

**TOWNSHIP OF BENNER**

**CENTRE COUNTY**

**STORMWATER MANAGEMENT ORDINANCE**

**Ordinance No. 58, February 1, 1993**

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## **CENTRE REGION STORMWATER**

### **COMMITTEE MEMBERS**

Gert Aron, Resident

Kent Baker, College Township

Mike Barr, Halfmoon Township

Stan Hoy, Harris Township

John Miknis, Patton Township

Lloyd Niemann, Penn State

Ron Seybert, Ferguson Township

Amy J. Story, Benner Township

Wes Wagner, State College Borough

## **ORDINANCE NO. 58**

### **REGULATING, RESTRICTING, AND DETERMINING THE RATE AND METHOD OF CONTROLLING STORMWATER RUNOFF RESULTING FROM THE DEVELOPMENT, USE, AND ALTERATION OF LAND; REQUIRING PLANS AND OTHER INFORMATION TO BE SUBMITTED FOR MUNICIPAL REVIEW AND APPROVAL OF SUCH METHODS; AND, PROVIDING FOR THE ADMINISTRATION AND ENFORCEMENT OF THE ORDINANCE.**

**WHEREAS**, Stormwater Management consists of the planning, design, and control of the conveyance and storage of surface waters resulting from precipitation. Major objectives are the protection of water quality, the prevention of flooding and erosion, and the promotion of the natural recharge of groundwater. Stormwater management continues to be of concern in the Centre Region as population increases and new land developments place increasing demands upon natural environmental resources and processes. The interrelationship of the entire hydrologic cycle has led to the recognition that only a comprehensive program of stormwater management can effectively solve the many problems associated with runoff.

The Pennsylvania Stormwater Management Act was enacted in 1978 to address these crucial issues. The General Assembly found that inadequately managed stormwater runoff is disruptive to the natural drainage system, is costly, and threatens public health and safety. The Act states that:

- (1) Inadequate management of accelerated runoff of stormwater resulting from development throughout a watershed increases flood flows and velocities, contributes to erosion and sedimentation, overtaxes the carrying capacity of streams and storm sewers, greatly increases the cost of public facilities to carry and control stormwater, undermines flood plain management and flood control efforts in downstream communities, reduces groundwater recharge, and threatens public health and safety.
- (2) A comprehensive program of stormwater management, including reasonable regulation of development and activities causing accelerated runoff, is fundamental to the public health, safety and welfare and the protection of the people of the Commonwealth, their resources and the environment.

The intent of the Act, therefore, is to encourage stormwater runoff planning and management, with the program administered locally, "consistent with the Commonwealth's duty as trustee of natural resources and the people's constitutional right to the preservation of...the environment." Moreover, the Act places major responsibility for managing stormwater on the landowner or developer, including implementing measures which will:

- (1) ..."assure that the maximum rate of stormwater runoff is no greater after development than prior to development activities", or
- (2) "manage the quantity, velocity, and direction of resulting stormwater runoff in a manner which otherwise adequately protects health and property from possible injury."

Recent increased pressure for new development within the Centre Region, and difficulties or deficiencies related to existing stormwater management practices, prompted a rewrite of the current ordinance, adopted in 1984. Deficiencies experienced with the existing ordinance included:

- \* Concentration of flows onto existing downstream properties and facilities.
- \* Increased frequency of runoff events, where previously few had occurred.
- \* Too much latitude in the application of existing computational and design criteria.
- \* Increased concerns regarding existing discharge to sinkholes and effects on groundwater recharge.
- \* Inadequate protection of natural drainage ways.
- \* Concerns with safety of stormwater facilities.
- \* Inadequate control of final facility construction and maintenance.

Revisions to the existing model ordinance were accomplished to incorporate current design standards, stormwater control criteria, and Best Management Practice guidelines.

It was recognized early within the revisions process that an effort should be made to redirect stormwater management from a site specific basis to a more comprehensive approach, allowing for future watershed level stormwater planning and management.

It is the intent of this model ordinance, which can be adopted by all the municipalities of the Centre Region, to accomplish the following goals:

1. To manage and control the quantity, velocity, and direction of post-development runoff to adequately protect health, safety, and property.
2. To mitigate damages from flood flows and velocities caused by new development.
3. To control erosion and sedimentation.

4. To prevent overtaxing the carrying capacity of streams and storm sewers.
5. To minimize the cost of public facilities needed to carry and control stormwater.
6. To augment the flood plain management and stormwater control efforts of downstream communities.
7. To maintain or increase the rate of groundwater recharge.
8. To maintain or improve the quality of groundwater for use by future generations using appropriate Best Management Practices.

**USE OF THE MODEL ORDINANCE**

The municipalities of the Centre Region are urged to incorporate stormwater management control legislation into their land development codes. This model ordinance can be adapted toward this end in three ways:

- (1) adopting it as a separate ordinance as written;
- (2) incorporating it into existing subdivision and zoning ordinances; or,
- (3) using it as a source of ideas and material for a municipality to prepare its own legislation.

**WHEREAS**, a Model Stormwater Management Ordinance for Municipalities in the Centre Region was prepared by GEO-Technical Services, Inc. and the Centre Region Stormwater Committee, comprised of representatives municipal engineers in Centre Region and the Pennsylvania State University, and

**WHEREAS**, the Centre Region Council of Government has forwarded this model stormwater ordinance to each of the municipalities in the vicinity of the Centre Region for adoption.

**NOW, THEREFORE BE IT ORDAINED**, by the Board of Supervisors of Benner Township, that the Stormwater Management Ordinance be enacted.

## **ARTICLE I**

### **GENERAL PROVISIONS**

#### **SECTION 1. SHORT TITLE.**

This Ordinance shall be known, and may be cited, as the "Benner Township Stormwater Management Ordinance".

#### **SECTION 2. PURPOSES.**

The purpose for which this Ordinance is enacted are:

- A. To carry out the purposes of the Municipalities Planning Code:
  - 1. To preserve natural values in the environment and to preserve forest, wetlands, aquifers and floodplains;
  - 2. To prevent loss of health, life or property from flood or other damage, from stormwater run-off.
  - 3. To preserve prime agriculture and farmland;
  
- B. To carry out the purpose of the Stormwater Management Act:
  - 1. To manage accelerated runoff of stormwater resulting from development;
  - 2. To protect the flood-carrying capacity of streams;
  - 3. To preserve natural stormwater run-off regimes;
  - 4. To protect and conserve ground waters and ground-water recharge areas.
  
- C. To carry out the powers of the Township under the Second Class Township Code:
  - 1. To protect against nuisances (53 P.S. 65712)
  - 2. To protect the health, comfort and safety of citizens of the Township (53 P.S. 65729)
  - 3. To provide for the good government and welfare of the Township and its trade, commerce and manufacturers.
  
- D. To carry out the duties of the Township under Article I, Section 27 of the Constitution of Pennsylvania:
  - 1. To preserve the natural, economic, scenic, aesthetic and recreational values of the environment.

#### **SECTION 3. AUTHORITY.**

This Ordinance is authorized by the following acts or constitutional provisions:

- A. Sections 604 and 605 of the Pennsylvania Municipalities Planning Code, 53 P.S. 10604 and 10605.

- B. Sections 2, 12, 13, 15 and 16 of the Pennsylvania Stormwater Management Act ;(32 P.S. 680.2, 680.12, 680.13, 680.15 and 680.16).
- C. Section 702 of the Second Class Township Code, cl 12 (Nuisances, 53 P.S. 65712); 29 (Public Health, 53 P.S. 65729); 41 (Ordinances, 53 P.S. 65741); 62 (General Powers, 53 P.S. 65762).
- D. Article I, Section 27 of the Constitution of the Commonwealth of Pennsylvania.

**SECTION 4. INTENT.**

This Ordinance is enacted for the following purposes:

- 4.1 To control accelerated runoff and erosion and sedimentation problems at their source by regulating activities which cause such problems; to utilize and preserve desirable existing natural drainage systems; to encourage recharge of groundwater; to prevent the watercourses in the municipality; to preserve and restore the flood carrying capacity of streams;
- 4.2 To provide for the design, installation, and proper maintenance of all permanent stormwater management structures which are constructed in the municipality;
- 4.3 To assure that the peak rate of stormwater runoff (peak discharge) is no greater after development than prior to development within any pre- development drainage subarea.
- 4.4 To minimize danger to public health and safety and damages to property by providing for management of stormwater runoff.

**SECTION 5. SCOPE.**

This Ordinance shall apply to all land and watercourses within the municipality in conjunction with the following activities: land development; land disturbance and alteration; construction of additional impervious surfaces, new structures, and additions to existing structures; changes or alterations of any watercourse or drainage way; diversion or piping of any natural or man-made stream channel; installation of stormwater systems or appurtenances thereto; and, logging or mining operations.

**SECTION 6. 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 7. RELATIONSHIP WITH OTHER RESTRICTIONS.**

Permits and approvals issued pursuant to this Ordinance do not relieve the applicant of the responsibility to secure required permits or approvals for activities regulated by any other applicable code, rule, act, or ordinance. If more stringent requirements concerning regulation of stormwater, erosion and sediment pollution control, and flood plain management are contained in the other code, rule, act, or ordinance, the more stringent regulation shall apply.

**SECTION 8. MUNICIPAL LIABILITY.**

The degree of stormwater management sought by the provisions of this article is considered reasonable for regulatory purposes. This article shall not create liability on the part of the Municipality, any appointed or elected official of the Municipality, the Centre County Conservation District, or any officer, engineer or employee thereof for any erosion, sedimentation or flood damages that result from reliance on this article or any administrative decision lawfully made thereunder.

**SECTION 9. DEFINITIONS.**

Definitions of terms used in this article may be found in Article VI.

**SECTION 10. REFERENCES:**

Specific methods and publications indicated in this Ordinance shall, in all cases, refer to the latest available edition and include revisions or amendments thereto.

## ARTICLE II

### STORMWATER MANAGEMENT PLAN REQUIREMENTS

#### SECTION 1. GENERAL REQUIREMENTS.

From and after the date of enactment of this Ordinance, a stormwater management plan and other information specified herein, shall be submitted to the Municipality for all lands subdivided or for which land development plans are prepared after the enactment of this Ordinance. A stormwater management plan and other information specified herein shall be submitted at the same time and together with submission of a preliminary subdivision or land development plan, along with a completed checklist supplied by the Municipality indicating the items contained within the submission.

Such plans and information shall be considered part of said zoning and subdivision documents and shall be reviewed in accordance with procedures established thereunder. Preliminary approval or final approval of a subdivision or land development plan, or the issuance of a zoning permit, shall be contingent upon the submission of a stormwater management plan and other materials specified herein, and approval of the stormwater management plan in accordance with provisions of this Ordinance.

All stormwater management plans shall be submitted to the Municipal Engineer for review and comment. Such review shall include a statement by the Municipal Engineer specifying the provisions of this Ordinance which have not been met by the plan as submitted.

Once a stormwater management plan has been approved together with a subdivision or land development plan approval, or together with the issuance of a zoning permit, said stormwater management plan shall be valid only for the subdivision, land development, or zoning permit approved. Any further development on the lot or lots requiring a revision of the approved plan or other construction or activities as defined by Municipal Zoning Regulations shall require the submission of a new, amended, or revised stormwater management plan and other information specified herein.

**1.1 Exemptions From Plan Preparation:** The following activities are specifically exempt from the plan preparation and submission provisions of this Ordinance, but remain subject to the design standards and criteria specified in Article III of this Ordinance (which include soil erosion requirements.)

- a. Land disturbances affecting less than 5,000 square feet.
- b. Land disturbance associated with the construction or alteration of one and two family dwellings, provided that the disturbance does not alter any stormwater conditions beyond the boundaries of the lot or alter provisions of a previously approved stormwater management plan for the lot or encompassing subdivision.

