ORDINANCE NO. 05-23

AN ORDINANCE REENACTING, AMENDING THE CODIFIED ORDINANCES OF BETHLEHEM TOWNSHIP WITH THE ADDITION OF CHAPTER 220, BETHLEHEM TOWNSHIP STORMWATER MANAGEMENT, AND REPEALING ALL ORDINANCES INCONSISTENT HEREWITH

WHEREAS, Bethlehem Township ("Township") is a political subdivision, municipal corporation, and First-Class Township of the Commonwealth of Pennsylvania ("Commonwealth"), being a body corporate and politic, situated in Northampton County, duly established and lawfully existing under and pursuant to the First-Class Township Code of the Commonwealth of Pennsylvania, 53 P.S. § 55101 et seq., as amended.

WHEREAS, the Pennsylvania Storm Water Management Act (Act 167), adopted by the General Assembly on October 4, 1978, as amended by Act 63 of May 24, 1984, imposed upon the County of Northampton (the "County"), a responsibility for promulgating watershed management plans for the Bushkill Creek, Fry's Run, Monocacy Creek, Nancy Run, and the County's other watersheds;

WHEREAS, the Township is required to adopt the Pennsylvania Department of Environmental Protection (DEP) water quality updates as part of the Northampton County Act 167 Global Update Watershed Stormwater Management Plan;

WHEREAS, the Township is required to adopt the requirements under the National Pollutant Discharge Elimination System ("NPDES") program for communities covered by the Phase II permit process and consistent with the DEP 2022 Model Stormwater Management Ordinance; and

NOW, THEREFORE, in order to comply with the state and federal requirements for water quality and the NPDES program, and to incorporate updates to the Northampton County Act 167 Stormwater Management Plan, the Board does hereby add Chapter 220 of the Codified Ordinances:

ARTICLE 1
GENERAL PROVISIONS

§ 220-1 TITLE

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

§ 220-2 STATEMENT OF FINDINGS

The Bethlehem Township Board of Commissioners find that:

A. Inadequate management of accelerated runoff of stormwater resulting from development throughout the watersheds of the Township increases runoff volumes, flood flows and velocities, contributes to erosion and sedimentation, changes the natural hydrologic patterns, destroys aquatic habitat, elevates aquatic pollutant concentrations and loadings, overtaxes the carrying capacity of streams and storm sewers, greatly increases the cost of public facilities to carry and control stormwater, undermines floodplain management and flood control efforts in downstream communities, reduces groundwater recharge, threatens public health and safety, and increases nonpoint source pollution of water resources.

B. A comprehensive program of stormwater management, including reasonable regulation of development and activities causing accelerated runoff and erosion and loss of natural infiltration, is fundamental to the public health, safety and welfare and the protection of the people of the Township and all the people of the Commonwealth, their resources, and the environment.

C. Stormwater is an important resource that provides groundwater recharge for water supplies and supports the baseflow of streams, which also protects and maintains surface water quality.

D. The use of green infrastructure and low impact development is intended to address the root cause of water quality impairment by using systems and practices which use or mimic natural processes to:

1. Infiltrate and recharge;
2. Evapotranspire; and/or
3. Harvest and use precipitation near where it falls to Earth.

Green infrastructure practices and low impact development contribute to the restoration or maintenance of pre-development hydrology.

E. Federal and state regulations require certain municipalities to implement a program of stormwater controls. These municipalities are required to obtain a permit for stormwater discharges from their separate storm sewer systems under the National Pollutant Discharge Elimination System (NPDES) program.

F. Non-stormwater discharges to Township separate stormwater sewer systems can contribute to pollution of waters of the Commonwealth by the Township.

G. Clear delineations are necessary with respect to the requirements for ownership and maintenance responsibilities for permanent stormwater management facilities/ Best Management Practices ("BMPs").

H. Public education on the control of pollution from stormwater is an essential component in successfully addressing stormwater.

§ 220-3 PURPOSE

The purpose of this Chapter is to promote public health, safety and welfare within the Township and the Bushkill Creek, Fry's Run, Monocacy Creek, and Nancy Run Watersheds by minimizing the harms and maximizing the benefits described in **§ 220-2A** above, through provisions designed to:

A. Meet legal water quality requirements under state law, including regulations of 25 Pa. Code Chapter 93, to protect and maintain "existing uses" and the level of water quality to support those uses in all streams, to protect and maintain water quality in "special protection" streams, to reclaim and restore the existing and designated uses of the waters of the Commonwealth.

B. Manage stormwater runoff impacts at their source by regulating activities which cause such problems.

C. Utilize and preserve the desirable existing natural drainage systems.

D. Encourage infiltration of stormwater, where appropriate, to maintain groundwater recharge, to prevent degradation of surface and groundwater quality and to otherwise protect water resources.

E. Maintain the existing flows and quality of streams and watercourses in the Township and the Commonwealth.

F. Preserve and restore the flood carrying capacity of streams.

G. Provide proper maintenance of all permanent stormwater management BMPs that are implemented in the Township.

H. Provide review procedures and performance standards for stormwater planning, design, and management.

I. Manage stormwater impacts close to the runoff source which requires a minimum of structures and relies on natural processes.

J. Prevent scour and erosion of streambanks and streambeds.

K. Provide standards to meet the NPDES permit requirements.

L. Provide criteria and standards for the ownership and maintenance of permanent stormwater management facilities/BMPs.

M. Manage stormwater runoff close to the source, reduce runoff volumes and mimic pre-development hydrology.

§ 220-4 STATUTORY AUTHORITY

The Township of Bethlehem is empowered to regulate land use activities that affect runoff by the authority of the Act of July 31, 1068, P.L. 805, No. 247, the Pennsylvania Municipalities Planning Code as amended, and/or the Act of October 4, 1978, P.L. 864 (Act 167), 32 P.S. § 680.1 et seq., as amended, the Stormwater Management Act, the First Class Township Code, and the Township of Bethlehem, Ordinance **230**, Subdivision and Land Development, and Ordinance **275**, Zoning.

§ 220-5 APPLICABILITY

All regulated activities that may affect stormwater runoff, including land development and earth disturbance activity, are subject to regulation by this Ordinance. Regulated activities include:

A. Although generally applicable to all drainage areas in the Township, the provisions of this Chapter, which make specific reference to the Bushkill Creek, Fry's Run, Monocacy Creek, and Nancy Run Watersheds or to the release rate maps contained in the plan, shall only apply to those areas of the Township which are located within the Bushkill Creek, Fry's Run, Monocacy Creek, and Nancy Run drainage basins with boundaries as delineated on a Stormwater Management Districts Map available for inspection at the Township office. Maps of the Bushkill Creek, Fry's Run, Monocacy Creek, and Nancy Run Watersheds at a reduced scale are included in Appendix B of this Ordinance for general reference.

