundary that would be affected by the project.
17. Horizontal and vertical profiles of all open channels, including hydraulic capacity.
18. Overland drainage paths.
19. A fifteen foot wide access easement around all storm water management facilities that would provide ingress to and egress from a public right-of-way.
20. A note on the plan indicating the location and responsibility for maintenance of storm water management facilities that would be located off-site. All off-site facilities shall meet the performance standards and design criteria specified in this Ordinance.
21. A construction detail of any improvements made to sinkholes and the location of all notes to be posted, as specified in this Ordinance.

22. A statement, signed by the landowner, acknowledging the storm water management system to be a permanent fixture that can be altered or removed only after approval of a revised plan by the Municipality.
23. The following signature block for the Municipality, if the Drainage Plan is not part of a subdivision and/or land development plan:

“Reviewed and approved this \_\_\_\_ day of \_\_\_\_\_, 20\_\_.

\_\_\_\_\_  
Chair or Secretary”

24. The location of all erosion and sedimentation control facilities.

C. Supplemental Information

1. A written description of the following information shall be submitted.
  - a) The overall storm water management concept for the project.
  - b) Storm water runoff computations as specified in this Ordinance.
  - c) Storm water management techniques to be applied both during and after development.
  - d) Expected project time schedule.
2. A soil erosion and sedimentation control plan, where applicable, as prepared for and submitted to the approval authority.
3. A geologic assessment of the effects of runoff on sinkholes as specified in this Ordinance.
4. The effect of the project (in terms of runoff volumes and peak flows) on adjacent properties and on any existing municipal storm water collection system that may receive runoff from the project site.

D. Storm Water Management Facilities

1. All storm water management facilities must be located on a plan and described in detail.
2. When groundwater recharge methods such as seepage pits, beds or trenches are used, the locations of existing and proposed septic tank infiltration areas and wells must be shown.
3. All calculations, assumptions, and criteria used in the design of the storm water management facilities must be shown.

## **SECTION 402. DRAINAGE PLAN CONTENTS**

The Drainage Plan shall consist of all applicable calculations, maps, and plans. A note on the maps shall refer to the associated computations and erosion and sedimentation control plan by title and date. The cover sheet of the computations and erosion and sedimentation control plan shall refer to the associated maps by title and date. All Drainage Plan materials shall be submitted to the Municipality in a format that is clear, concise, legible, neat, and well organized; otherwise, the Drainage Plan shall be disapproved and returned to the Applicant.

## **SECTION 403. DRAINAGE PLAN SUBMISSION**

For all activities regulated by this Ordinance and that require preparation of a Drainage Plan, the steps below shall be followed for submission of the Drainage Plan. Permits issued for activities regulated under applicable local, state, or federal regulations shall become part of the Drainage Plan.

- A. The Drainage Plan shall be submitted by the Developer as part of the Preliminary Plan submission for the Regulated Activity.
- B. Four (4) copies of the Drainage Plan shall be submitted.
- C. Distribution of the Drainage Plan will be as follows:
  - 1. Two (2) copies to the Municipality accompanied by the requisite Municipal Review Fee, as specified in this Ordinance.
  - 2. One (1) copy to the Municipality(ies).
  - 3. One (1) copy to the County Planning Commission/Office when in conjunction with a subdivision or land development plan as defined by the Municipalities Planning Code.

#### **SECTION 404. DRAINAGE PLAN REVIEW**

- A. The Municipality shall review the Drainage Plan for consistency with this Ordinance. The Municipality shall require receipt of a complete plan, as specified in this Ordinance.
- B. The Municipality shall review the Drainage Plan for any submission or land development against the municipal subdivision and land development ordinance provisions not superseded by this Ordinance.
- C. For activities regulated by this Ordinance, the Municipality shall determine within 90 calendar days whether the Drainage Plan is consistent with this Ordinance. Should the Drainage Plan be determined to be consistent with this Ordinance, the Municipality will forward an approval letter to the Developer.
- D. Should the Drainage Plan be determined to be inconsistent with this Ordinance, the Municipality will forward a disapproval letter to the Developer citing the reason(s) for the disapproval. Any disapproved Drainage Plans may be revised by the Developer and resubmitted consistent with this Ordinance.
- E. For Regulated Activities requiring a PADEP Joint Permit Application, the Municipality shall notify PADEP whether the Drainage Plan is consistent with this Ordinance and forward a copy of the review letter to the Municipality and the Developer. PADEP may consider the Municipality's review comments in determining whether to issue a permit.
- F. The Municipality shall not approve any subdivision or land development for Regulated Activities specified in Sections 104.A and 104.B of this Ordinance if the Drainage Plan has been found to be inconsistent with this Ordinance, as determined by the Municipality. All required permits from PADEP must be obtained prior to approval.
- G. The Municipal Building Permit Office shall not issue a building permit for any Regulated Activity specified in Section 104 of this Ordinance if the Drainage Plan has been found to be inconsistent with this Ordinance, as determined by the Municipality, or without considering the comments of the Municipality. All required permits from PADEP must be obtained prior to issuance of a building permit.
- H. The Developer shall be responsible for completing an "As-Built Survey" of all storm water management facilities included in the approved Drainage Plan. The As-Built Survey and an explanation of any discrepancies with the design plans shall be submitted to the Municipality for final approval. In no case shall the Municipality approve the As-Built Survey until the Municipality receives a copy