- c. Use of land for gardening for home consumption.
  - d. Agriculture.
  - e. Forest management operations.
- 1.2** Owner is responsible to bare all monetary costs for plan review, including Engineering and staff reviews.

**SECTION 2. PLAN CONTENT.**

The content of the plans shall consist of annotated maps, drawings, engineering plans, and construction details. Said plan shall be prepared by a registered professional engineer licensed in the State of Pennsylvania, with said preparer's seal and registration number affixed to the plan. Plans for tracts of less than 20 acres shall be drawn at a scale of one inch equals no more than 50 feet; for tracts of 20 acres or more, plans shall be drawn at a scale of one inch equals no more than 100 feet. Plans shall be submitted on the following sheet size: 36" x 42". All lettering shall be drawn to a size to be legible if the plans are reduced to half size. All sheets comprising a submission shall be on one size.

The following information, unless specifically exempted in writing by the Municipal Engineer, must be provided for stormwater management plan submission:

- a. The name of the proposed development and the name and address of the owner of the property and the individual or firm preparing the plan.
- b. Date of submission and revision.
- c. Graphic and written scale.
- d. North point.
- e. Total tract boundary with distances marked to the nearest foot and bearings to the nearest degree and total acreage of the tract.
- f. Key map showing all existing natural and man- made features beyond the property boundary affected by the project and the extent of the watershed or sub-basin which drains through the project site.
- g. Topographic conditions of both existing and proposed elevations at intervals of two (2) feet for land with an average natural slope of four (4) percent or less, and at intervals of five (5) feet for land with an average natural slope exceeding four (4) percent.

- h. Drainage areas and subareas affecting the site, including areas necessary to determine downstream impacts analysis, where required, for proposed stormwater management facility.
- i. Existing and proposed use, including the total area of impervious surfaces after construction.
- j. Existing soil types, Karst formations, flood plain boundaries, sinkholes, undrained depressions, rock outcrops, streams, drainage courses, wetlands based on existing sources and references, and vegetation.
- k. Complete drainage systems for the site, including details for construction. All existing drainage features which are to be incorporated in the design shall be so identified. If the site is to be developed in stages, a general drainage plan for the entire site shall be presented with the first stage and appropriate development stages for the drainage system shall be indicated.
- l. Location and selected plant material used for vegetative filter paths to sinkholes.
- m. If stormwater management facilities are off site, a note on the plan referring to location and agreements indicating responsibility for conveyance to and maintenance of the facilities; all such off-site facilities shall meet the design standards and criteria specified in Article III and details of the facilities shall be included with the plan. Details of the off-site facilities shall be included with the plan.
- n. Proposed easement locations, including drainage, maintenance, and access easements in conformance with Article III, Section 1.12 of this Ordinance.
- o. A statement, signed by the landowner, acknowledging the stormwater management system is to be maintained in accordance with the approved Ownership and Maintenance Program and remain a permanent fixture which can be altered or removed only after approval of a revised plan.
- p. The location of the permanent watercourse to which stormwater from the site will drain.
- q. The location of all erosion and sedimentation control facilities.

**2.18** Hydraulic capacity of all conveyance systems.

**2.19** The following signature block for the registered professional preparing the Stormwater Management Plan:

"I, \_\_\_\_\_, hereby certify that the stormwater management plan meets all design standards and criteria of the Benner Township Stormwater Management Ordinance."

**2.20** The following signature block for the Municipal Engineer reviewing the Stormwater Management Plan:

"I, \_\_\_\_\_, have reviewed this Stormwater Management Plan in accordance with the Design Standards and Criteria of the Benner Township Stormwater Management Ordinance."

**2.21** The following signature block for the Technician from the Centre County Conservation District reviewing the Soil Erosion and Sediment Pollution Control Plan:

"This plan appears adequate to meet State requirements on erosion and sediment pollution control and appears to adequately satisfy the requirements of Title 25, Chapter 102, the Erosion Control Regulations of the Pennsylvania Clean Streams Law.

---

Erosion & Sediment Pollution                      Date  
Control Technician

**SECTION 3. SUPPLEMENTAL INFORMATION.**

In addition to the plan information enumerated in Section 2 above, the following information shall be submitted:

**3.1** A written description of:

- a. The overall project concept;
- b. Stormwater runoff computations as specified in Article III, and in accordance with criteria contained in Appendix A:
  - 1. Capacities of all existing and proposed conveyance systems.
  - 2. Hydraulic, hydrologic, and structural computations for all proposed stormwater management facilities and measures.
- c. Stormwater controls both during and after development; and,
- d. Expected project time schedule.

- 3.2** The effect of the project on runoff volume, time to peak flow, and rate of flow on adjacent property and upon an existing municipal stormwater drainage system when such will be utilized.
- 3.3** Description of all watercourses, impoundments, and wetlands on or adjacent to the site or into which stormwater flows.
- 3.4** Soils investigation report, including boring logs, compaction requirements, and recommendations for construction of detention basins.
- 3.5** Karst Features Identification and Analysis Reports and a hydrogeologic assessment of the effects of runoff on sinkholes as specified in Article III, Sections 1.8(b), 2.3, 2.4.
- 3.6** A soil erosion and sediment pollution control plan, including all reviews and approvals, by the Pennsylvania Department of Environmental Resources and/or Centre County Conservation District.
- 3.7** All easements, deed restrictions, covenants, and maintenance measures of the system shall be outlined in an Ownership and Maintenance Program in accordance with Article III, Section 4 of this ordinance. For stormwater management systems to be dedicated to the municipality, a maintenance guarantee, as specified by the PA Municipalities Planning Code, may be required by the Township of Benner. The municipality has the explicit right to reject any Offer of Dedication.
- 3.8** All permits required by the Pennsylvania Department of Environmental Resources, Pennsylvania Department of Transportation, and Army Corps of Engineers and other regulatory agencies.

## ARTICLE III

### DESIGN STANDARDS AND CRITERIA

#### SECTION 1. DESIGN STANDARDS

All subdivision and land development activities involving an increase in impervious cover (i.e. reduction in permeability), shall be conducted in conformance with the following standards:

- 1.1** After installation of impervious cover, peak discharges for the 1, 10, and 100-year frequency storms from the site shall not exceed the respective peak discharge rates before development for all drainage areas and subareas.

Stormwater runoff shall be controlled so that no downstream increases in flood damages or impairment of streets and other public facilities occur. The Municipal Engineer may require that downstream impacts be evaluated at critical locations such as dams, tributaries, existing developments, undersized culverts, and flood prone areas. The applicant shall evaluate the effects of the proposed plan on such critical locations by providing computed water surface elevations (WSEL) for the 10 and 100-year storms. Methods of computation shall have prior approval of the Municipal Engineer. At such downstream critical locations, stormwater control may be exercised by:

- a. Providing off-site improvements to downstream conveyances in order to contain flow increases.
- b. Providing downstream drainage easements with sufficient widths to contain the flood limits.

The Municipality and its Engineer shall make the final determination with respect to the degree of control required for any site.

- 1.2** **Groundwater Recharge:** The Municipality may impose water quality control measures in accordance with Appendix A, Section IV to protect against ground or surface water pollution where the type of business or the nature of the runoff and soils underlying stormwater control facilities would constitute a substantial risk of contamination.

- 1.3** In establishing the watershed conditions for calculating runoff prior to development, the following assumptions shall apply:

- a. Woodland or meadow in good condition shall be used for all undeveloped areas.

- b. Average antecedent moisture conditions as defined by the Soil Conservation Service.
- c. Drainage area reductions equal to the area of undrained depressions or pond factor adjustments in accordance with the SCS TR 55 procedure shall be applied in determining pre-development peak discharges from Karst geologic areas as approved by the Township.

**1.4** Plans for facilities other than storm sewers should determine stormwater peak discharge and runoff by the use of the Soil Cover Complex Method. The Municipal Engineer may permit the use of the Modified Rational Method or other methods for calculation of the storage capacity of a stormwater control facility from drainage areas of fifty (50) acres or less.

- a. Acceptable runoff coefficient values for use in the Rational Method, and permissible curve numbers for TR 55, maximum velocities, and suggested roughness coefficients and permissible velocities for channels are identified in Tables A-2 through A-5 of Appendix A, Section I.
- b. The Rational Method may be used in lieu of the Soil Cover Complex Method to compute design flows for the sizing of storm sewers, inlets, and swales. Methods approved by the Pennsylvania Department of Transportation and/or Environmental Resources may be used to design the waterway areas of bridges.
- c. Rainfall amounts for the return periods specified shall be determined using the Pennsylvania Department of Transportation Intensity Duration Frequency Curves presented in Appendix A, Section I, as Figure A-1.
- d. In order to reduce runoff volumes from developed areas and encourage groundwater recharge, underground storage methods are permitted in those areas where soils, geologic, and water table conditions permit. Performance criteria which govern the location, design, construction, and maintenance of these infiltration facilities are contained in Appendix A, Section 4.

**1.5 Stormwater management facilities and related installations are provided:**

- a. To permit unimpeded flow of natural watercourses. Such flow may be redirected only if there are no practicable alternatives and subject to the approval of the Department of Environmental Resources and the Municipality.
- b. To insure adequate drainage of all low points along the curb line of streets.
- c. To intercept stormwater runoff along streets at intervals reasonably related to the extent and grade of the area drained, and to prevent substantial flow of

water across intersections or flooded intersections during storms, in accordance with the procedures contained in Design Manual Part 2 (DM-2), Chapter 10, of the Pennsylvania Department of Transportation.

- d. To insure adequate and unimpeded flow of stormwater under driveways in, near, or across natural water courses or drainage swales. Suitable swales or other waterways shall be provided as necessary.
- e. To properly drain stormwater runoff from all land development projects. All lot and open areas shall be designed to drain to the nearest practical street or drainage system, existing or proposed, as defined by the Municipal Engineer, with no impact on adjoining properties, unless an area specifically designed for stormwater detention is provided.

#### **1.6 Storm sewers and related installations:**

- a. Storm sewers, where required by zoning and land use densities, shall be placed under or immediately adjacent to the roadway side of the curb, or as directed by the Municipality, when parallel to the street within the right-of-way.

When located in undedicated land, they shall be placed within a drainage easement not less than twenty (20) feet wide as approved by the Municipal Engineer.

Storm sewers constructed in areas susceptible to sinkhole formation shall have water-tight joints to prevent exfiltration of stormwater into the surrounding soil.

The use of properly designed, graded, and turfed drainage swales is encouraged in lieu of storm sewers in commercial and industrial areas and, where approved by the Municipal Engineer, in residential areas. Such swales are to be stabilized through the use of erosion control fabrics and vegetation.

- b. The design capacity of storm sewer and drainage swales shall be determined in accordance with the ten (10) year frequency storm of the duration equal to the time of concentration. More stringent criteria may be required where a ten (10) year storm will aggravate existing problems or create new problems. Storm drainage systems shall be designed without surcharging inlets to provide controlled conveyance of the ten (10) year storm into a detention basin or similar facility utilized to control the rate of runoff. Conveyance of storms to the stormwater pond, up to and including the one hundred (100) year frequency, shall be provided so as not to endanger life or seriously damage property.
- c. Inlet types and inlet assemblies shall conform to the Pennsylvania Department of Transportation Standards for Roadway Construction as approved by the Municipal Engineer. Inlet tops shall be precast concrete top units with a 10"

hood or equivalent in order to place the inlet in a 2" sump condition and they shall be compatible with the type of curb installed.

1. Inlets shall, at a minimum, be located at the lowest point of street intersections to intercept the stormwater before it reaches pedestrian crossings; or at sag points of vertical curves in the street alignment which provide a natural point of ponding of surface stormwater. On curbed sections, a double inlet shall be placed at a low point on sag vertical curves.
2. Where the Municipality deems it necessary because of special land requirements, special inlets may be approved.
3. The interval between inlets collecting stormwater runoff shall be determined in accordance with DM-2, Chapter 10, Section 5, "Capacity of Waterway Areas".