B. This Ordinance shall only apply to permanent stormwater management facilities constructed as part of any of the activities listed in this section. Stormwater management and erosion and sedimentation control during construction involved with any of these activities are specifically not regulated by this Ordinance but shall continue to be regulated under existing laws and ordinances.

C. This Ordinance contains only those stormwater runoff control criteria and standards which are necessary or desirable from a total watershed perspective. Additional stormwater management design criteria (i.e., inlet spacing, inlet type, collection system details, etc.), which represent sound engineering practice, may be regulated either by separate stormwater ordinance provisions or as part of the general responsibilities of the Township Engineer.

D. The following activities are defined as regulated activities and shall be regulated by this Ordinance, except those which meet the waiver specifications presented thereafter:

1. Land Development (as that term is defined in the MPC);
2. Subdivision (as that term is defined in the MPC);
3. Construction of new or additional impervious surfaces (driveways, parking lots, etc.);
4. Construction of new buildings or additions to existing buildings;
5. Diversion or piping of any natural or man-made stream channel;
6. Installation of stormwater systems or appurtenances thereto;
7. Regulated earth disturbance activities;
8. Other than what is included in **§ 220-5 D (1)** through **D (7)**, any earth disturbance activities or any activities that include the alteration or development of land in a manner that may affect stormwater runoff onto adjacent property.

E. Any proposed regulated activity, except those defined in Subsection **D (5)** and **(6)**, above, which would create 5,000 square feet or less of additional impervious cover would be exempt from meeting the provisions of this Ordinance. Development plans qualifying for this waiver would still be required to manage the quantity, velocity, and direction of resulting storm runoff as is reasonably necessary to prevent injury to health, safety, or other property (see **§ 220-35**).

F. For development taking place in stages, the entire development plan must be used in determining conformance with this criteria.

G. Additional impervious cover shall include, but not be limited to, any roof, parking or driveway areas and any new streets and sidewalks constructed as part of or for the proposed regulated activity. Any areas which may be designed to initially be semipervious (e.g., gravel, crushed stone, porous pavement, etc.) shall be considered impervious areas for the purpose of the waiver provisions of **§ 220-35**, hereof.

H. The hardship waiver provisions found in **§ 220-40** shall not be available for regulated activities as defined in Subsection **D (5)** and **(6)**, above.

§ 220-6 COMPATIBILITY WITH OTHER REQUIREMENTS

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

§ 220-7 ERRONEOUS PERMIT

Any permit or authorization issued or approved based on false, misleading, or erroneous information provided by an applicant is void without the necessity of any proceedings for revocation. Any work undertaken or use established pursuant to such permit or other authorization is unlawful. No action may be taken by a board, agency, or employee of the Township purporting to validate such a violation.

§ 220-8 WAIVERS

A. If the Township determines that any requirement under this Ordinance cannot be achieved for a particular regulated activity, the Township may, after an evaluation of alternatives, approve measures other than those in this Ordinance, subject to **§ 220-8**, paragraphs B and C.

B. Waivers or modifications of the requirements of this Ordinance may be approved by the Township if enforcement will exact undue hardship because of peculiar conditions pertaining to the land in question, provided that the modifications will not be contrary to the public interest and that the purpose of the Ordinance is preserved. Cost or financial burden shall not be considered a hardship. Modification may be considered if an alternative standard or approach will provide equal or better achievement of the purpose of the Ordinance. A request for modifications shall be in writing and accompany the Stormwater Management Drainage Plan or Site Plan submission. The request shall provide the facts on which the request is based, the provision(s) of the Ordinance involved and the proposed modification.

C. No waiver or modification of any regulated stormwater activity involving earth disturbance greater than or equal to one acre may be granted by the Township unless that action is approved in advance by the DEP or the delegated county conservation district.

§ 220-9 DUTY OF PERSONS ENGAGED IN THE DEVELOPMENT OF LAND

Notwithstanding any provisions of this Ordinance, including waiver provisions, any landowner and any person engaged in the alteration or development of land which may affect stormwater runoff characteristics shall implement such measures as are reasonably necessary to prevent injury to health, safety, or other property. Such measures shall include such actions as are required to manage the rate, volume, and direction of resulting stormwater runoff in a manner which otherwise adequately protects health and property from possible injury.

Township review and approval of the Drainage Plan or the subsequent observation and approval of stormwater management facilities, shall not constitute land development on behalf of or by the Township or otherwise cause the Township to be engaged in the alteration or development of land.

By submitting an application under this Ordinance, the Developer (as herein defined) hereby agrees to indemnify, defend, and hold harmless the Township and all its agents, servants, employees, officials, and consultants of and from any and all claims, demands, causes of action, or suite which arise out of or relate to the review, approval, construction, or observation of the Developer's Drainage Plan and stormwater management facilities.

§ 220-10 PUBLIC RECORDS AND WAIVER OF COPYRIGHT

A. By making a submission under this Ordinance, the Developer acknowledges and agrees that all documents and other information submitted to the Township or its consultants pursuant hereto constitute public records within the meeting of the Pennsylvania Right to Know Law ("RTK Law"), Act 3 of 2008, as amended, and are subject to review and reproduction upon request in accordance with the RTK Law and applicable Township ordinances and resolutions.

B. To the extent that any documents or materials constitute public records but are subject to copyright protection pursuant to applicable law, the Developer and all of its agents, employees and consultants, by filing such documents with the Township pursuant to this Ordinance, shall be deemed to have waived all copyright protection and damages related hereto. This waiver of copyright protection shall relate only to the reproduction and use of such documents in connection with the review, analysis, or approval of a plan and the use of the information contained within such documents for the purpose of review and analysis of the impact of the plan to other property.

C. By making a submission under this Ordinance, the Developer hereby agrees to indemnify, defend, and hold harmless the Township and all its agents, servants, employees, officials, and consultants of and from any and all claims, damages, suits or causes of actions arising out of violations or allegations of violations of copyright law.

§ 220-11 UNSWORN FALSIFICATION TO AUTHORITIES

All statements made, whether written or oral, to the Township in connection with any submission pursuant to this Ordinance, shall be true and correct to the best of the knowledge, information and belief of the applicant or its agents and consultants, and with the understanding that any false statement is subject to the penalties of 18 Pa. C.S.A. Section 4904, relating to "Unsworn Falsification to Authorities".