of an approved Declaration of Adequacy, Highway Occupancy Permit from the PADOT District Office, and any applicable permits from PADEP.

- I. The Municipality's approval of a Drainage Plan shall be valid for a period not to exceed 5 years. This 5 -year time period shall commence on the date that the Municipality signs the approved Drainage Plan. If storm water management facilities included in the approved Drainage plan have not been constructed, or if an As-Built Survey of these facilities has not been approved within this 5 -year time period, then the Municipality may consider the Drainage plan disapproved and may revoke any and all permits. Drainage Plans that are considered disapproved by the Municipality shall be resubmitted in accordance with Section 407 of this Ordinance.

#### **SECTION 405. MODIFICATION OF PLANS**

A modification to a submitted Drainage Plan for a development site that involves a change in storm water management facilities or techniques, or that involves the relocation or re-design of storm water management facilities, or that is necessary because soil or other conditions are not as stated on the Drainage Plan as determined by the Municipality, shall require a resubmission of the modified Drainage Plan consistent with Section 404 of this Ordinance and be subject to review as specified in Section 405 of this Ordinance.

A modification to an already approved or disapproved Drainage Plan shall be submitted to the Municipality, accompanied by the applicable review. A modification to a Drainage Plan for which the Municipality has not taken a formal action shall be submitted to the Municipality, accompanied by the applicable Municipality Review Fee.

**SECTION 406. RESUBMISSION OF DISAPPROVED DRAINAGE PLANS**

A disapproved Drainage Plan may be resubmitted, with the revisions addressing the Municipality's concerns documented in writing, to the Municipality in accordance with Section 404 of this Ordinance and be subject to review as specified in Section 405 of this Ordinance. The applicable Municipality Review Fee must accompany a resubmission of a disapproved Drainage Plan.

## **ARTICLE V - INSPECTIONS**

### **SECTION 501. SCHEDULE OF INSPECTIONS**

- A. The Municipality or the municipal assignee shall inspect all phases of the installation of the permanent storm water management facilities.
- B. During any stage of the work, if the Municipality determines that the permanent storm water management facilities are not being installed in accordance with this Ordinance, the Municipality shall revoke any existing permits until a revised Drainage Plan is submitted and approved, as specified in this Ordinance.

## **ARTICLE VI - FEES AND EXPENSES**

### **SECTION 601. GENERAL**

A Municipal Review fee shall be established by the Municipality to defray review costs incurred by the Municipality. The Applicant shall pay all fees.

### **SECTION 602. MUNICIPALITY DRAINAGE PLAN REVIEW FEE**

The Municipality shall establish a Review Fee Schedule by resolution of the municipal governing body based on the size of the Regulated Activity and based on the Municipality's costs for reviewing Drainage Plans. The Municipality shall periodically update the Review Fee Schedule to ensure that review costs are adequately reimbursed.

### **SECTION 603. EXPENSES COVERED BY FEES**

The fees required by this Ordinance shall, at a minimum, cover:

- A. Administrative/clerical Costs.
- B. The review of the Drainage Plan by the Municipality.
- C. The site inspections including, but not limited to, pre-construction meetings, inspections during construction of storm water facilities and appurtenances, and final inspection upon completion of the storm water facilities and drainage improvements.
- D. Any additional work required to monitor and enforce any permit provisions regulated by this Ordinance, correct violations, and assure proper completion of stipulated remedial actions.

## **ARTICLE VII-MAINTENANCE RESPONSIBILITIES**

### **SECTION 701. PERFORMANCE GUARANTEE**

The applicant shall provide a financial guarantee to the Municipality for the timely installation and proper construction of all storm water management controls as required by this Ordinance equal to the full construction cost of the required controls.