In curbed sections, the maximum encroachment of water on the roadway pavement shall not exceed half of a through traffic lane or one (1) inch less than the depth of curb during the 10-year design storm of five (5) minute duration. Inlets shall be provided to control the encroachment of water on the pavement. When inlets are used in a storm system within the right-of-way limits of a street in lieu of manholes, the spacing of such inlets shall not exceed the maximum distance of four hundred fifty (450) feet.

- d. Accessible drainage structures shall be located on a continuous storm sewer system at all vertical dislocations, at all locations where a transition in storm sewer pipe sizing is required, at all vertical and horizontal angle points exceeding five (5) degrees, and at all points of convergence of two or more influent storm sewer mains. The construction locations of accessible drainage structures shall be as indicated on the subdivision drainage plan or area drainage plan approved by the Municipality.
  - e. When evidence available to the Municipality indicates that existing storm sewers have sufficient capacity as determined by hydrograph summation and are accessible, the subdivider may connect their stormwater facilities to the existing storm sewers so long as the peak rate of discharge does not exceed the amount.
- 1.7** Bridges and culverts shall have ample waterway to carry expected flows, based on a minimum storm frequency of ten (10) years for driveways; twenty-five (25) years for local streets; fifty (50) years for collector streets; and one hundred (100) years for arterials; or as required by the Municipal Engineer.

- a. The design criteria contained in this article are intended for use in conjunction with the Chapter 105 Regulations of the Pennsylvania Department of Environmental Resources entitled, "Water Obstructions and Encroachments". All information and regulations contained in Chapter 105 shall be considered to be incorporated into this article as if reproduced in full.

A DER permit in accordance with Chapter 105 shall be required for any obstruction or encroachment in the regulated waters of the Commonwealth, prior to the approval of the Stormwater Plan. In the event any question or conflict arises between this article and the DER Chapter 105 Regulations, the design criteria contained in the DER regulations shall govern.

- b. Refer to Appendix A, Section II for additional design criteria.

**1.8** Detention or retention basins for the control of stormwater peak discharges shall meet the following requirements:

- a. Basins shall be installed prior to or concurrent with any earthmoving or land disturbances which they will serve. The phasing of their construction shall be noted in the narrative and on the plan.
- b. The design of all facilities over limestone formations shall include measures to prevent groundwater contamination and, where required, sinkhole formation.
- c. Energy dissipators and/or level spreaders shall be installed at points where pipes or drainageways discharge to or from basins. Generally, outlet pipes designed to carry the predevelopment, one (1) year storm flow will be permitted to discharge to a stream with only an energy dissipator; discharges to drainage swales shall be spread with a level spreader or piped to an acceptable point of discharge downstream.
- d. Outlet structures within detention/retention basins shall be constructed of reinforced concrete or an approved alternate. With the exception of those openings designed to carry perennial stream flows, design openings shall have childproof, non-clogging trash racks over all openings twelve inches (12") or larger in any dimension. Outlet protection shall extend at a minimum to the toe of the basin slope. Where spillways will be used to control peak discharges in excess of the ten (10) year storm, the control weirs shall be constructed to withstand the pressures of impounded waters and convey flows at computed outlet velocities without erosion.

1. Detention facilities shall be designed to release their total volumes detained within the following maximum time periods:

Roofs, Parking Lots	24 hours
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Detention Basins	48 hours
Infiltration Facilities	72 hours

- e. When the Pennsylvania Department of Environmental Resources (DER) requires facilities to be permitted, the designer shall submit all information to the DER and obtain all necessary approvals and permits.
- f. Downstream Analysis:
  1. Where deemed necessary by the Municipal Engineer, the applicant shall submit an analysis of the impacts of detained stormwater flows on downstream areas within the watershed, established with the concurrence of the Municipal Engineer. The analysis shall include hydrologic and hydraulic calculations necessary to determine the impact of peak discharge modifications of the proposed development on critical locations such as dams, tributaries, existing developments, undersized culverts, and flood prone areas.
  2. Review and comment of the analysis by the Engineer of a downstream Municipality shall be obtained when stormwater management facilities are proposed within one thousand (1,000) feet of the affected downstream Municipality.
- g. Detention basins may be waived by the Municipality, upon recommendation of the Municipal Engineer, at sites in close proximity to larger receiving streams, depending on the hydrology of the watershed. This is to facilitate drainage prior to main stream flooding. It shall be incumbent upon the applicant to demonstrate that no downstream increase in stream flooding or channel erosion will result in accordance with Section 1.8(f) above, and that no increases in peak discharge within the receiving stream will occur as outlined under Section 1.1. All conveyance facilities between the project and the stream must have adequate capacity to safely pass the proposed ten (10) year storm, or greater if required by the Township, or they must be improved.
- h. Multiple Use Basins: The design and construction of multiple use stormwater detention facilities are strongly encouraged. In addition to stormwater management, facilities should where appropriate allow for recreational uses including: ballfields, play areas, picnic grounds, etc. Provision for parking facilities within basins and permanent wet ponds with stormwater management capabilities may also be appropriate. Prior approval and consultation with the Municipality are required before design.
- i. Multiple Development Basins: Stormwater management facilities designed to serve more than one property or development in the same watershed are encouraged. Staged construction of existing or proposed multiple-use detention

facilities by several developers in conjunction with watershed development is encouraged. Each developer shall be responsible for the incremental increase in runoff generated by the respective development and incremental construction improvements necessary for the overall detention facility. Prior approval and consultation with the Municipality is required before design of such facilities.

- j. Alternative Detention Facilities: Alternative stormwater detention facilities including roof top, subsurface basins or tanks and in-pipe detention storage, or other approved alternative designs are permitted as determined by the Municipal Engineer.
  - k. Specific criteria related to the design of detention basins is contained in Appendix A, Section III.
- 1.11** Natural drainageways shall be utilized to the maximum extent possible in carrying stormwater runoff, provided such use remains consistent with the purpose of this Ordinance specified in Article I, Section 2.
- 1.12** Stormwater management facilities located outside of existing or proposed right-of-ways shall be located within and accessible by easements as follows:
- a. Drainage Easements: Where a tract is traversed by a watercourse, drainageway, channel or stream, there shall be provided a drainage easement paralleling the line of such watercourse, drainageway, channel or stream. The width of the drainage easement will be adequate to preserve the unimpeded flow of natural drainage in the 100-year flood plain.  
  
Drainage easements shall provide for occasional maintenance and for the purpose of widening, deepening, improving or protecting such drainage facilities.
  - b. Access Easements: Where proposed stormwater management facilities are not adjacent to proposed or existing public right-of-ways or are not accessible due to physical constraints, as determined by the Municipal Engineer, a twenty (20) ft. wide passable access easement specifying rights of entry shall be provided. Access easements shall provide for vehicle ingress and egress.
  - c. Maintenance Easements: A maintenance easement shall be provided which encompasses the stormwater facility and appurtenances and provides for access for maintenance purposes. The maintenance easement must be located at least twenty (20) feet outside of the one hundred (100) year surface elevation and the stormwater facility and appurtenances.
  - d. Easements shall stipulate that no trees, shrubs, structures, excavation, or fill be placed, and no regrading be performed within the area of the easement without written approval from the Municipality upon review by the Municipal Engineer.

Upon approval of the Municipal Engineer, such landscaping may be placed in maintenance easements, provided it does not impede access.

- e. Whenever practicable, easements shall be parallel with and conjunctive to property lines of the subdivision.
- f. All easement agreements shall be recorded with a reference to the recorded easement indicated on the site plan.

## **SECTION 2. SINKHOLE PROTECTION.**

**2.1** Stormwater from roadways, parking lots, storm sewers, roof drains, or other concentrated runoff paths shall not be discharged directly into sinkholes without Township approval and without prior filtration in accordance with 2.2 below.

**2.2** Sinkholes capable of absorbing substantial amounts of stormwater shall be protected by diverting such runoff around the sinkhole or, upon recommended approval of the Municipal Engineer, by planting and maintaining a dense filter path of suitable vegetative material [Refer to Appendix A, Section V(D)] in such manner and location to disperse and slow the runoff to a sheet flow condition to promote the maximum possible filtration and sedimentation of impurities.

The filter path must be at least one hundred (100) ft. in length and twenty (20) feet in width. Ten (10) ft. wide filter paths are acceptable if land slope is less than two (2) percent.

Filter paths shall be designed and installed so that they filter sheet flow rather than concentrated flow. If concentrated flow occurs, grading and shaping or the use of best management practices such as grass waterways or drop structures may be required.

Sedimentation basins designed to DER Chapter 102 Standards or permanent stormwater storage criteria, whichever is larger, and proposed vegetative filter paths, in conjunction with temporary stone filter check dams, shall be installed prior to subdivision or land development construction activities, where sinkholes are used to accept stormwater discharges.

**2.3** If increased runoff is to be discharged into a sinkhole, even in filtered condition, a hydrogeologic assessment of the effects of such runoff on the increased risk of land subsidence and adverse impacts to existing sinkhole flood plains and groundwater quality shall be made by a qualified professional and submitted with the stormwater management plan. Such discharge shall be prohibited if the Municipal Engineer determines that such poses a hazard to life, property, or groundwater resources.

- 2.4 To protect sensitive Karst areas, the municipal engineer may require basins to contain an impervious liner. The liner may be of the impervious membrane type, placed in accordance with the manufacturer's recommendations, or consist of soils with suitable clay content, or may be constructed by mixing Bentonite, or an approved alternative, with existing soil available at the site as approved by the Municipal Engineer.

### **SECTION 3. EROSION AND SEDIMENT CONTROL.**

- 3.1 All plans for erosion and sediment pollution control (E&SPC) shall meet the requirements of The Clean Streams Law, Act of June 22, 1937, P.L. 1987 as amended, 35 P.S. 691.1, et.seq. & 25 PA Code 102.1 et.seq. Erosion Control. The Department of Environmental Resources, bureau of Soil and Water Conservation Erosion and Sedimentation Control Manual shall be used as the basis for E & S design.

The Centre County Conservation District has been delegated the authority by the PA Department of Environmental Resources to administer the Erosion & Sediment Pollution Control Program in Centre County. It shall be the responsibility of the land developer to submit the E&SPC Plan, Application, and other necessary material to the Conservation District. A copy of the transmittal letter shall be provided to the Municipality.

"Comments shall be received and E&SPC Plan approval obtained from the Conservation District prior to issuance of any building permits for construction within the area covered by the stormwater management plan."

### **SECTION 4. OWNERSHIP AND MAINTENANCE.**

- 4.1 Each stormwater management plan shall contain provisions which clearly set forth the ownership and maintenance responsibility of all permanent stormwater management and erosion and sediment control facilities. Including:

- a. Description of Maintenance Requirements.
- b. Establishment of suitable easements for access to all facilities by Public Officials, in accordance with Section 1.12 of this Article.
- c. Identification of the responsible party or entity for ownership and maintenance of both temporary and permanent stormwater management erosion control facilities. In meeting this requirement, the following options are hereby provided for upon approval by the Municipal Engineer:

Facilities may be incorporated within individual lots so that the respective lot owners will own and be responsible for maintenance in accordance with

recorded deed restriction. A description of the facility or system and the terms of the required maintenance shall be incorporated as part of the deed to the property.

Ownership and maintenance may be the responsibility of a Property Owners Association. The stated responsibilities of the Property Owners Association in terms of owning and maintaining the stormwater management facilities shall be submitted with final plans for determination of their adequacy, and upon their approval shall be recorded with the approved subdivision plan among the deed records of Centre County, Pennsylvania. In addition, the approved subdivision plan and any deed written from said plan for a lot or lots shown herein shall contain a condition that it shall be mandatory for the owner or owners of said lot to be members of said Property Owners Association.