§ 220-12 LIABILITY

Neither the approval nor the granting of any building permit, occupancy permit, floodplain permit, site plan review, subdivision approval, land development approval, zoning permit, erosion review, stormwater runoff review, steep slope review or any other review or permit of this Section, involving any land governed by the provisions of this Section of the Ordinance, by an officer, consultant, employee or agency of the Township, shall constitute a representation, guarantee or warranty of any kind by the Township or its employees, consultants, officials, or agencies of the practicality or safety of any structure, use, land development or subdivision; and shall create no liability upon, nor a cause of action against such public body, official, consultant nor employee for any damage that may result pursuant thereto.

ARTICLE 2
DEFINITIONS

§ 220-13 DEFINITIONS OF TERMS AND PHRASES

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

A. Words used in the present tense include the future tense; the singular number includes the plural and the plural number includes the singular; words of masculine gender include feminine gender and words of feminine gender include masculine gender.

B. The word "includes" or "including" shall not limit the term to the specific example but is intended to extend its meaning to all other instances of like kind and character.

C The words "shall" and "must" are mandatory; the words "may" and "should" are permissive.

D. Any word, term or phase used in this Ordinance, but not specially defined herein, shall be given its normal and customary meaning.

These definitions do not necessarily reflect the definitions contained in pertinent regulations or statutes and are intended for this Ordinance only.

Accelerated Erosion – The removal of the surface of the land through the combined action of human activities and natural processes, at a rate greater than would occur because of the natural process alone.

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

Agricultural Plowing or Tilling Activity – (1) Earth disturbance activity involving the preparation and maintenance of soil for the production of agricultural crops. (2) The term includes no-till cropping methods, which is the practice of planting crops with minimal mechanical tillage.

Applicant – A landowner, developer, person, partnership, association, corporation or other entity or other responsible person therein or agent thereof, who has filed an application to the Township for approval to engage in any regulated activity at a project site in the Township.

Best Management Practice (BMP) – Activities, facilities, designs, measures, or procedures used to manage stormwater quantity and quality impacts from regulated activities listed in **§ 220-5** to meet state Water Quality requirements, to promote groundwater recharge, and to otherwise meet the purposes of this Ordinance. Stormwater BMPs are commonly grouped into one of two broad categories or measures: "structural" or "non-structural." In this Ordinance, non-structural BMPs or measures refer to operational and/or behavior-related practices that attempt to minimize the contact of pollutants with stormwater runoff, whereas structural BMPs or measures are those that consist of a physical device or practice that is installed to capture and treat stormwater runoff. Structural BMPs include, but are not limited to, a wide variety of practices and devices, from large-

scale retention ponds and constructed wetlands to small-scale underground treatment systems, infiltration facilities, filter strips, low impact design, bioretention, wet ponds, permeable paving, grassed swales, riparian or forested buffers, sand filters, detention basins, and manufactured devices. Structural stormwater BMPs are permanent appurtenances to the project site.

Best Management Practice Operations and Maintenance Plan – Documentation, included as part of a Drainage Plan, detailing the proposed BMPs, how they will be operated and maintained and who will be responsible.

Bioretention – Densely vegetated, depressed features that store stormwater and filter it through vegetation, mulch, planting soil, etc. Ultimately, stormwater is evapotranspirated, infiltrated or discharged. Optimal bioretention areas mimic natural forest ecosystems in terms of species diversity, density, distribution, use of native plants, etc.

Buffer

1. Streamside buffer. A zone of variable width located along a stream that is vegetated and is designed to filter pollutants from runoff; and
2. Special geologic feature buffer. A required isolation distance from a special geologic feature to a proposed BMP needed to reduce the risk of sinkhole formation due to stormwater management activities.

Capture/Reuse – Stormwater management techniques, such as cisterns and rain barrels which direct runoff into storage devices, surface or subsurface for later reuse, such as irrigation of gardens and other planted areas.

Carbonate Bedrock – Rock consisting chiefly of carbonate minerals, such as limestone and dolomite; specifically, a sedimentary rock composed of more than 50% by weight of carbonate minerals that underlies soil or other unconsolidated superficial material.

Channel – The bed and banks of watercourses, which confine and convey the normal flow of the water, either continuously or intermittently.

Cistern – An underground reservoir or tank for storing rainwater.

Closed Depression – In a karst area, a distinctive bowl-shaped depression in the land surface. It is characterized by internal drainage, varying magnitude, and an unbroken ground surface.

Concentrated Drainage Discharge – Stormwater runoff leaving a property via a point source.

Conservation District – The Northampton County Conservation District (NCCD), as applicable.

Constructed Wetlands – Constructed wetlands are similar to wet ponds (see below) and consist of a basin which provides for necessary stormwater storage as well as a permanent pool or water level, planted with wetland vegetation. To be successful, constructed wetlands must have adequate natural hydrology (both runoff inputs as well as soils and water table which allow for maintenance of a permanent pool of water). In these cases, the permanent pool must be designed carefully, usually with shallow edge benches, so that water levels are appropriate to support carefully selected wetland vegetation.

Culvert – A pipe, conduit or similar structure including appurtenant works which carries surface water.

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

DEP – The Pennsylvania Department of Environmental Protection.

Design Storm – The depth and time distribution of precipitation from a storm event measured in probability of occurrence (e.g., 100-year storm) and duration (e.g., 24 hours), used in the design and evaluation of stormwater management control systems.

Detention Basin – A basin designed to retard stormwater runoff by temporarily storing the runoff and releasing it at a predetermined rate.

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

Developer – See "Applicant."

Development Site – See "Project Site."

Diffused Drainage – See "Sheet Flow."

Direct Recharge/Subsurface BMP – A BMP designed to direct runoff to groundwater recharge without providing for vegetative uptake. Examples include infiltration trenches, seepage beds, drywells, and stormwater drainage wells such that nearly all runoff becomes recharge to groundwater.

Disturbed Area – An unstabilized land area where an earth disturbance activity is occurring or has occurred.

Disturbance – Any activity involving the clearing, excavating, storing, grading, filling, or transporting of soil or any other activity which causes soil to be exposed to the danger of erosion.

Diversion – A channel with or without a supporting ridge on the lower side constructed to intercept and divert surface runoff.

Drainage – The removal of surface water or groundwater from land by drains, grading, or other means and includes control of runoff to minimize erosion and sedimentation during and after construction or development and means necessary for water supply preservation or prevention or alleviation of flooding.

Drainage Easement – A right granted by a landowner to a grantee, allowing the use of private land for stormwater management purposes.

Drainage Plan – The documentation of the proposed stormwater quantity and quality management controls, if any, to be used for a given development site, including a BMP Operations and Maintenance Plan, the contents of which are established in **§ 220-36**.

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

Embankment – A man-made deposit of soil, rock, or other material.

Erosion – The natural process by which the surface of the land is worn away by water, wind, ice, chemical action or other geological agents.