### **SECTION 702. MAINTENANCE RESPONSIBILITIES**

- A. The Drainage Plan for the development site shall contain an operation and maintenance plan prepared by the developer and approved by the Municipality. The operation and maintenance plan shall outline required routine maintenance actions and schedules necessary to insure proper operation of the facility(ies).
- B. The Drainage Plan for the development site shall establish responsibilities for the continuing operating and maintenance of all proposed storm water control facilities, consistent with the following principals:
- C. If a development consists of structures or lots which are to be separately owned and in which streets, sewers and other public improvements are to be dedicated to the Municipality, storm water control facilities may also be dedicated to and maintained by the Municipality; however, nothing in this Ordinance shall require the Municipality to accept such dedications, and responsibility for maintaining the facilities shall not transfer to the Municipality unless such a dedication is formally accepted by the Municipality.
- D. If a development site is to be maintained in a single ownership or if sewers and other common improvements are to be privately owned and maintained, then the ownership and maintenance of storm water control facilities shall be the responsibility of the owner or private management entity. For privately owned stormwater management facilities, all operation and maintenance responsibilities, including an identification of the party or parties responsible, must be contained in a written document that is recorded in the Office of the Recorder of Deeds of Adams County, Pennsylvania. Such document shall be indexed so that the responsibilities and duties for such facilities will be found in the course of a title search of any lot, tract, or portion of the property served by the facilities.
- E. The governing body of the Municipality, shall make the final determination on the continuing maintenance responsibilities prior to final approval of the Drainage Plan. The governing body may require a dedication of such facilities as part of the requirements for approval of the Drainage Plan. Such a requirement is not an

indication that the Municipality will accept the facilities. The governing body reserves the right to accept the ownership and operating responsibility for any or all of the storm water management controls.

### **SECTION 703. MAINTENANCE AGREEMENT FOR PRIVATELY OWNED STORM WATER FACILITIES**

- A. Prior to final approval of the site's storm water management plan, the property owner shall sign and record a maintenance agreement covering all storm water control facilities that are to be privately owned. Said agreement, designated as Appendix C, is attached and made part hereto.
- B. Other items may be included in the agreement where determined necessary to guarantee the satisfactory maintenance of all facilities. The maintenance agreement shall be subject to the review and approval of the municipal solicitor and governing body.

### **SECTION 704. MUNICIPAL STORM WATER MAINTENANCE FUND**

- A. If storm water facilities are accepted by the Municipality for dedication, persons installing storm water storage facilities shall be required to pay a specified amount to the Municipal Storm Water Maintenance Fund to help defray costs of periodic inspections and maintenance expenses. The amount of the deposit shall be determined as follows:
  - 1. If the storage facility is to be owned and maintained by the Municipality, the deposit shall cover the estimated costs for maintenance and inspections for ten (10) years. The Municipality will establish the estimated costs utilizing information submitted by the applicant.
  - 2. The amount of the deposit to the fund shall be converted to present worth of the annual series values. The Municipality shall determine the present worth equivalents, which shall be subject to the approval of the municipal governing body.
- B. If a storage facility is proposed that also serves as a recreation facility (e.g. ballfield, lake), the Municipality may reduce or waive the amount of the maintenance fund deposit based upon the value of the land for public recreation purpose.
- C. If at some future time a storage facility (whether publicly or privately owned) is eliminated due to the installation of storm sewers or other storage facility, the unused portion of the maintenance fund deposit will be applied to the cost of

abandoning the facility and connecting to the storm sewer system or other facility. Any amount of the deposit remaining after the costs of abandonment are paid will be returned to the depositor.

**SECTION 705. POST-CONSTRUCTION MAINTENANCE  
INSPECTIONS**

- A. Basins should be inspected by the land owner/developer or responsible entity (including the Municipality for dedicated facilities) on the following basis:
  - 1. Annually for the first 5 years.
  - 2. Once every 3 years thereafter,
  - 3. During or immediately after the cessation of a 100-year or greater storm event.
  
- B. The entity conducting the inspection should be required to submit a report to the Municipality regarding the condition of the facility and recommending necessary repairs, if needed.