It shall be the Township's responsibility to maintain any facilities that are dedicated to the Township. Upon completion of the facilities which the developer or owner wishes to dedicate ownership to the Township and before their acceptance by the Township, the applicant shall provide to the Township an amount determined by the Township which at a rate of 6% per annum, will provide sufficient interest income per year to cover the annual maintenance of such facilities, which the developer or owner wishes the Township to accept for future maintenance.

Example:           Maintenance \$250.00 per year = \$4,166.67 deposit  
                          Maintenance \$500.00 per year = \$8,333.33 deposit

Prior to the Township approving the final D/SWM Plan upon which the facilities are shown for dedication to the Township, the developer or owner shall provide to the Township satisfactory surety as approved by the Township Solicitor to ensure the payment of the said required maintenance amount at the completion of construction and prior to acceptance by the Township Engineer/Consultant.

## **SECTION 5. ADDITIONAL GENERAL CRITERIA.**

Compliance with the provisions of this Ordinance shall be in accordance with the following additional general criteria:

- 5.1 Materials Workmanship and Methods:** All materials, workmanship, and methods of work shall comply with the Pennsylvania Department of Transportation Form 408 Specifications, as accepted and commonly used by the Municipality, and shall be considered to be incorporated into this article as if copied in full. In the event a conflict arises between the requirements of this article and the Form 408 Specifications, the Municipal Engineer shall resolve the difference, and his opinion shall be binding.

- 5.2** **Record Set (As-Built) Plans:** At the completion of the project, and as a prerequisite for the release of the guarantee or issuance of an occupancy permit, the owner or his representative shall:
- a. Provide a certification of completion from a registered professional verifying that all permanent facilities have been constructed according to the plans and specifications and approved revisions thereto; and
  - b. Provide a set of approved stormwater management plan drawings showing all approved revisions, and elevations and inverts to all manholes, inlets, pipes, and stormwater control facilities.
- 5.3** Maintenance inspections may be performed by the Municipality to ensure proper functioning of all stormwater management facilities.
- 5.4** If the Municipality determines at any time that any permanent stormwater management control facility has been eliminated, altered, or improperly maintained, the owner of the property shall be advised of corrective measures required and given a reasonable period of time to take necessary action. If such action is not taken by the property owner, the Municipality may cause the work to be done and back charge all costs to the property owners in accordance with Article IV.
- 5.5** Supplemental standards and criteria technical reference materials incorporated into these controls for information and to govern the design and hydrologic control provisions of this Ordinance are contained in Appendix B.

## ARTICLE IV

### WAIVERS, VARIANCES AND APPEALS

#### SECTION 1. WAIVERS

- 1.1 Purpose:** The purpose of this section is to "cut red tape" and provide a procedure to permit the modification of specific technical requirements of the Ordinance where the effect of the modification is 1) to propose an alternative technical solution which, in the circumstances, is as practical and effective as the technical requirement in the Ordinance, or 2) to propose the waiver of a requirement which, because of circumstances, is of negligible importance (i.e., de minimis) in meeting the specific requirement of the Ordinance.
- 1.2 Request of Waiver:** A landowner may request a waiver of one or more specific technical requirements of the Ordinance applicable to the plan submitted. Such request for waiver shall be made in writing by the landowner or his agent to the municipal engineer. Such request shall specify each specific requirement of the ordinance, identifying the section of the ordinance, and stating the reasons that waiver is requested.
- 1.3 Engineer's Recommendations:** The municipal engineer shall review the request for waiver, and shall report thereon in writing to the landowner his recommendations.
- 1.4 Waiver:** Upon consideration of final approval of a stormwater management plan, the Board of Supervisors may waive specific technical requirements of this Ordinance upon receipt of the written recommendation of the municipal engineer. In order to qualify for waiver, the municipal engineer shall certify in writing that the proposed item recommended for waiver meets the requirements for waiver specified in Article IV, Section 1.1. above.
- 1.5 Disputes:** In the event of a dispute between the landowner and municipal engineer regarding the municipal engineer's recommendation as to a waiver, the Board of Supervisors shall consider the waiver at the time of final approval and may grant or deny the waiver after hearing both parties. It shall be presumed in all events that the requirements specified are valid, reasonable and binding upon all developments, and the only grounds of a granting of a waiver shall be: 1) uniqueness where, in the circumstances, an alternative technical solution is as practical and effective as the technical requirement in the ordinance; and 2) uniqueness, where because of the circumstances, meeting the specific requirement would be of negligible importance (i.e., de minimis), in meeting the specific requirement of the ordinance. In the event, a request for waiver is denied, the landowner may appeal to the zoning hearing board.

## **SECTION 2. VARIANCES AND APPEALS**

- 2.1 Appeals:** The landowner shall have the right to appeal from any decision of the Board of Supervisors granting, granting in part, granting subject to conditions, or denying approval of a plan. Said appeal shall be made by the landowner in writing to the Zoning Hearing Board of Benner Township pursuant to the provisions of the Pennsylvania Municipalities Planning Code.
- 2.2 Variances:** Variances may be requested by a landowner from the provisions of this Ordinance pursuant to the provisions of Article IX of the Pennsylvania Municipalities Planning Code, 53 P.S. 10901 et seq., relating to variances and procedures before zoning hearing boards.

## ARTICLE V

### VIOLATING, PENALTIES AND REMOVAL OF NUISANCES

#### SECTION 1. VIOLATIONS

- 1.1 Notice of Violation:** If it appears to the municipality that a violation of this Ordinance has occurred, the designated municipal representative shall cause a written notice to be served upon the owner, applicant, property manager, resident, or other person responsible for the property or the violation. The notice shall identify the specific violations, with a description of the items which have not been met, and citing the specific provisions of the Ordinance. The notice shall state the date before which steps for compliance must be commenced, and the date before which the steps must be completed. The notice shall notify the recipient of the right of appeal to the Zoning Hearing Board within 30 days in accordance with this Ordinance. The notice shall inform the recipient that failure to comply with the notice within the time specified, unless extended by appeal to the Zoning Hearing Board, constitutes a violation. The notice shall describe the possible sanctions for failure to comply.
- 1.2 Civil Penalty:** Any person, partnership or corporation who or which has violated or permitted the violation of the provisions of this ordinance shall, upon being found liable therefor in a civil enforcement proceeding commenced by a municipality, pay a judgment of not more than \$500 plus all court costs, including reasonable attorney fees incurred by a municipality as a result thereof. No judgment shall commence or be imposed, levied or payable until the date of the determination of a violation by the district justice. If the defendant neither pays nor timely appeals the judgment, the municipality may enforce the judgment pursuant to the applicable rules of civil procedure. Each day that a violation continues shall constitute a separate violation, unless the district justice determining that there has been a violation further determines that there was a good faith basis for the person, partnership, or corporation violating the ordinance to have believed that there was no such violation, in which event there shall be deemed to have been only one such violation until the fifth day following the date of the determination of a violation by the district justice and thereafter each day that a violation continues shall constitute a separate violation. All judgments, costs and reasonable attorney fees collected for the violation of this ordinance shall be paid over to the municipality whose ordinance has been violated.
- 1.3 Causes of Action:** The designated municipal representative, in addition to actions for civil penalties, may institute any appropriate action or proceeding to prevent, restrain, correct or abate the activity or situation constituting a violation or this Ordinance.

## **SECTION 2. REMOVAL OF PUBLIC NUISANCES**

- 2.1 Public Nuisance:** Any activity conducted in violation of this Ordinance is declared by State Law [Section 15 of the Pennsylvania Stormwater Management Act, 32 P.S. 680.15(a)] and by this Ordinance, to be a public nuisance.
- 2.2 Removal:** In the event that the owner, developer, occupant, applicant, property manager or other person responsible fails to comply with terms of the enforcement notice in the time specified therein by the designated municipal representative, the municipality may take actions necessary to remove the public nuisance. The costs of removal of the public nuisance shall be in addition to any civil penalties for violation or other actions.
- 2.3. Suits in Equity:** In addition to the penalties for violation and actions to remove public nuisances provided for by this Article, the municipality may institute proceedings in Courts of Equity to require owners and/or persons responsible to comply with the provisions of this Ordinance.
- 2.4. Lien:** The cost of removal, penalty, attorneys fees and costs herein above mentioned may be entered by the municipality as a lien against such property in accordance with existing provisions of law.

## ARTICLE VI

### DEFINITIONS

#### SECTION 1. LANGUAGE INTERPRETATIONS

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

- 1.1 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.
- 1.2 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.
- 1.3 The word "person" includes an individual, firm, association, organization, partnership, trust, company, corporation, or any other similar entity.
- 1.4 The words "shall" and "must" are mandatory; the words "may" and "should" are permissive.
- 1.5 The words "used" or "occupied" include the words "intended, designed, maintained, or arranged to be used or occupied".

#### SECTION 2. DEFINITIONS.

The following words and phrases when used in this Ordinance shall have, unless the context clearly indicates otherwise, the meanings given to them in this section. All words and terms not defined herein shall be used with a meaning of standard usage.

**ALLUVIAL SOILS:** Those areas delineated pursuant to the Centre County, Pennsylvania, Soil Survey, August 1981, and subsequent revisions.

**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 a zoning permit or subdivision approval.

**CARBONATE:** a sediment formed by the organic or inorganic precipitation of mineral compounds characterized by the fundamental chemical ion  $\text{CO}_3$ , the principle element in limestone and dolomite strata.

**CHANNEL:** a perceptible natural or artificial waterway which periodically or continuously contains moving water having a definite bed and banks which confine the water.

**CONSERVATION DISTRICT:** the Centre County Conservation District.

**CLOSED OR UNDRAINED DEPRESSION:** in a Karst geologic area, a distinct bowl-shaped depression in the land surface; size and amplitude are variable; drainage is internal. It differs from a sinkhole in that the ground surface is unbroken and usually occurs in greater density per unit area.

**DBH:** Diameter at Breast Height - the diameter of a tree at a height of four and one-half (4-1/2) feet above the ground, on the uphill side.

**DESIGN STORM:** the magnitude of precipitation from a storm event measured in probability of occurrence (e.g. 10-yr. storm) and duration (e.g. 24-hr.), and used in designing stormwater management control systems.

**DETENTION BASIN:** a pond or basin designed to retard stormwater runoff by temporarily storing the runoff and releasing it at a predetermined rate. A detention pond may be designed to drain completely after a storm event (dry pond), or it may be designed to contain a permanent pool of water (wet pond).

**DEVELOPER:** a person or persons, partnership, association, corporation or other entity, or any responsible person therein or agent thereof, who undertakes the activities covered by this Ordinance.

**EASEMENT:** a recorded agreement of right-of-way granted, but not dedicated, for limited use of private land for a public or quasi-public purpose, identified on the final plan, and within which the owner of the property shall not erect any permanent structures, but shall have the right to make any other use of the land which is not inconsistent with the rights of the grantee.

**EROSION:** the removal of soil, stone, and other surface materials by the action of natural elements.

**FLOOD PLAIN:** a flood plain or flood hazard area is that land, within the Municipality, adjoining any watercourse subject to a one hundred (100) year recurrence interval flood as delineated by: a study prepared by any Federal, State, or County agency; a registered professional engineer experienced in the preparation of hydrological and hydraulic studies and the determination of flood boundary lines; or the area denoted as having alluvial soils on the most recent soil survey of the Soil Conservation Service, United States Department of Agriculture.

**GABION:** a large rectangular box of heavy gage wire mesh which holds large cobbles and boulders. Used in streams and ponds to change flow patterns, stabilize banks, or prevent erosion.

**GEOLOGIC FORMATION:** the basic or fundamental rock stratigraphic unit in the local classification of rocks, consisting of a body of rock (usually a sedimentary stratum or strata but also igneous or metamorphic) generally characterized by some degree of internal lithologic homogeneity or distinctive lithologic features (such as chemical composition, structures, textures, gross aspect of fossils or time of deposition.) Typically used for mapping the geology of an area.