Excavation or Cut – An act by which soil or soils are cut into, dug, quarried, uncovered, removed, displaced, or relocated.

Existing Condition – The dominant land cover during the 5-year period immediately preceding a proposed regulated activity.

Existing Grade – The vertical location of the existing ground surface prior to cutting or filling.

Existing Uses – Those uses actual attained in the water body on or after November 28, 1975, whether or not they are included in the water quality standards. (25 Pa. Code Chapter 93.1)

FEMA – Federal Emergency Management Agency.

Fill – Man-made deposits of natural soils or rock products and waste materials.

Filter Strips – See "Vegetated Buffers."

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

Floodway – The channel of the watercourse and those portions of the adjoining floodplains that are reasonably required to carry and discharge the 100-year flood. Unless otherwise specified, the boundary of the floodway is as indicated on maps and flood insurance studies provided by FEMA. In an area where

no FEMA maps or studies have defined the boundary of the 100-year floodway, it is assumed--absent evidence to the contrary--that the floodway extends 50 feet from the top of the bank of the stream.

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

Freeboard – The incremental depth in a stormwater management structure, provided as a safety factor of design, above that required to convey the design runoff event.

Grading – Any stripping, cutting, filling, stockpiling or any combination thereof and shall include the land in its cut or filled condition.

Green Infrastructure – Systems and practices that use or mimic natural processes to infiltrate, evapotranspire, or reuse stormwater on the site where it is generated.

Ground Floor – The first floor of a building other than a cellar or basement, as those areas are defined in the Township-adopted Building Code.

Groundwater Recharge – Replenishment of existing natural underground water supplies.

Hardship Waiver Request – A written request for a waiver alleging that the provisions of this Chapter inflict unnecessary hardship upon the applicant. Hardship waiver does not apply to and is not available from the water quality provisions of this Chapter, and shall not be granted.

Hot Spot Land Uses – A land use or activity that generates higher concentrations of hydrocarbons, trace metals or other toxic substances than typically found in stormwater runoff. These land uses are listed in **§ 220-18P.**

Hydrologic Soil Group (HSG) – Infiltration rates of soils vary widely and are affected by subsurface permeability as well as surface intake rates. Soils are classified into four HSGs (A, B, C, and D) to indicate the minimum infiltration rates, which are obtained for bare soil after prolonged wetting. The Natural Resources Conservation Service (NRCS) defines the four groups and provides a list of most of the soils in the United States and their group classification. The soils in the area of the development site may be identified from a soil survey report that can be obtained from local NRCS offices or conservation district offices. Soils become less pervious as the HSG varies from A to D (NRCS1,2).

Impervious Surface (Impervious Cover) – A surface which prevents the percolation of water into the ground. Impervious surfaces (or areas) shall include, but not be limited to: roofs; additional indoor living spaces, swimming pools, patios, garages, storage sheds and similar structures; and any paved streets, sidewalks, driveways, and parking areas. Decks, parking areas, and driveway areas are not counted as impervious areas if they do not prevent infiltration.

Infiltration Practice – A practice designed to allow direct runoff an opportunity to infiltrate into the ground, (e.g., French drain, seepage pit, seepage trench or bioretention area).

Infiltration Structure – A structure designed to direct runoff into the ground, (e.g., French drain, seepage pit, or seepage trench).

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

Land Development – See definition in the Township Subdivision and Land Development Ordinance ("SALDO") and the MPC.

Loading Rate – The ratio of the land area draining to the system, as modified by the weighting factors in **§ 220-18B** compared to the base area of the infiltration system.

Local Runoff Conveyance Facilities – Any natural channel or man-made conveyance system which has the purpose of transporting runoff from the site to the mainstem.

Low Impact Development – Site design approaches and small-scale stormwater management practices that promote the use of natural systems for infiltration, evapotranspiration, and reuse of rainwater. Low impact development can be applied to new development, urban retrofits, and revitalization projects. Low

impact development utilizes design techniques that infiltrate, filter, evaporate, and store runoff close to its source. Rather than rely on costly large-scale conveyance and treatment systems, low impact development addresses stormwater through a variety of small, cost-effective landscape features located on-site.

Lowest Floor – Lowest floor of the enclosed area, including basements and cellars, as those areas are defined in the Township-adopted Building Code.

LVPC – Lehigh Valley Planning Commission.

Mainstem (Main Channel) – Any stream segment or other conveyance used as a reach in the Bushkill Creek, Fry's Run, Monocacy Creek, or Nancy Run hydrologic models.

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

Maryland Stormwater Design Manual – A stormwater design manual written by the Maryland Department of the Environment and the Center for Watershed Protection. The manual can be obtained through the following web site: www.mde.state.md.us.

Minimum Disturbance/Minimum Maintenance Practices (MD/MM) – A site design practice in which careful limits are placed on site clearance prior to development allowing for maximum retention of existing vegetation (woodlands and other), minimum disturbance and compaction of existing soil mantle and minimum site application of chemicals post-development. Typically, MD/MM includes disturbance setback criteria from buildings as well as related site improvements such as walkways, driveways, roadways, and any other improvements. This criteria may vary by community context as well as by type of development being proposed. Additionally, MD/MM also shall include provisions (e.g., deed restrictions, conservation easements) to protect these areas from future disturbance and from application of fertilizers, pesticides and herbicides.

No Harm Runoff Quantity Option – The option of using a less restrictive runoff quantity control if it can be shown that adequate and safe runoff conveyance exists and that the less restrictive control would not adversely affect health, safety, and property.

NPDES Regulations – National Pollutant Discharge Elimination System regulations.

NRCS – USDA Natural Resource Conservation Service (formerly the Soil Conservation Service).

Obstruction – Any structure, materials, fill or activity that would impede, retard, or change natural or approved stormwater flows.

Oil/Water Separator – A structural mechanism designed to remove free oil and grease (and possibly solids) from stormwater runoff.

Outfall – "Point source" as described in 40 CFR § **122.2** at the point where the Township's storm sewerage system discharges to waters of the Commonwealth.

Owner – One with an interest in and often dominion over a property.

Parent Tract – A lot or tract of land with its condition considered at the time of the Township adoption of the original Bushkill Creek, Fry's Run, Monocacy Creek, and Nancy Run Act 167 Stormwater Management Ordinances (May 1992, February 1999, March 1989, and March 1989 respectively). A parent tract is all contiguous land held in single and separate ownership, regardless of whether such land is divided into one or more lots, parcels, purparts, or tracts; such land was acquired by the landowner at different times or by different deeds, devise, partition or otherwise; or such land is bisected by public or private streets or rights-of-way. Single and separate ownership is the ownership of property by any person, partnership, or corporation.