## **ARTICLE VIII-ENFORCEMENT AND PENALTIES**

### **SECTION 801. RIGHT-OF-ENTRY**

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

### **SECTION 802. NOTIFICATION**

In the event that a person fails to comply with the requirements of this Ordinance, or fails to conform to the requirements of any permit issued hereunder, the Municipality shall provide written notification of the violation. Such notification shall set forth the nature of the violation(s) and establish a time limit for correction of these violations(s). Failure to comply within the time specified shall subject such person to the penalty provision of this Ordinance. All such penalties shall be deemed cumulative and shall not prevent the Municipality from pursuing any and all other remedies. It shall be the responsibility of the owner of the real property on which any Regulated Activity is proposed to occur, is occurring, or has occurred, to comply with the terms and conditions of this Ordinance.

### **SECTION 803. ENFORCEMENT**

The municipal governing body is hereby authorized and directed to enforce all of the provisions of this ordinance. All inspections regarding compliance with the Drainage Plan shall be the responsibility of the Municipality or other qualified persons designated by the Municipality.

- A. A set of design plans approved by the Municipality shall be on file at the site throughout the duration of the construction activity. Periodic inspections may be made by the Municipality or designee during construction.
- B. Adherence to Approved Plan

It shall be unlawful for any person, firm or corporation to undertake any regulated activity under Section 104 on any property except as provided for in the approved Drainage Plan and pursuant to the requirements of this ordinance. It shall be unlawful to alter or remove any control structure required by the Drainage Plan pursuant to this ordinance or to allow the property to remain in a condition which does not conform to the approved Drainage Plan.

- C. At the completion of the project, and as a prerequisite for the release of the performance guarantee, the owner or his representatives shall:
1. Provide a certification of completion from an engineer, architect, surveyor or other qualified person verifying that all permanent facilities have been constructed according to the plans and specifications and approved revisions thereto.
  2. Provide a set of as built drawings.
- D. After receipt of the certification by the Municipality, a final inspection shall be conducted by the governing body or its designee to certify compliance with this ordinance.
- E. Suspension and revocation of Permits
1. Any permit issued under this ordinance may be suspended or revoked by the governing body for:
    - a) Non-compliance with or failure to implement any provision of the permit.
    - b) A violation of any provision of this ordinance or any other applicable law, ordinance, rule or regulation relating to the project.
    - c) The creation of any condition or the commission of any act during construction or development which constitutes or creates a hazard or nuisance, pollution or which endangers the life or property of others, or as outlined in Article IX of this ordinance.
  2. A suspended permit shall be reinstated by the governing body when:
    - a) The Municipality or his designee has inspected and approved the corrections to the storm water management and erosion and sediment pollution control measure(s), or the elimination of the hazard or nuisance, and/or;
    - b) The governing body is satisfied that the violation of the ordinance, law, or rule and regulation has been corrected.
    - c) A permit, which has been revoked by the governing body, cannot be reinstated. The applicant may apply for a new permit under the procedures outlined in this Ordinance.

F. Occupancy Permit

An occupancy permit shall not be issued unless the certification of compliance has been secured. The occupancy permit shall be required for each lot owner and/or developer for all subdivisions and land development in the Municipality.

**SECTION 804. PUBLIC NUISANCE**

- A. The violation of any provision of this ordinance is hereby deemed a Public Nuisance.
- B. Each day that a violation continues shall constitute a separate violation

**SECTION 805. PENALTIES**

- A. A violation of this Ordinance may be punished as provided by the Second Class Township Code of the Commonwealth of Pennsylvania as a violation of a building, housing, property maintenance, health, water pollution, or public safety code ordinance. Each day's violation shall be deemed a separate offense.
- B. In addition, the Municipality, through its solicitor, 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 any 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.

**ENACTED and ORDAINED** this 12th day of June, 2006.

TOWNSHIP OF GERMANY

Attest:

/s/ Richard A. Valko  
Chairman

/s/ David H. Krebs  
Its Secretary

/s/ John K. Lee  
Supervisor

/s/William T. Ridinger  
Supervisor

## ORDINANCE APPENDIX A

### EXAMPLE VOLUME CONTROL STANDARD CALCULATIONS

#### Example 1 Example Calculation of Runoff Capture Volume Requirement

**Given:**

*BMP CN:* CN for individual land covers based on Table 2.2a (TR-55, SCS, 1986).  
Hydrologic Soil Group = B

**Procedure:**

**Step 1:** For the pre-development condition, determine percentage of each land cover occurring on the site and the CN associated with each land cover.