**GEOLOGIC MEMBER:** a rock stratigraphic unit which is subordinate (a subject) of a formation. This unit is not necessarily mappable and is usually a unified subdivision of local extent that may or may not be contained in more than one formation.

**GHOST LAKE:** a body of standing water occurring in a sinkhole or closed depression of a Karst region that is usually visible after sufficient precipitation has occurred. They may form from slow permeability of soils, rises in the water table or the development of a natural liner of slow permeable clays or soils.

**GRADING:** the act the excavating and/or filling land for the purpose of changing natural slope.

**GROUNDWATER RECHARGE:** replenishment of existing natural underground water supplies.

**IMPERVIOUS AREA:** impermeable surfaces, such as pavement or rooftops, which limits the infiltration of water into the soil, as outlined in Table A-2 of Appendix A, Section I.

**IMPERVIOUS SURFACE:** a surface which limits the penetration of water into the ground.

**INFILTRATION STRUCTURE:** a structure designed to direct runoff into the ground, such as french drains, seepage pits, or seepage trenches.

**KARST:** a type of topography that is formed over limestone, dolomite, or gypsum by bedrock solution, and that is characterized by closed depressions or sinkholes, caves, and underground drainage (from AGI, Glossary of Geology, 1972).

**LAND DISTURBANCE:** any activity involving grading, tilling, digging, or filling of ground or stripping of vegetation or any other activity which causes land to be exposed to erosion.

**LEVEL SPREADER:** a device used to spread out stormwater runoff uniformly over the ground surface as sheet flow (i.e., not through channels). The purpose of level spreaders are to prevent concentrated, erosive flows from occurring, and to enhance infiltration.

**LINEAMENTS:** straight or gently curved, lengthy features frequently expressed topographically as depressions or lines on the earth's surface. They can be more easily observed at a height of 100 meters or more and are usually found by researching aerial photographs or satellite photography. They are usually located in areas of faulting or in dense jointing along some rock stratigraphy.

**LOW FLOW CHANNEL:** an incised or paved channel from inlet to outlet in a dry basin which is designed to carry low runoff flows and/or base flow directly to the outlet without detention.

**MUNICIPALITY:** the Township of Benner, Centre County, Pennsylvania.

**PEAK DISCHARGE:** the maximum rate of flow of water at a given point and time resulting from a storm event.

**PENNSYLVANIA MUNICIPALITIES PLANNING CODE:** Act of 1968, July 31, P.L. 805, as amended (53 P.S. 10101 et seq.).

**REGISTERED PROFESSIONAL:** an individual registered in and licensed by the State of Pennsylvania including, for the purposes of this Ordinance, land surveyors, landscape architects, architects and engineers.

**RETENTION BASIN:** a basin in which the runoff from a given flood event is stored and is not discharged into the downstream drainage system during the flood event.

**RIPRAP:** a combination of large stone, cobbles, and boulders used to line channels, stabilize banks, and reduce runoff velocities.

**RUNOFF:** that part of precipitation which flows over the land.

**SCS:** Soil Conservation Service, U.S. Department of Agriculture.

**SEDIMENTATION:** the process by which mineral or organic matter is accumulated or deposited by the movement of water.

**SEDIMENT BASIN:** a barrier, dam, retention or detention basin located and designed to retain rock, sand, gravel, silt, or other water transported material.

**SHEET FLOW:** runoff which flows over the ground surface as a thin, even layer, not concentrated in a channel. Flow depth is generally 0.1 ft. or less.

**SINKHOLE:** a localized, gradual or rapid sinking of the land surface to a variable depth, occurring in areas of carbonate bedrock; generally characterized by a roughly circular outline, a distant breaking of the ground surface and downward movement of soil into bedrock voids.

**SINKHOLE FLOOD PLAIN:** the area inundated by the 100-year, twenty-four hour storm, assuming no drainage from the sinkhole or closed depression based upon anticipated runoff volumes with maximum development permitted by zoning within the catchment area or area draining to the sinkhole.

**SOIL-COVER COMPLEX METHOD:** a method of runoff computation developed by SCS, and found in its publication "Urban Hydrology for Small Watersheds", Technical Release No. 55, as revised.

**STORM SEWER:** a system of pipes or other conduits which carries intercepted surface runoff, street water and other wash water or drainage, excluding domestic sewage and industrial wastes.

**STORMWATER:** the drainage runoff from the surface of the land resulting from precipitation, snow, or ice melt.

**STRATA:** tabular or sheet-like mass, distinct layers of homogenous or gradational sedimentary material (consolidated rock or unconsolidated earth) of any thickness, visually separable from other layers above and below by a discrete change in the character of the material deposited or by a sharp physical break, deposition or both.

**STRATIGRAPHIC UNIT:** a stratum or body of strata recognized as a unit in the classification of the rocks of the earth's crust with respect to any specific rock character, property, attribute or for any purpose such as description, mapping, and correlation.

**SWALE:** a low-lying vegetated stretch of land or wide shallow ditch, usually grassed or paved, which gathers or carries surface water runoff.

**TOPOGRAPHY:** the general configuration of a land surface or any part of the earth's surface, including its relief and position of its natural and man-made features. The natural or physical surface features of a region, considered collectively as to its form.

**USDA:** United States Department of Agriculture.

**WATERSHED:** the entire region or area drained by a river or other body of water, whether natural or artificial; a drainage basin or sub-basin.

**WETLANDS:** those areas defined in the Federal Manual for Identifying and Delineating Jurisdictional Wetlands, latest edition.

**ARTICLE VII**

**ENACTMENT**

**SECTION 1. REPEALER.**

All other ordinances or parts of ordinances of the Township of Benner which are contrary to the provisions of this Ordinance are hereby repealed to the extent necessary to give this Ordinance full force and effect.

**SECTION 2. EFFECTIVE DATE.**

This Ordinance shall become effective on February 6, 1993.

Michael R. Kelleher  
John H. Lopez  
Richard C. Lakin

Board of Supervisors  
Benner Township

**ATTEST:**

Sharon Royer

Sharon Royer, Secretary  
Benner Township

## **APPENDIX A**

### **I. STORMWATER MANAGEMENT COMPUTATIONAL VALUES**

**Figure A-1:** Design Storm Curves for Centre Region

**Table A-2:** TR 55 Curve Numbers

**Table A-3:** Rational Equation Runoff Coefficients

**Table A-4:** Manning Roughness Coefficients

**Table A-5:** Permissible Velocities for Channels

A-5.1: Bare Earth Channels

A-5.2: Lined with Vegetation

A-5.3: Rock Lined Channels with Riprap

A-5.4: Reno Matress and Gabions

**Table A-6:** Description of the Modified Puls Routing

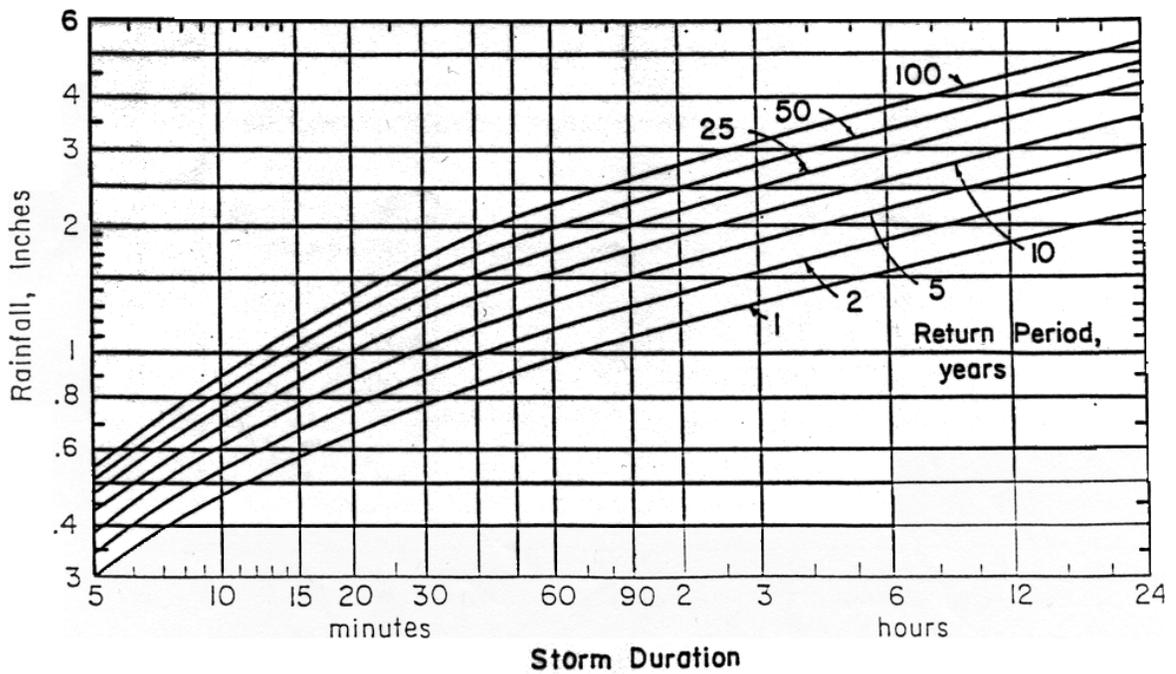
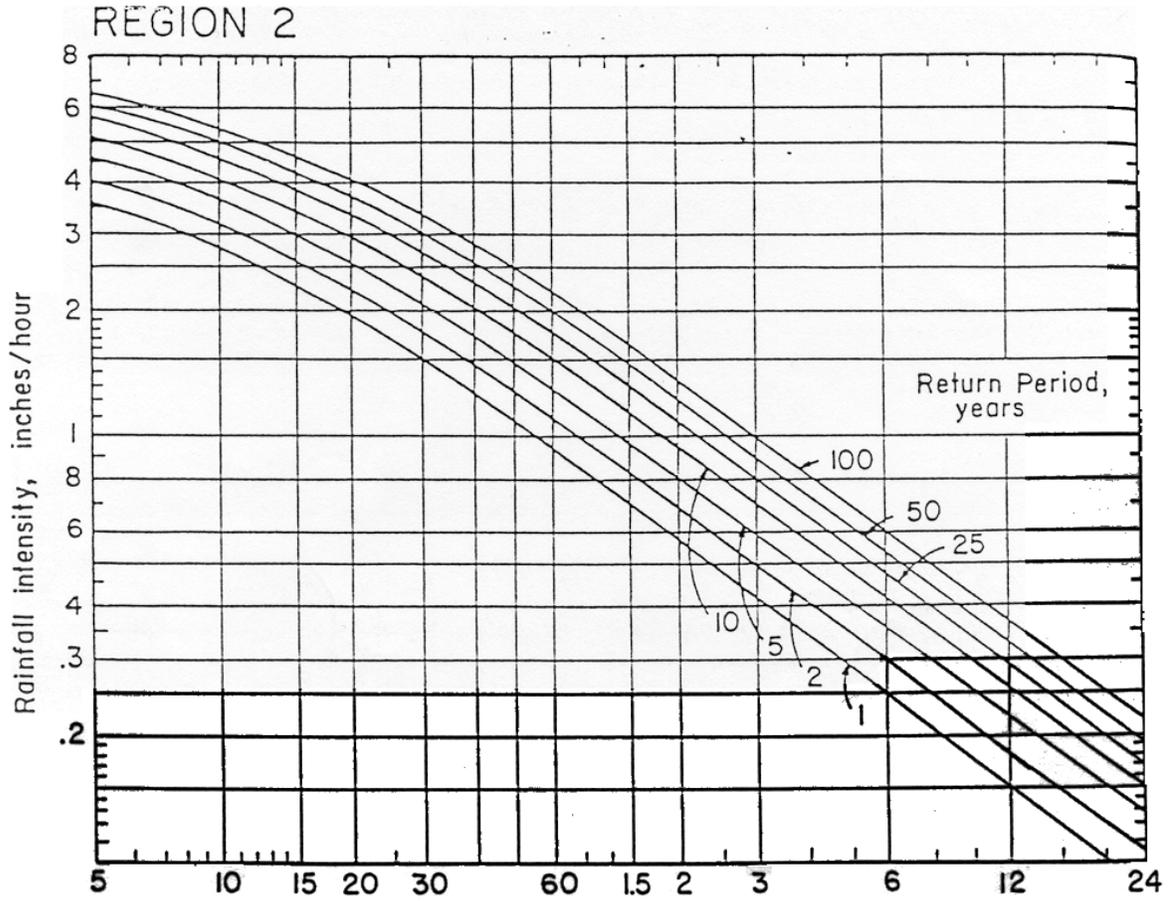
### **II. DESIGN CRITERIA FOR DRAINAGE SWALES, PERENNIAL STREAMS, CULVERTS, AND DRAINAGE CHANNELS**