Peak Discharge – The maximum rate of flow of stormwater runoff at a given location and time resulting from a specific storm event.

Penn State Runoff Model (PSRM) – The computer-based hydrologic modeling technique adapted to each watershed for the Act 167 Plans. The model was calibrated to reflect actual flow values by adjusting key model input parameters.

Person – An individual, partnership, public or private association or corporation, or a governmental unit, public utility or other for or not for profit statutory entity or other legal entity whatsoever which is recognized by law as the subject of rights and duties.

Pervious Area – Any area not defined as impervious.

Point Source – Any discernible, confined, and discrete conveyance including, but not limited to, any pipe, ditch, channel, tunnel, or conduit from which stormwater is or may be discharged, as defined in state regulations at 25 Pa. Code § 92.1.

Porous Pavement – A specific type of pavement with a high porosity that allows rainwater to pass through it into the ground below.

Preliminary Site Investigation – The determination of the depth to bedrock, the depth to the seasonal high-water table and the soil permeability for a possible infiltration location on a site through the use of published data and on-site surveys. In carbonate bedrock areas, the location of special geologic features must also be determined along with the associated buffer distance to the possible infiltration area.

Pre-Treatment – Measures implemented for Hot Spot Land Uses designed to reduce concentration of hydrocarbons, trace metals, and other toxic substances to levels typically found in stormwater runoff.

Project Site – The specific area of land where any regulated activities in the Township are planned, conducted, or maintained.

Public Water Supplier – A person who owns or operates a public water system.

Public Water System – A system which provides water to the public for human consumption which has at least 15 service connections or regularly serves an average of at least 25 individuals daily at least 60 days out of the year. (see 25 Pa. Code Chapter 109).

Qualified Geotechnical Professional – A licensed professional engineer or geologist who has a background or expertise in geology, hydrogeology, or geotechnical engineering.

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

Rational Method – A method of peak runoff calculation using a standardized runoff coefficient (rational "c"), acreage of tract and rainfall intensity determined by return period and by the time necessary for the entire tract to contribute runoff. The rational formula is stated as follows: Q = ciA, where "Q" is the calculated peak flow rate in cubic feet per second, "c" is the dimensionless runoff coefficient (see Appendix C), "I" is the rainfall intensity in inches per hour, and "A" is the area of the tract in acres. [The Rational method formula for runoff volume calculation is as follows: V= cPA/12 where "c" and "A" are as noted above, "P" is the total depth of precipitation for the design event in inches, and "V" is the total runoff volume in acre-feet].

Reach – Any of the natural or man-made runoff conveyance channels used for watershed modeling purposes to connect the subareas and transport flows downstream.

Recharge Volume (REv) – The portion of the water quality volume (WQv) used to maintain groundwater recharge rates at development sites. (See **§ 220-18J**).

Regulated Activities – Any earth disturbance activities or any activities that involve the alteration or development of land in a manner that may affect stormwater runoff and which are governed by this Chapter as specified in **§ 220-5D**.

Regulated Earth Disturbance Activity – Activity involving earth disturbance, other than agricultural plowing or tilling, subject to regulation under 25 Pa. Code 92, 25 Pa. Code 102, or the Clean Streams Law. Earth disturbance activity other than agricultural plowing or tilling of one acre or more with a point source discharge to surface waters or to the Township's storm sewer system or earth disturbance activity of five acres or more regardless of the planned runoff. This includes earth disturbance on any portion of, part or during any stage of a larger common plan of development.

Release Rate – The percentage of the pre-development peak rate of runoff for a development site to which the post-development peak rate of runoff must be controlled to avoid peak flow increases throughout the watershed.

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

Riparian Buffer – A permanent area of trees and shrubs located adjacent to streams, lakes, ponds, and wetlands.

Road Maintenance – Earth disturbance activities within the existing road cross-section such as grading and repairing existing unpaved road surfaces, cutting road banks, cleaning, or clearing drainage ditches and other similar activities.

Runoff – That part of precipitation which flows over the land.

Runoff BMP – A BMP designed for essentially the full volume of runoff entering the BMP to be discharged off-site.

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

Sediment Traps/ Catch Basin Sumps – A chamber which provides storage below the outlet in a storm inlet to collect sediment, debris, and associated pollutants, typically requiring periodic clean out.

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

Separate Storm Sewer System – A conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains) primarily used for collecting and conveying stormwater runoff.

Sheet Flow – Stormwater runoff flowing in a thin layer over the ground surface.

Soil-Cover-Complex Method – A method of runoff computation developed by NRCS which is based upon relating soil type and land use/cover to a runoff parameter called a curve number.

Special Geologic Features – Carbonate bedrock features including, but not limited to, closed depressions, existing sinkholes, fracture traces, lineaments, joints, faults, caves, and pinnacles, which may exist and must be identified on a site when stormwater management BMPs are being considered.

Spill Prevention and Response Program – A program that identifies procedures for preventing and, as needed, cleaning up potential spills and makes such procedures known and the necessary equipment available to appropriate personnel.

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

1. Each stream segment in Pennsylvania has a "designated use," such as "cold water fishes" or "potable water supply," which are listed in Chapter 93. These uses must be protected and maintained, under state regulations;
2. "Existing uses" are those attained as of November 1975, regardless whether they have been designated in Chapter 93. Regulated earth disturbance activities must be designed to protect and maintain existing uses and maintain the level of water quality necessary to protect those uses in all streams and to protect and maintain water quality in special protection streams; and
3. Water quality involves the chemical, biological and physical characteristics of surface water bodies. After regulated earth disturbance activities are complete, these characteristics can be impacted by addition of pollutants such as sediment and changes in habitat through increased flow volumes and/or rates as a result of changes in land surface area from those activities. Therefore, permanent discharges to surface waters must be managed to protect the stream bank, streambed, and structural integrity of the waterway, to prevent these impacts.

Storage Indication Method – A method of routing or moving an inflow hydrograph through a reservoir or detention structure. The method solves the mass conservation equation to determine an outflow hydrograph as it leaves the storage facility.

Storm Drainage Problem Areas – Areas which lack adequate stormwater collection and/or conveyance facilities and which present a hazard to persons or property. These areas are either documented in Appendix B of this Chapter or identified by the Township or Township Engineer.

Storm Sewer – A system of pipes or other conduits which carries intercepted surface runoff, street water and other wash waters or drainage, but excludes domestic sewage and industrial wastes.

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

Stormwater Detention – The holding or slowing down of stormwater runoff to limit the amounts of post development runoff (release rate) to a required percentage of the pre-development amounts of runoff during peak periods.