Land Cover	HSG	CN	% of Site	Land Coverage (ft <sup>2</sup> )
Open space (good condition)	B	61	55	32,670
Woods (fair condition)	B	55	45	10,890

**Step 2:** Calculate the pre-development composite CN using a weighted average technique.

$$CN = \frac{61 * 32,670 + 55 * 10,890}{32,670 + 10,890}$$

$$CN = 59.5$$

**Step 3:** Calculate the required Runoff Capture Volume.

$$P = \text{Runoff Capture Volume} = \frac{200}{CN} - 2$$

$$P = \text{Runoff Capture Volume} = \frac{200}{59.5} - 2$$

$$P = \text{Runoff Capture Volume} = 1.36 \text{ inches}$$

For this hypothetical site, 1.36 inches of rainfall must be retained/infiltrated on the site.

**Example 2**  
**BMP CN Calculation**

**Given:**

*BMP CN:* CN for individual land covers based on Table 2.2a (TR-55, SCS, 1986).  
Hydrologic Soil Group = B

**Procedure:**

**Step 1:** Determine percentage of each land cover occurring on the site and the CN associated with each land cover.

Land Cover	HSG	CN	% of Site	Land Coverage (ft <sup>2</sup> )
Impervious (directly connected)	B	98	5	2,178
Impervious (unconnected)	B	98	10	4,356
Pervious pavement	B	70	5	2,000
Open space (good condition)	B	61	55	24,136
Woods (fair condition)	B	55	25	10,890

**Step 2:** Calculate the composite custom CN.

$$CN_c = \frac{CN_1 A_1 + CN_2 A_2 \dots + CN_j A_j}{A_1 + A_2 \dots + A_j}$$

$$CN_c = \frac{98 \times 2,178 + 98 \times 4,356 + 70 \times 2,000 + 61 \times 24,136 + 55 \times 10,890}{2,178 + 4,356 + 2,000 + 24,136 + 10,890}$$

$$CN_c = 65.4$$

**Step 2:** Calculate the BMP development CN based on the connectivity of site imperviousness.

$$CN_p = \frac{70 \times 2,000 + 61 \times 24,136 + 55 \times 10,890}{2,000 + 24,136 + 10,890}$$

$$CN_p = 59.7$$

$$R = \frac{10}{15}$$

$$R = 0.67$$

$$CN_c = CN_p + \left( \frac{P_{imp}}{100} \right) \times (98 - CN_p) \times (1 - 0.5R)$$

$$CN_c = 59.7 + \left( \frac{15}{100} \right) \times (98 - 59.7) \times (1 - 0.5 \times 0.67)$$

$$CN_c = 63.5$$

### Example 3

#### Runoff Volume Calculation

**Given:** Runoff Control Volume Requirement (Example 1) = 1.38 inches.  
Post development composite runoff curve number = 63.5 (Example 2)  
Development area = 43,560 square feet (Example 3)

$$\begin{array}{l|l} S = \frac{1000}{CN} - 10 & Q(\text{inches}) = \frac{(P - 0.2S)^2}{(P + 0.8S)} \\ S = \frac{1000}{63.5} - 10 & Q(\text{inches}) = \frac{(1.36 - 0.2 \times 5.7)^2}{(1.36 + 0.8 \times 5.7)} \\ S = 5.7 & Q(\text{inches}) = 0.01 \text{ inches} \end{array}$$

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$$Q(\text{cubic feet}) = Q(\text{inches}) \times \frac{1 \text{ foot}}{12 \text{ inches}} \times \text{Area}$$

$$Q(\text{cubic feet}) = 0.01 \times \frac{1 \text{ foot}}{12 \text{ inches}} \times 43,560 \text{ square feet}$$

$$Q(\text{cubic feet}) = 36 \text{ cubic feet}$$

P = Required Runoff Control Precipitation Volume

For this hypothetical case, P = 1.36 inches (Example 1)

CN = post-development runoff curve number

For this hypothetical case, CN = 63.5 (Example 2)

Area = Development site area (square feet)

For this hypothetical case, Area = 43,560 (Example 2)

Q = "excess" runoff volume to be controlled by supplementary runoff volume control BMPs

Therefore: Approximately 36 cubic feet of runoff volume must be controlled using supplemental structural runoff volume control BMPs.

## ORDINANCE APPENDIX B

### LOW IMPACT DEVELOPMENT PRACTICES

#### ALTERNATIVE APPROACH FOR MANAGING STORM WATER RUNOFF

Natural hydrologic conditions may be altered radically by poorly planned development practices, such as introducing unneeded impervious surfaces, destroying existing drainage swales, constructing unnecessary storm sewers, and changing local topography. A traditional drainage approach of development has been to remove runoff from a site as quickly as possible and capture it in a detention basin. This approach leads ultimately to the degradation of water quality as well as expenditure of additional resources for detaining and managing concentrated runoff at some downstream location.