### **III. RUNOFF CONTROL MEASURES**

### **IV. DESIGN CRITERIA FOR FACILITIES TO ENCOURAGE RECHARGE**

### **V. GRADING AND LANDSCAPING**

FIGURE A-1  
DESIGN STORM CURVES



A-1

Source: Pennsylvania Department of Transportation

Table A-2

Runoff Curve Numbers and Average Imperviousness  
For Various Land Uses by Hydrologic Soil Group

TR-55

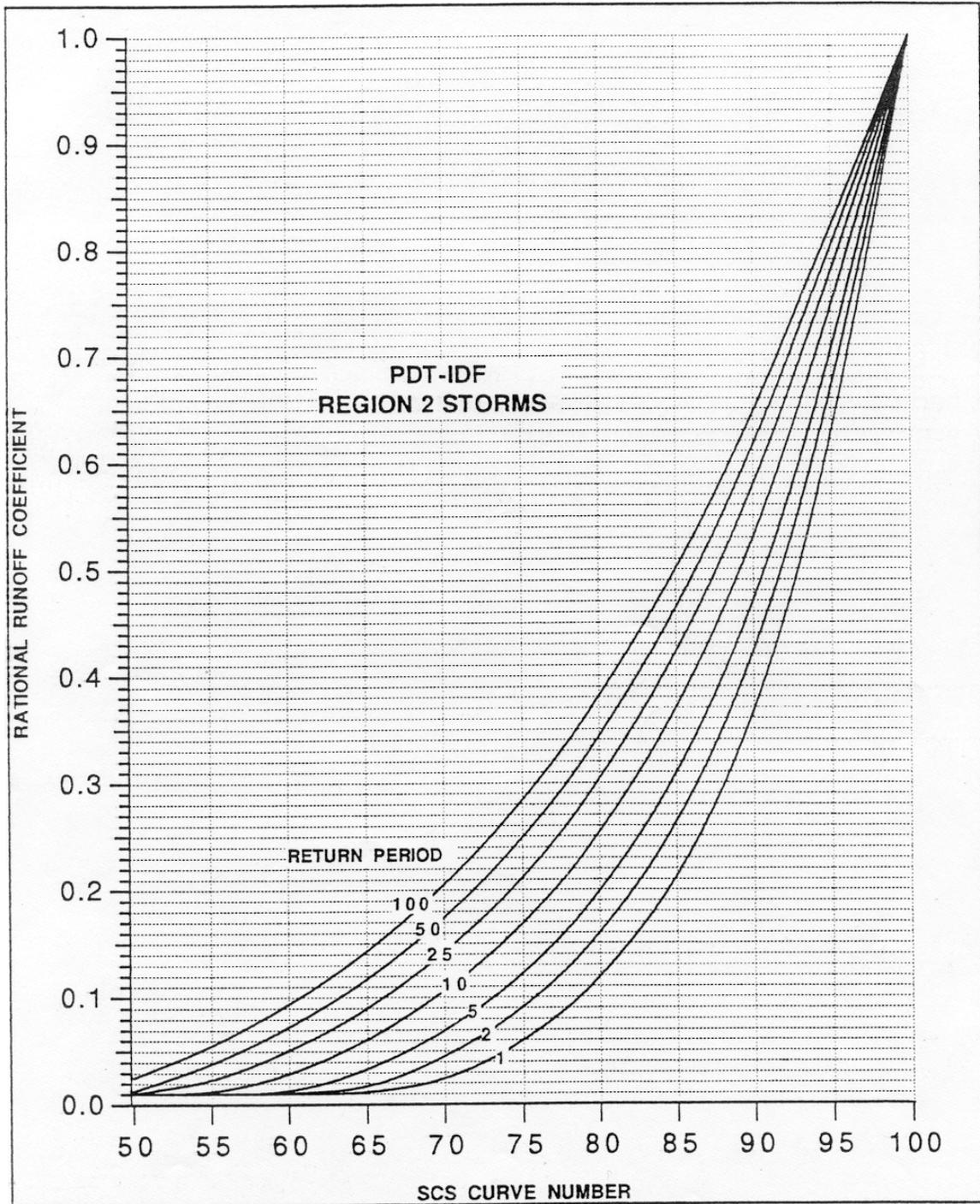
Cover Description Land Use/Cover Type	Average Imperviousness (%)	Curve Numbers For Hydrologic Soil Group			
		A	B	C	D
Open Space (lawns, parks, golf courses, cemeteries, etc.):					
Good condition (grass cover greater than 75%)	n/a <sup>a</sup>	39	61	74	80
Impervious Areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	n/a	98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)	n/a	98	98	98	98
Paved; open ditches (including right-of-way)	n/a	98	98	98	98
Gravel (including right-of-way)		76	85	89	91
Urban Districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential Districts by Average Lot Size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Woods:	n/a	30	55	70	77
Brush:		35	56	70	77
Meadow:		30	58	71	78

<sup>a</sup> Not applicable.

Source: U.S. Department of Agriculture, Soil Conservation Service, Engineering Division, 1986, "Urban Hydrology for Small Watersheds," Technical Release 55, Washington, DC.

Table A-3

# RUNOFF COEFFICIENTS AS A FUNCTION OF CURVE NUMBER



Source: Dr. Gert Aron, The Pennsylvania State University  
A-3

Table A-4  
Manning Roughness Coefficients

	Manning's n range	Manning's n range
<b>I. Closed Conduits:</b>		
A. Concrete pipe .....	0.011-0.013	
<b>B. Corrugated-metal pipe or pipe arch:</b>		
1. 2-2/3 by 1/2 in. corrugation (riveted) pipe):		
a. Plain or fully coated .....	0.024	
b. Paved invert (range values are for 25 and 50 percent of circumference paved):		
(1) Flow full depth .....	0.021-0.018	
(2) Flow 0.8 depth .....	0.021-0.016	
(3) Flow 0.6 depth .....	0.019-0.013	
2. 6 by 2-in. corrugation (field bolted) .....	0.030	
C. Cast-iron pipe, uncoated .....	0.013	
D. Steel pipe .....	0.009-0.011	
<b>E. Monolithic concrete:</b>		
1. Wood forms, rough .....	0.015-0.017	
2. Wood forms, smooth .....	0.012-0.014	
3. Steel forms .....	0.012-0.013	
<b>F. Cemented rubble masonry walls:</b>		
1. Concrete floor and top .....	0.017-0.022	
2. Natural floor .....	0.019-0.025	
<b>II. Open Channels, Lined (straight alignment):</b>		
<b>A. Concrete, with surfaces as indicated:</b>		
1. Formed, no finish .....	0.013-0.017	
2. Trowel finish .....	0.012-0.014	
3. Float finish .....	0.013-0.015	
4. Float finish, some gravel on bottom .....	0.015-0.017	
5. Gunite, good section .....	0.016-0.019	
6. Gunite, wavy section .....	0.018-0.022	
<b>B. Concrete, bottom float finished, sides as indicated:</b>		
1. Dressed stone in mortar .....	0.015-0.017	
2. Random stone in mortar .....	0.017-0.020	
3. Cement rubble masonry .....	0.020-0.025	
4. Cement rubble masonry, plastered .....	0.016-0.020	
5. Dry rubble (riprap) .....	0.020-0.030	
<b>C. Gravel bottom, sides as indicated:</b>		
1. Formed concrete .....	0.017-0.020	
2. Random stone in mortar .....	0.020-0.023	
3. Dry rubble (riprap) .....	0.023-0.033	
<b>D. Asphalt</b>		
1. Smooth .....	0.013	
2. Rough .....	0.016	
<b>E. Concrete-lined excavated rock:</b>		
1. Good section .....	0.017-0.020	
2. Irregular section .....	0.022-0.027	
<b>III. Open Channels, Excavated (straight alignment, natural lining):</b>		
<b>A. Earth, uniform section:</b>		
1. Clean, recently completed ....	0.016-0.018	
2. Clean, after weathering .....	0.018-0.020	
3. With short grass, few weeds ..	0.022-0.027	
4. In gravelly soil, uniform section, clean .....	0.022-0.025	
<b>B. Earth, fairly uniform section:</b>		
1. No vegetation .....	0.022-0.025	
2. Grass, some weeds .....	0.025-0.030	
3. Dense weeds or aquatic plants in deep channels .....	0.030-0.035	
4. Sides clean, gravel bottom ...	0.025-0.030	
5. Sides clean, cobble bottom ...	0.030-0.040	
<b>C. Dragline excavated or dredged:</b>		
1. No vegetation .....	0.028-0.033	
2. Light brush on banks .....	0.035-0.050	
<b>D. Rock:</b>		
1. Based on design section .....	0.035	
2. Based on actual mean section:		
a. Smooth and uniform .....	0.035-0.040	
b. Jagged and irregular .....	0.040-0.045	
<b>E. Channels not maintained, weeds and brush uncut:</b>		
1. Dense weeds, high as flow depth	0.080-0.120	
2. Clean bottom, brush on sides .	0.050-0.080	
3. Clean bottom, brush on sides, highest stage of flow .....	0.070-0.110	
4. Dense brush, high stage .....	0.100-0.140	
<b>IV. Channels &amp; Swales w/Maintained Vegetation (Values shown are for velocities of 2 &amp; 6 f.p.s.):</b>		
<b>A. Depth of flow up to 0.7 foot:</b>		
1. Bermudagrass, Kentucky bluegrass, buffalograss		
a. Mowed to 2 inches .....	0.045-0.070	
b. Length 4-6 inches .....	0.050-0.090	
2. Good stand, any grass:		
a. Length about 12 inches ....	0.090-0.180	
b. Length about 24 inches ....	0.150-0.300	
3. Fair stand, any grass:		
a. Length about 12 inches ....	0.080-0.140	
b. Length about 24 inches ....	0.130-0.250	
<b>B. Depth of flow 0.7-1.5 feet:</b>		
1. Bermudagrass, Kentucky bluegrass, buffalograss:		
a. Mowed to 2 inches .....	0.035-0.050	
b. Length 4 to 6 inches .....	0.040-0.060	
2. Good stand, any grass:		
a. Length about 12 inches ....	0.070-0.120	
b. Length about 24 inches ....	0.100-0.200	
3. Fair stand, any grass:		
a. Length about 12 inches ....	0.060-0.100	
b. Length about 24 inches ....	0.090-0.170	
<b>V. Street and Expressway Gutters:</b>		
A. Concrete gutter, troweled finish	0.012	
<b>B. Asphalt pavement:</b>		
1. Smooth texture .....	0.013	
2. Rough texture .....	0.016	
<b>C. Concrete gutter with asphalt pavement</b>		
1. Smooth .....	0.013	
2. Rough .....	0.015	
<b>D. Concrete pavement:</b>		
1. Float finish .....	0.014	
2. Broom finish .....	0.016	
<b>E. For gutters with small slope, where sediment may accumulate, increase above values of x by ...</b>		
	0.002	

Source: Chow, V.T., 1959, "Open Channel Hydraulics," McGraw Hill, New York.