Stormwater Drainage Wells – Wells for injection of stormwater to the surface that are regulated by the U.S. Environmental Protection Agency to protect underground sources of drinking water.

Stormwater Filters – Any number of structural mechanisms such as multi-chamber catch basins, sand/peat filters, sand filters and so forth, which are installed to intercept stormwater flow and remove pollutants prior to discharge. Typically, these systems require periodic maintenance and clean out.

Stormwater Management District – Individual areas as they appear on the Bushkill Creek, Fry's Run, Monocacy Creek and Nancy Run release rate maps. Each district is assigned an allowable release rate.

Stormwater Management Facility – Any structure, natural or man-made, that, due to its condition, design, or construction, conveys, stores, or otherwise affects stormwater runoff. Typical stormwater management facilities include but are limited to: detention and retention basins; open channels; storm sewers; pipes; and infiltration facilities.

Stormwater Management Plan – The plan for managing stormwater runoff adopted by Northampton County for the Bushkill Creek, Fry's Run, Monocacy Creek, and Nancy Run Watersheds as required by the Act of October 4, 1978, P.L. 864, (Act 167), as amended, and known as the "Stormwater Management Act."

Stormwater Management Site Plan – The plan prepared by the developer or its representative indicating how stormwater runoff will be managed at a development site in accordance with this Ordinance, in cases as outlined in **§ 220-47**.

Stream – A watercourse.

Subarea – The smallest unit of watershed breakdown for hydrologic modeling purposes for which the runoff control criteria have been established in the Stormwater Management Plan.

Subdivision – As defined in the Pennsylvania Municipalities Planning Code, Act of July 31, 1968, P.L. 805, No. 247 and the Township Subdivision and Land Development Ordinance.

Surface Waters – Perennial and intermittent streams, rivers, lakes, reservoirs, ponds, wetlands, springs, natural seeps, and estuaries, excluding water at facilities approved for wastewater treatment such as wastewater treatment impoundments, cooling water ponds and constructed wetlands used as part of a wastewater process.

Swale – A low-lying stretch of land which gathers or carries surface water runoff. See also "vegetated swale."

Technical Best Management Practice Manual and Infiltration Feasibility Report, November 2002 – The report written by Cahill Associates that addresses the feasibility of infiltration in carbonate bedrock areas in the Little Lehigh Creek Watershed. The report is available at the Lehigh Valley Planning Commission offices.

Timber Harvesting Activities – Earth disturbance activities, including the construction of skid trails, logging roads, landing areas and other similar logging or silvicultural practices.

Township – Bethlehem Township, Northampton County, Pennsylvania.

Trash/Debris Collectors – Racks, screens or other similar devices installed in a storm drainage system to capture coarse pollutants (trash, leaves, etc.).

USDA – United States Department of Agriculture.

Vegetated Buffers – Gently sloping areas that convey stormwater as sheet flow over a broad, densely vegetated earthen area, possibly coupled with the use of level spreading devices. A water quality BMPs

vegetated buffers serve to filter pollutants from runoff and promote infiltration. Vegetated buffers should be situated on minimally disturbed soils, have low-flow velocities and extended residence times. Vegetated buffers may be, but are not restricted to, use in riparian (streamside) conditions.

Vegetated Roofs – Vegetated systems installed on roofs that generally consist of a waterproof layer, a root-barrier, drainage layer (optional), growth media and suitable vegetation. Vegetated roofs store and eventually evapotranspirate the collected rooftop rainfall; overflows may be provided for larger storms.

Vegetated Swales

1. Vegetated earthen channels designed to convey and possibly treat stormwater. These swales are not considered to be water quality BMPs; and
2. Broad, shallow, densely vegetated, earthen channels designed to treat stormwater while slowly infiltrating, evapotranspirating, and conveying it. Swales should be gently sloping with low flow velocities to prevent erosion. Check dams may be added to enhance performance.

Vegetated/Surface BMP – A BMP designed to provide vegetative uptake and soil renovation or surface infiltration of runoff. Capture/reuse BMPs are included if the captured runoff is applied to vegetated areas. Examples include bioretention and surface infiltration basins.

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

Water Quality Inserts – Any number of commercially available devices that are inserted into storm inlets to capture sediment, oil, grease, metals, trash, debris, etc.

Water Quality Volume (WQv) – The increase in runoff volume on a development site associated with a 2-year, 24 hour storm event. (See **§ 220-18B).**

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

Watershed – Region or area drained by a river or other body of water whether natural or artificial.

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

Wet Detention Ponds – A basin that provides necessary stormwater storage as well as a permanent pool of water. To be successful, wet ponds must have adequate natural hydrology (both runoff inputs as well as soils and water table which allow for maintenance of a permanent pool of water) and must be able to support a healthy aquatic community so as to avoid creation of mosquito and other health and nuisance problems.

ARTICLE 3
STORMWATER MANAGEMENT STANDARDS

§ 220-14 GENERAL REQUIREMENTS

A For all regulated activities, unless preparation of a Drainage Plan is specifically exempted in Section **§ 220-35**:

1. Preparation and implementation of an approved Drainage Plan is required; and
2. No regulated activities shall commence until the Township issues written approval of a Drainage Plan, which demonstrates compliance with the requirements of this Ordinance.

B. Drainage Plans approved by the Township, in accordance with **§ 220-38**, shall be on site throughout the duration of the regulated activity.

C. The Township may, after consultation with DEP, approve measures for meeting the state water quality requirements other than those in this Ordinance, provided that they meet the minimum requirements of, and do not conflict with, state law including, but not limited to, the Clean Streams Law.

D. For all regulated earth disturbance activities, erosion, and sediment control BMPs shall be designed, implemented, operated, and maintained during the regulated earth disturbance activities (e.g., during

construction) to meet the purposes and requirements of this Ordinance and to meet all requirements under Title 25 of the Pennsylvania Code and the Clean Streams Law. Various BMPs and their design standards are listed in the *Erosion and Sediment Pollution Control Program Manual* (E&S Manual[3]), No. 363-2134-008, as amended and updated.

E Impervious areas:

1. The measurement of impervious areas shall include all of the impervious areas in the total proposed development even if development is to take place in stages;
2. For development taking place in stages, the entire development plan must be used in determining conformance with this Ordinance; and
3. For projects that add impervious area to a parcel, the total impervious area on the parcel is subject to the requirements of this Ordinance; except that the volume controls in **§ 220-41** and the peak rate controls of **§ 220-42** do not need to be retrofitted to existing impervious areas that are not being altered by the proposed regulated activity.