The recommended alternative approach is to promote practices that will minimize post-development runoff rates and volumes, which will minimize needs for artificial conveyance and storage facilities. To simulate pre-development hydrologic conditions, forced infiltration is often necessary to offset the loss of infiltration by creation of impervious surfaces. The ability of the ground to infiltrate depends upon the soil types and its conditions.

Preserving natural hydrologic conditions requires careful alternative site design considerations. Site design practices include preserving natural drainage features, minimizing impervious surface area, reducing the hydraulic connectivity of impervious surfaces, and protecting natural depression storage. A well-designed site will contain a mix of all those features. The following describes various techniques to achieve the alternative approach:

- **\*Preserving Natural Drainage Features.** Protecting natural drainage features, particularly vegetated drainage swales and channels, is desirable because of their ability to infiltrate and attenuate flows and to filter pollutants. However, this objective is often not accomplished in land development. In fact, commonly held drainage philosophy encourages just the opposite pattern -- streets and adjacent storm sewers typically are located in the natural headwater valleys and swales, thereby replacing natural drainage functions with a completely impervious system. As a result, runoff and pollutants generated from impervious surfaces flow directly into storm sewers with no opportunity for attenuation, infiltration, or filtration. Developments designed to fit site topography also minimizes the amount of grading on site.
- **Protecting Natural Depression Storage Areas.** Depressional storage areas have no surface outlet, or drain very slowly following a storm event. They can be commonly seen as ponded areas in farm fields during the wet season or after large runoff events. Traditional development practices eliminate these depressions by

- filling or draining, thereby obliterating their ability to reduce surface runoff volumes and trap pollutants. The volume and release-rate characteristics of depressions should be protected in the design of the development site. The depressions can be protected by simply avoiding the depression or by incorporating its storage as additional capacity in required detention facilities.
- **Avoiding introduction of impervious areas.** Careful site planning should consider reducing impervious coverage to the maximum extent possible. Building footprints, sidewalks, driveways and other features producing impervious surfaces should be evaluated to minimize impacts on runoff.
  - **Reducing the Hydraulic Connectivity of Impervious Surfaces.** Impervious surfaces are significantly less of a problem if they are not directly connected to an impervious conveyance system (such as storm sewer). Two basic ways to reduce hydraulic connectivity are routing of roof runoff over lawns and reducing the use of storm sewers. Site grading should promote increasing travel time of storm water runoff, and should help reduce concentration of runoff to a single point in the development.
  - **Routing Roof Runoff Over Lawns.** Roof runoff can be easily routed over lawns in most site designs. The practice discourages direct connections of downspouts to storm sewers or parking lots. The practice also discourages sloping driveways and parking lots to the street. By routing roof drains and crowning the driveway to run off to the lawn, the lawn is essentially used as a filter strip.
  - **Reducing the Use of Storm Sewers.** By reducing use of storm sewers for draining streets, parking lots, and back yards, the potential for accelerating runoff from the development can be greatly reduced. The practice requires greater use of swales and may not be practical for some development sites, especially if there are concerns for areas that do not drain in a “reasonable” time. The practice requires educating local citizens and public works officials, who expect runoff to disappear shortly after a rainfall event.
  - **Reducing Street Widths.** Street widths can be reduced by either eliminating on-street parking or by reducing roadway widths. Municipal planners and traffic designers should encourage narrower neighborhood streets which ultimately could lower maintenance.
  - **Limiting Sidewalks to One Side of the Street.** A sidewalk on one side of the street may suffice in low-traffic neighborhoods. The lost sidewalk could be replaced with bicycle/recreational trails that follow back-of-lot lines. Where appropriate, backyard trails should be constructed using pervious materials.
  - **Using Permeable Paving Materials.** These materials include permeable interlocking concrete paving blocks or porous bituminous concrete. Such materials should be considered as alternatives to conventional pavement surfaces, especially for low use surfaces such as driveways, overflow parking lots, and emergency access roads.

- **Reducing Building Setbacks.** Reducing building setbacks reduces driveway and entry walks and is most readily accomplished along low-traffic streets where traffic noise is not a problem.
- **Constructing Cluster Developments.** Cluster developments can also reduce the amount of impervious area for a given number of lots. The biggest savings is in street length, which also will reduce costs of the development. Cluster development clusters the construction activity onto less-sensitive areas without substantially affecting the gross density of development.