Table A-4 (continued)  
Manning Roughness Coefficients

	Manning's n range		Manning's n range
<b>VI. Natural Stream Channels:</b>			
<b>A. Minor streams (surface width at flood stage less than 100 feet):</b>			
<b>1. Fairly regular section:</b>			
a. Some grass & weeds, little or no brush .....	0.030-0.035	2. Cultivated areas:	
b. Dense growth of weeds, depth of flow materially greater than weed height ..	0.035-0.050	a. No crop .....	0.030-0.040
c. Some weeds, light brush on banks .....	0.035-0.050	b. Mature row crops .....	0.035-0.045
d. Some weeds, heavy brush on banks .....	0.050-0.070	c. Mature field crops .....	0.040-0.050
e. Some weeds, dense willows on banks .....	0.060-0.080	3. Heavy weeds, scattered brush ..	0.050-0.070
f. For trees within channel with branches submerged at high stage, increase all above values by .....	0.010-0.020	4. Light brush and trees:	
<b>2. Irregular sections, with pools, slight channel meander; increase values given in 1a-e about .....</b>	<b>0.010-0.020</b>	a. Winter .....	0.050-0.060
<b>3. Mountain streams, no vegetation in channel, banks usually steep, trees and brush along banks submerged at high stage</b>		b. Summer .....	0.060-0.080
a. Bottom of gravel, cobbles and few boulders .....	0.040-0.050	5. Medium to dense brush:	
b. Bottom of cobbles, with large boulders .....	0.050-0.070	a. Winter .....	0.070-0.110
<b>B. Flood plains (adjacent to natural streams):</b>		b. Summer .....	0.100-0.160
1. Pasture, no brush:		6. Dense willows, summer, not bent over by current .....	0.150-0.200
a. Short grass .....	0.030-0.035	7. Cleared land w/tree stumps, 100-150 per acre:	
b. High grass .....	0.035-0.050	a. No sprouts .....	0.040-0.050
		b. With heavy growth of sprouts .....	0.060-0.080
		8. Heavy stand of timber, a few down trees, little undergrowth:	
		a. Flood depth below branches	0.100-0.120
		b. Flood depth reaches branches .....	0.120-0.160
		<b>C. Major streams (surface width at flood stage more than 100 ft.):</b>	
		Roughness coefficient is usually less than for minor streams of similar description on account of less effective resistance offered by irregular banks or vegetation on banks. Values of n may be somewhat reduced. Follow recommendation in publication cited if possible. The value of n for larger streams of most regular section, with no boulders or brush, may be in the range of....	0.028-0.033

MANNING'S ROUGHNESS COEFFICIENTS FOR SHEET FLOW

SURFACE DESCRIPTION	n <sup>1</sup>	SURFACE DESCRIPTION	n
Smooth Surfaces (concrete, asphalt, gravel, or bare soil).....	0.011	Range (natural).....	0.13
Fallow (no residue).....	0.05	Woods:	
Cultivated Soils:		Light underbrush.....	0.40
Residue cover 20%.....	0.06	Dense underbrush.....	0.80
Residue cover 20%.....	0.17		
Grass:			
Short grass prairie.....	0.15		
Dense grasses.....	0.24		
Bermudagrass.....	0.41		

Source: Chow, V.T., 1959, "Open Channel Hydraulics," McGraw Hill, New York.

TABLE A-5: Permissible Velocities for Channels

Soil Materials	n*	Clear Water (V fps)	Water Transporting Colloidal Silts (V fps)
Fine sand, noncolloidal	.020	1.50	2.50
Sandy loam, noncolloidal	.020	1.75	2.50
Silt loam, noncolloidal	.020	2.00	3.00
Alluvial silts, noncolloidal	.020	2.00	3.50
Ordinary firm loam	.020	2.50	3.50
Stiff clay, very colloidal	.025	3.75	5.00
Alluvial silts, colloidal	.025	3.75	5.00
Shales and hardpan	.025	6.00	6.00
Fine Gravel	.020	2.50	5.00
Graded loam - cobbles (when noncolloidal)	.030	3.75	5.00
Graded silt - cobbles (when noncolloidal)	.030	4.00	5.50
Coarse gravel, noncolloidal	.025	4.00	6.00
Cobbles and shingles	.035	5.00	5.50

\* Listed n values assume good to excellent construction techniques which produce uniform channel dimensions. Values should be adjusted, by use of SCS Engineering Handbook #5, Supplement B, for other construction conditions.

Cover	Slope Range Percent	Permissible Velocity ft/sec.	
		Erosion Resistant Soil <sup>1</sup>	Easily Eroded Soil <sup>2</sup>
Kentucky Bluegrass Tall Fescue	< 5	7 <sup>3</sup>	5
	5-10	6 <sup>3</sup>	4
	> 10	5	3
Grass Mixture Reed Canarygrass	< 5	5	4
	5-10	4	3
Sericea Lespedeza Weeping Lovegrass Redtop Red Fescue	< 5	3.5	2.5
Annuals temporary cover only Sudangrass	< 5	3.5	2.5

<sup>1</sup> Cohesive (clayey) fine grain soils and coarse grain soils with a plasticity index of 10 to 40 (CL, CH, SC, & GC).

<sup>2</sup> Soils that do not meet the requirements for erosion resistant soils.

<sup>3</sup> Use velocities exceeding 5 ft/sec only where good cover and proper maintenance can be obtained.

TABLE A-5.3 Maximum Permissible Velocities for Rock Lined Channels and Riprap				
NSA No.	Graded Rock Size (In.)			Permissible velocity fps*
	Max	D <sub>50</sub>	Min.	
R-1	1.5	.75	NO. 8	2.5
R-2	3	1.50	1	4.5
R-3	6	3	2	6.5
R-4	12	6	3	9.0
R-5	18	9	5	11.5
R-6	24	12	7	13.0
R-7	30	15	12	14.5

\* Permissible velocities based on rock at 165 lbs. per cubic foot. Adjust velocities for other rock weights used. See Figure 4.6

TABLE A-5.4 Maximum Permissible Velocities for Reno Mattress & Gabions				
Type	n	Thickness (in)	Rock fill Gradation (in)	Permissible* Velocity - fps
Reno Mattress	.025	6	3 - 6	13.5
	.025	9	3 - 6	16.0
	.025	12	4 - 6	18.0
Gabion	.027	18 +	5 - 9	22.0

Permissible velocities may be increased by the introduction of sand mastic grout. Refer to manufacturers recommendations/specifications for permissible velocities.

SOURCE: PA DER Bureau of Soil and Water Conservation Erosion and Sediment Pollution Control Program Manual, April 1990.

Refer to this reference for additional stipulations in the use of Tables A-5.1 through A-5.4.

## APPENDIX A

### II. DESIGN CRITERIA FOR DRAINAGE SWALES, PERENNIAL STREAMS, CULVERTS, AND DRAINAGE CHANNELS

#### A. Drainage Swales

**Criteria:**

1. Where vegetated drainage swales are used in lieu of or in addition to storm sewers, they shall be designed to carry the ten (10) year discharge without erosion, and also to increase the time of concentration, reduce the peak discharge and velocity, and permit the water to percolate into the soil.
2. Depth of flow in swales provided in cut areas shall not encroach upon the shoulder during a 10-year frequency storm of five (5) minute duration. Frequent and/or sustained flooding of the sub-base shall be avoided.
3. The maximum velocity as determined by Manning's equation shall not exceed the allowable velocity for specific types of vegetative material as specified in Appendix A, Section I. Inlets shall be provided to control the shoulder encroachment and water velocity.
4. The side slope for any vegetated drainage channel requiring mowing of the vegetation shall have a maximum grade of three (3) horizontal to one (1) vertical on those areas to be mowed.
5. Erosion Prevention: All drainage swales shall be designed to prevent the erosion of the bed and bank areas. Suitable stabilization during vegetative cover establishment shall be provided to prevent erosion.
6. All storm sewers or drainage swales shall discharge to a detention or retention basin for the control of peak runoff discharge except as provided in the plan.
7. Design Standard: Because of the critical nature of vegetated drainage channels, the design of all vegetated channels shall, as a minimum, conform to the design procedures outlined in the Centre-Clinton County Conservation District Erosion and Sediment Control Handbook.
8. A minimum grade of one percent shall be maintained for all swales. Grades less than one percent may be approved by the Township Engineer on a case-by-case basis and only if there are no other alternatives.

**Guidelines:**

1. Deed restrictions may be required on property(ies) containing draining swales and/or perennial streams. When required, these deed restrictions shall specify that no property owner obstruct or alter any drainage swale or perennial stream identified in the stormwater management plan.

**B. Culverts and Drainage Channels**

**Criteria:**

1. Design Flow Standard: Culverts and drainage channels shall be designed to carry flow rates determined as outlined in Article III, Section 1.7 (Soil Conservation Service, Technical Release No. 55).
2. Erosion Prevention: All drainage channels shall be designed to prevent the erosion of the bed and bank areas. Suitable bank stabilization shall be provided where required to prevent erosion of the drainage channels.
  - a. The maximum velocities permitted for lined water carrying channels shall be in accordance with the values presented in Table A-5 in Section I of this Appendix.
  - b. A minimum grade of one (1) percent shall be maintained for all channel flow. Grades less than one percent may be approved by the Township Engineer on a case-by-case basis and only if there are no other alternatives.
3. Pipe Capacity: The capacity of all pipe culverts shall, as a minimum, provide the required carrying capacity as determined by the following sources:
  - Federal Highway Administration Hydraulic Design of Highway Culverts Hydraulic Design Series No. 5  
September 1985

Reference to publications and source documents in this section shall be deemed to include any amendments and revisions thereof.

4. Minimum Grade and Size: All storm drain culvert pipes shall be designed to maintain a minimum grade of one-half (0.5) percent. All storm pipes shall have minimum inside diameter of fifteen (15) inches or a cross-sectional area of one hundred seventy-six (176) square inches, except that pipes under a twenty-five (25) foot or greater fill shall not be less than twenty-four (24) inches or a cross-sectional area of four hundred fifty-three (453) square inches, and shall consist of reinforced concrete.

5. Where storm sewers discharge into existing drainage channels at an angle greater than thirty (30) degrees from parallel with the downstream channel flow, the far side bank shall be stabilized by the use of riprap or masonry, and/or concrete walls, the stabilization shall be designed to prevent erosion and frost heave under and behind the stabilizing media.

**Guidelines:**

1. Pipe Arches: Where cover is restricted, equivalent pipe arches may be used in lieu of circular pipe.

### **III. RUNOFF CONTROL MEASURES**

#### **A. Design of Detention Basins**

**Criteria:**

1. All detention basin storage shall be designed by hydrograph routings. Hydrographs shall be developed from methods outlined in Section 1.4 under the approval of the Municipal Engineer. Hydrographs shall be routed through the basin or stormwater control facility using the Modified Puls Method.

#### **B. Basin Design**

**Criteria:** The design criteria contained in Article III, Section 1.1, shall be used in the design of all detention basins in the Municipality. The emergency spillway must have the ability to pass the post development 100 year flow.