F. Stormwater flows onto adjacent property shall not be created, increased, or otherwise altered without written notification to the adjacent property owner(s). Such stormwater flows shall be subject to the requirements of this Ordinance. Areas of existing diffused drainage discharge onto adjacent property shall be managed such that, at minimum, the peak diffused flow does not increase in the general direction of discharge, except as otherwise provided in this Ordinance. If diffused flow is proposed to be concentrated and discharged onto adjacent property (including flows from detention basin emergency spillways), the developer's engineer must document and certify that there are adequate downstream conveyance facilities to safely transport the concentrated discharge to the point of pre-development flow concentration, to the stream reach, or otherwise prove that no harm will result from the concentrated discharge. It is recommended the developer obtain written permission from the downstream property owner(s) for the proposed discharges. Areas of existing diffused drainage discharge shall be subject to any applicable release rate criteria in the general direction of existing discharge where they are proposed to be concentrated or maintained as diffused drainage areas.

G. All regulated activities shall include such measures as necessary to:

1. Protect health, safety, and property; and
2. Meet the water quality goals of this Ordinance by implementing measures to:
   a. Minimize disturbance to floodplains, wetlands, and wooded areas;
   b. Maintain or extend riparian buffers;
   c. Avoid erosive flow conditions in natural flow pathways;
   d. Minimize thermal impacts to waters of the Commonwealth;
   e. Disconnect impervious surfaces by directing runoff to pervious areas, wherever possible; and
   f. Incorporate methods described in the "Pennsylvania Stormwater Best Management Practices Manual" (BMP Manual).

H. The design of all facilities over karst areas shall include an evaluation of measures to minimize adverse effects.

I. Infiltration BMPs should be spread out, made as shallow as practicable, and located to maximize use of natural on-site infiltration features while still meeting the other requirements of this Ordinance.

J. Normally dry, open top, storage facilities should completely drain both the volume control and rate control capacities over a period of time not less than 24 and not more than 72 hours from the end of the design storm.

K. The design storm volumes to be used in the analysis of peak rates of discharge should be obtained from the latest version of the Precipitation-Frequency Atlas of the United States, (NOAA), National Weather Service, Hydrometeorological Design Studies Center, Silver Spring, Maryland.

NOAA's Atlas 14[5] can be accessed at: http://hdsc.nws.noaa.gov/hdsc/pfds/.

L. For all regulated activities, SWM BMPs shall be designed, implemented, operated, and maintained to meet the purposes and requirements of this Chapter and to meet all requirements under Title 25 of the Pennsylvania Code, the Clean Streams Law, and the Storm Water Management Act.

M. Various BMPs and their design standards are listed in the BMP Manual[4].

N. Storm drainage system shall be designed to preserve natural watercourses except as modified by stormwater detention facilities, recharge facilities, water quality facilities, pipe systems or open channels consistent with this Ordinance.

O. Where a site is traversed by watercourses, swales, ditches, etc., there shall be drainage easements provided conforming substantially with the line of such watercourses, swales, ditches, etc. The width of any easement shall be adequate to provide for unimpeded flow of post-development storm runoff based on either calculations completed by the developer in conformance with **§ 220-22** for the 100-year return period runoff, the Bushkill Creek, Fry's Run, Monocacy Creek, and Nancy Run Act 167 100-year return period flows, or Federal Emergency Management Agency (FEMA) 100-year frequency flood flows and to provide a freeboard allowance of 0.5 foot above the design water surface level. In all areas, the flow rate to be utilized shall be the maximum rate identified through either developer's calculations, the Bushkill Creek, Fry's Run, Monocacy Creek, and Nancy Run Act 167 or (if applicable) FEMA study flows. In areas where the Act 167 flow rate is the maximum rate, this rate shall be used unless a reduced flow rate is determined by the Lehigh Valley Planning Commission to take precedence over the Act 167 flow rate. This maximum flow rate shall be used to determine the 100-year water surface elevations based on HEC-RAS modeling (or other modeling method as approved by the Township). The terms of the easement shall prohibit excavation, the placing of fill or structures, and any alterations which may adversely affect the flow of stormwater within any portion of the easement in the post-development condition. Also, periodic maintenance of the easement to ensure proper runoff conveyance shall be required. Watercourses for which the 100-year floodplain is formally defined by FEMA studies are subject to the applicable municipal floodplain regulations. All proposed buildings within or adjacent to a floodplain as defined by FEMA studies shall have first floor elevations at least 1.5 feet above the 100-year frequency flood elevation. The 100-year flood elevation to be used to establish the first-floor elevation shall be determined using the greater of the maximum flow rate referenced in FEMA study flows, Act 167 flows, or calculated flows as set forth above.

P. Any drainage facilities or structures required by this Ordinance that are located on state highway rights-of-way shall be subject to approval by the Pennsylvania Department of Transportation (PENNDOT) and the Township.

Q. When it can be shown that, due to topographic conditions, natural drainage swales on the site cannot adequately provide drainage, open channels may be constructed conforming substantially to the line and grade of such natural drainage swales. Capacities of open channels shall be calculated using the Manning's Equation.

R. Storm drainage facilities and appurtenances shall be so designed and provided as to minimize erosion in watercourse channels and at all points of discharge.

S. Consideration should be given to the design and use of volume controls for stormwater management, where geology and soils permit. Areas of suitable geology for volume controls shall be determined by the Township. Documentation of the suitability of the soil for volume controls shall be provided by the applicant. Volume controls shall be acceptable in areas of suitable geology where the soils are designated as well drained in the County Soil Survey. Other soils may be acceptable for use of volume controls based on site-specific soils evaluations provided by the applicant.

T. Within areas containing soils identified by the Soils Conservation Service to be sinkhole prone, detention basins shall be lined with a material which, after installation, attains a permeability rate of less than or equal to 1×10^{-7} cm/sec.

U. Parking lot ponding depth may not exceed two inches in areas of anticipated pedestrian traffic and six inches in all other areas for a 25-year frequency storm.

V. Post-construction BMPs shall be designed, installed, operated, and maintained to meet the requirements of the Clean Streams Law and implementing regulations, including the established practices in 25 Pa. Code Chapter 102 and the specifications of this Chapter as to prevent accelerated erosion in watercourse channels and at all points of discharge.

W. No earth disturbance activities associated with any regulated activities shall commence until approval by the Township of a plan which demonstrates compliance with the requirements of this Ordinance.

X. Techniques described in Appendix F (Low Impact Development) of this Ordinance are encouraged because they reduce the costs of complying with the requirements of this Ordinance and the state Water Quality Requirements.

Y. Infiltration for stormwater management is encouraged where soils and geology permit, consistent with the provisions of this Ordinance and, where appropriate, the Recommendation Chart for Infiltration

Stormwater Management BMPs in Carbonate Bedrock in Appendix D.[2] Infiltration is encouraged for capturing and treating the Water Quality Volume (as calculated in **§ 220-18**), any part of the Water Quality volume or for otherwise meeting the purposes of this Ordinance.