1. Riser: Where a riser is provided at the outlet of the detention basin, the riser shall be constructed of metal or concrete as approved by the Municipal Engineer. Risers shall be designed so that the rate of outflow is controlled by the pipe barrel through the basin berm when the depth of the water within the basin exceeds the height of the riser, or by accurately sized orifices. All metal risers, where approved for use, shall be suitably coated to prevent corrosion. A trash rack or similar appurtenance shall be provided to prevent debris from entering the riser. All metal risers shall have a concrete base attached with a watertight connection. The base shall be sufficient weight to prevent flotation of the riser. An anti-vortex device, consisting of a thin vertical plate normal to the basin berm, shall be provided on the top of all metal risers. Suitable perforated metal riser designs are outlined in the following sources:
  - Erosion and Sediment Control Handbook
  - Centre County Soil and Water Conservation District
2. Emergency Spillway: Emergency spillways shall be constructed of reinforced concrete, vegetated earth, or riprap in accordance with generally accepted engineering practice. All emergency spillways shall be constructed so that the

detention basin berm is protected against erosion. The minimum capacity of all emergency spillways shall be the peak flow rate from the post-development one hundred (100) year design storm. The dimensions of the emergency spillways can be determined from the Centre County Erosion and Sediment Control Handbook. Emergency spillways shall extend along the upstream and downstream berm embankment a minimum of three (3) feet below the spillway crest elevation. The downstream slope of the spillway shall as a minimum extend to the toe of the berm embankment. The emergency spillway shall not discharge over uncompacted earthen fill and/or easily erodible material.

3. Antiseep Collars: Antiseep collars shall be installed around the principal pipe barrel within the normal saturation zone of the detention basin berms. The antiseep collars and their connections to the pipe barrel shall be watertight. The antiseep collars shall extend a minimum of two (2) feet beyond the outside of the principal pipe barrel. The maximum spacing between collars shall be fourteen (14) times the minimum projection of the collar measured perpendicular to the pipe.
4. Freeboard: Freeboard is the difference between the design flow elevations in the emergency spillway and the top of the settled detention basin embankment. The minimum freeboard shall be one (1) foot.
5. Slope of Detention Basin Embankment: The top or toe of any slope shall be located a minimum of ten (10) feet from any property line. Whenever possible the side slopes and basin shape shall be amenable to the natural topography. Straight side slopes and rectangular basins shall be avoided whenever possible.
  - a. Exterior slopes of compacted soil shall not exceed three (3) feet horizontal to one (1) foot vertical, and may be further reduced if the soil has unstable characteristics.
  - b. Interior slopes of the basin shall not exceed three (3) feet horizontal to one (1) foot vertical, except with approval of the Municipality.
  - c. An access ramp at least 10 feet wide must be constructed of durable, non-slip material to a grade of less than ten (10) percent to facilitate accessing the basin's bottom and outlet structure.
6. Width of Berm: The minimum top width of detention basin berms shall be ten (10) feet.

7. Slope of Basin Bottom: In order to insure proper drainage of the detention basin, a minimum grade of two (2) percent shall be maintained for all sheet flow.
  - a. Inlet and outlet structures will be located at maximum distances from one another. The Municipal Engineer may require a rock filter berm, rock-filled gabions, or suitable landscaping or vegetative material between inlet and outlet areas when the distance is deemed insufficient, for improved sediment trapping.
  - b. A collecting swale or low flow channel and/or underdrain shall be provided to drain basins.
8. Energy Dissipators: Energy dissipating devices (riprap, end sills, etc.) shall be placed at all basin outlets.
9. The distance from the highest free water surface of any detention basin or drainage facility to a dwelling unit shall be a minimum of fifty (50) feet.
10. Landscaping and Grading of Detention Basins: All landscaping and grading standards particularly applicable to detention basins are included in Section V of this Appendix.
11. Construction of Basins:
  - a. A quality control program is critical for embankment fills. Therefore, wherever embankment fill material in excess of three (3) feet is to be used, each layer of compacted fill shall be compacted to not less than 97% of the dry weight density determined in accordance with PTM No. 112 or PTM No. 402. Embankment material must be placed in uniform horizontal layers not more than a loose 8" depth.
  - b. Compaction test reports shall be kept on file at the site and be subject to review at all times with copies being forwarded to the Municipal Engineer.
  - c. When rock is encountered during the excavation of a pond, it shall be removed to an elevation of at least twelve (12) inches below the proposed basin floor. For a manufactured liner, 24" - 30".
  - d. Temporary and permanent grasses or stabilization measures shall be established on the sides and base of all earthen basins within 15 days of construction.
12. Design Information: As part of the Stormwater Management Plan and Report, all design information along with the information required in Section 2 of

Article II of this Ordinance shall be submitted including, but not limited to, the following:

- a. General description of proposed facilities and the operation of the runoff control measures.
- b. A detail of the detention basin showing the berm embankment and outlet structure, the embankment top elevation and width, embankment side slopes, emergency spillway elevation, perforated riser dimensions, pipe barrel dimensions, and dimensions and spacing of antiseep collars.
- c. Design computations for the pipe barrel and riser.
- d. A plot or table of the stage-storage (acre-feet vs. elevation) and all supporting computations.
- e. Flood routing computations.
- f. A detailed plan of the trash rack and anti-vortex device.
- g. A plan, at a scale of one (1) inch equals fifty (50) feet or larger showing the grading, landscaping, and fencing around the detention basin.

#### **IV. DESIGN CRITERIA FOR FACILITIES TO ENCOURAGE RECHARGE**

##### **A. Methods of Stormwater Infiltration**

1. Methods of stormwater infiltration including but not limited to: seepage pits and seepage trenches, multiple, staged, or extended detention (i.e., greater than 24 hours), wet ponds with stormwater detention capabilities, infiltration trenches and basins, porous pavement, and vegetative practices including urban forestry, basin landscaping or shallow marsh creation may be used. Suggested guidelines and design criteria for these alternatives are outlined in the publications Controlling Urban Runoff - A Practice Manual for Planning and Designing Urban BMPs, Metropolitan Washington Council of Governments, July 1987, and Standards and Specifications for Infiltration Practices (MD DNR). All design methods and selected alternates shall have prior approval of the Municipal Engineer.

#### **V. GRADING AND LANDSCAPING**

##### **A. Cuts**

**Criteria:**

1. No excavation should be made with a cut face steeper than three (3) feet horizontal to one (1) foot vertical, except under the conditions that the material in which the excavation is made is sufficiently stable to sustain a slope of steeper than three (3) feet horizontal to one (1) foot vertical. Retaining walls will be required if a stable slope cannot be maintained. Any retaining wall design must be approved by the Municipal Engineer. The top of the slope of headwall of any cut must be located a minimum of ten (10) feet from property lines.

**B. Fills**

**Criteria:** No fill shall be made which creates any exposed surface steeper in slope than three (3) feet horizontal to one (1) foot vertical, except where the fill is located so that settlement, sliding, or erosion will not result in property damage or be a hazard to adjoining property, streets, or buildings. For an exposed surface steeper than 3:1 to be permitted, the applicant must provide documentation that the 3:1 slope is not a safety concern.

**Guidelines:** A concrete or stone masonry wall designed and constructed in Accordance with these specifications and standards may be required to support face of the fill where the above-specified slopes are exceeded.

**C. Planting**

**Criteria:**

1. Grassed or Grass/Ground Cover Combination: All such areas specified on proposed or approved plans shall be prepared, installed, and maintained in accordance with Pennsylvania Department of Transportation, Form 408 Specifications as amended.
2. Open Space, Storm Drainage, and Retention Areas:
  - a. Planting Requirement: All areas proposed for recreational use, whether active or passive, shall be planted to effectively naturalize the areas to become an integral and harmonious element in the natural landscape.
  - b. Drainage Channels and Retention Areas: All storm drainage channels and retention areas, whether existing or proposed, shall be graded and planted to effectively naturalize area(s) so as to become an integral and harmonious part of the landscape by contour and type of plant material employed.

- c. Vegetative Filter Path: To work properly, a filter strip must be 1) equipped with some sort of level spreading device; 2) densely vegetated with a mix of erosion resistant plant species that effectively bind the soil; 3) graded to a uniform, even, and relatively low slope; 4) be at least as long as the contributing runoff area; and 5) top soil within the vegetative filter path be 12" to 18" deep.

A dense cover of erosion resistant grass suitable to existing site conditions shall be established including: Kentucky 31 Tall Fescue, where draught resistance is required, or Reed Canary grass, where water tolerance is required.

- d. Top Soil: A minimum of six (6) inches of topsoil material shall be placed on all areas affected by the basin construction (bottom of basin, side slopes, top of berm, etc.). The material must meet the requirements of the Pennsylvania Department of Transportation, Form 408 Specifications as amended.

**Guidelines:**

1. Crown Vetch: Detention basins may be seeded with crown vetch, or turfed if, in the opinion of the Municipality, a crown vetch covering would reduce the use of the detention basin for recreational purposes or would be unsightly.
2. Fencing and Screening: A fence or suitable vegetative screening may be provided, as required by the Municipality, around all detention basins. All fencing should be at least three and one-half (3 1/2) feet in height as approved by the Municipality. A vegetative screening of suitable landscaping plant material in or around a detention basin may also be required. Vegetative screenings should generally provide a barrier to prevent entrance to, and effectively naturalize the appearance of, the detention basin area.

Combinations of grassed areas and densely planted shrub areas consisting of species suited to use in the highway environment are encouraged. Species of raspberry (*Rubus* spp.) are recommended.

Rock filter check dams are encouraged for use as level spreaders.

**D. Building Site Excavation and Surface Runoff**

**Criteria:**

1. If temporary or permanent diversion channels or berms have not been established during general site preparation, diversion channels or berms shall be installed whenever slopes exceed 10% above or below proposed excavation areas.

Installation shall occur prior to or concurrent with excavations or other earthmoving on the uphill or downhill sides of the building location and any other areas to be disturbed. This requirement may be waived if it would result in the destruction of trees and shrubs. In all cases, hay bales or silt fence shall be installed and maintained downhill of all excavations and until the diversion channels or berms required by the Municipal Engineer have been stabilized.

2. All exposed earth shall be stabilized with appropriate grasses or other materials no later than fifteen (15) days after construction.

## APPENDIX B

### SUPPLEMENTAL STANDARDS AND CRITERIA

The following technical reference materials are hereby incorporated into these controls for information and to govern the design and hydrologic control provisions of this Ordinance:

1. Controlling Urban Runoff - A Practice for Planning and Designing Urban Best Management Practices, Metropolitan Washington, Council of Governments, July 1987.
2. Design Manual Part 2, Highway Design, Publication 13, Commonwealth of Pennsylvania, Department of Transportation, January 1990.
3. Engineering Field Manual, USDA SCS, 1977.
4. Engineering Standard and Specifications, USDA SCS, May 1977.
5. Field Manual of Pennsylvania Department of Transportation Storm Intensity-Duration-Frequency Charts, Department of Civil Engineering and Institute for Research on Land Water Resources, Pennsylvania State University, University Park, PA, 1986.
6. Flood Hazard Study, Township of Benner, Centre County, Federal Insurance Administration, 1989.
7. Guidelines for Erosion and Sediment Control Planning and Implementation, U.S. Government Printing Office, Washington, DC, EPA-R2-72-015, August 1972.
8. National Engineering Handbook, Section 4, Hydrology, USDA, August 1972.
9. Practices in Detention of Urban Stormwater Runoff, Special Report No. 43, American Public Works Association, June 1974.
10. Soil Erosion and Sediment Pollution Manual, Pennsylvania Department of Environmental Resources, May 1990.
11. Soil Survey of Centre County, Pennsylvania, USDA SCS, August 1981.
12. Standards for Roadway Construction, Series RC-0 to 100, Pennsylvania Department of Transportation, Bureau of Highway Design, Publication No. 72, May 1983.
13. Standards and Specifications for Infiltration Practices, Maryland Department of Natural Resources, Water Resources Administration, February 1984.
14. Title 25 Rules and Regulations, Chapter 105, Dam Safety and Waterway Management, as amended, Commonwealth of Pennsylvania, Department of Environmental Resources.
15. Urban Hydrology for Small Watersheds, Technical Release No. 55, USDA SCS, June 1986.