Z. Rates of post development stormwater runoff (measured in cubic feet per second) shall not exceed the percentages of the pre-development flow rates for any area as mandated by this section. Allowable post development percentages shall be as follows:

1. For the Bushkill Creek Watershed, as is listed for each individual stormwater management district as shown on the Watershed Release Rate Map (Appendix B of this Ordinance);
2. For the Monocacy Creek Watershed, as is listed for each individual stormwater management district as shown on the Watershed Release Rate Map (Appendix B of this Ordinance);
3. For the Nancy Run Watershed, as is listed for each individual stormwater management district as shown on the Watershed Release Rate Map (Appendix B of this Ordinance);
4. For the Fry's Run Watershed, as is listed for each individual stormwater management district as shown on the Watershed Release Rate Map (Appendix B of this Ordinance); and
5. During construction and preparatory earthmoving in all areas of the Township: 100%.

AA. Control of runoff from a site shall occur using appropriate means of detention of the water on the site and/or other approved types of stormwater management within the requirements of this Section.

BB. Runoff that is detained shall be held and released at a predetermined controlled rate by appropriately installed devices. The release shall be in the same manner as the natural or pre-development means of discharge from a Site (such as point discharge or sheet flow).

CC. Stormwater runoff shall not be increased or redirected in such a way that it results in hazards to persons or property or interferes with the normal movement of vehicles.

DD. All stormwater management methods are subject to review by the Township Engineer.

EE. Stormwater shall be directed away from buildings and on-lot septic systems.

FF. All Drainage Plans shall take into account and provide for existing flows within the entire Watershed.

GG. The existing points of natural drainage discharge onto adjacent property shall not be altered nor shall the concentration of water runoff be increased because of development without the written approval of all affected landowners.

HH. No stormwater runoff or natural drainage water shall be so diverted as to overload existing Drainage systems, or create flooding or the need for additional Drainage structures on other private properties or public lands, without complete approval of provisions being made by the Developer for properly handling such conditions, including water runoff impoundments, if necessary.

II. All lots shall be laid out and graded to prevent cross lot drainage, to provide positive drainage away from proposed building locations and any primary or alternate septic system location.

JJ. An adequate storm sewerage system consisting of inlets and other underground drainage structures with approved outlets shall be constructed where the runoff of stormwater and the prevention of erosion cannot be accomplished satisfactorily by surface drainage facilities, as determined by the Board of Commissioners based upon the recommendation of the Township Engineer.

KK. Outlet locations shall be reviewed by the Township Engineer.

LL. Sequence of construction. No substantial grading shall occur, and no building permits shall be issued for any building unless any Detention Basin, siltation basin or improved major swale approved to handle the resulting runoff is in place. Any Detention Basin shall be seeded and stabilized and have an installed outlet structure prior to the construction of any streets or buildings within that Drainage Basin.

§ 220-15 EXEMPTIONS

A. Regulated activities that result in cumulative earth disturbances less than one acre and that meet the exemption criteria of **§ 220-5.E.** are exempt from the requirements in **§ 220-41, § 220-42**, and Article 4 of this Ordinance.

B. Agricultural activity is exempt from the Drainage Plan preparation requirements of this Chapter provided the activities are performed according to the requirements of 25 Pa. Code Chapter 102.

C. Forest management and timber operations are exempt from the Drainage Plan preparation requirements of this Ordinance provided the activities are performed according to the requirements of 25 Pa. Code Chapter 102.

D. Exemptions from any provisions of this Ordinance shall not relieve the applicant from the requirements in **§ 220-5 (D)(5)** through **§ 220-5 (D)(7)**.

E. The Township may deny or revoke any exemption pursuant to this Section at any time for any project that the Township believes may pose a threat to public health and safety or the environment.

§ 220-16 PERMIT REQUIREMENTS BY OTHER GOVERNMENT ENTITIES

The following permit requirements apply to certain regulated and earth disturbance activities and must be met prior to commencement of regulated and earth disturbance activities, as applicable:

A. All regulated and earth disturbance activities subject to permit requirements by DEP under regulations at 25 Pa. Code Chapter 102.

B. Work within natural drainageways subject to permit by DEP under 25 Pa. Code Chapter 102 and Chapter 105.

C. Any stormwater management facility that would be located in or adjacent to surface waters of the Commonwealth, including wetlands, subject to permit by DEP under 25 Pa. Code Chapter 105.

D. Any stormwater management facility that would be located on a state highway right-of-way or require access from a state highway shall be subject to approval by the PENNDOT.

E. Culverts, bridges, storm sewers, or any other facilities which must pass or convey flows from the tributary area and any facility which may constitute a dam subject to permit by DEP under 25 Pa. Code Chapter 105.

§ 220-17 EROSION AND SEDIMENT CONTROL DURING REGULATED EARTH DISTURBANCE ACTIVITIES

A. No regulated earth disturbance activities within the Township shall commence until approval by the Township of an erosion and sediment control plan for construction activities. Written approval by DEP or a delegated County Conservation District shall satisfy this requirement.

B. An erosion and sediment control plan is required by DEP regulations for any earth disturbance activity of 5,000 square feet or more under **25** Pa. Code § 102.4(b) and must be approved by the Conservation District per the Memorandum of Understanding between the Township and the Conservation District (as applicable).

C. No regulated Earth Disturbance Activities within the Township shall commence until erosion and sedimentation control facilities are in place.

D. A DEP NPDES Stormwater Discharges Associated with Construction Activities Permit is required for regulated earth disturbance activities under 25 Pa. Code Chapter **92**.

E. Evidence of any necessary permit(s) for regulated earth disturbance activities from the appropriate DEP regional office or County Conservation District must be provided to the Township before the commencement of earth disturbance activity.

F. A copy of the erosion and sediment control plan and any permit, as required by DEP regulations, shall be available at the project site at all times.

§ 220-18 POST-CONSTRUCTION WATER QUALITY CRITERIA

A. No regulated earth disturbance activities within the Township shall commence until approval by the Township of a Drainage Plan which demonstrates compliance with this Chapter. This Chapter provides standards to meet NPDES permit requirements associated with construction activities and MS4 permit requirements.

B. The water quality volume (WQv) shall be captured and treated. The WQv shall be calculated two ways.

1. First, WQv shall be calculated using the following formula:

$$WQv = \frac{(c)(P)(A)}{12}$$

Where:

WQv	=	Water quality volume in acre-feet
c	=	Rational Method post-development runoff coefficient for the 2-year storm
P	=	1.25 inches
A	=	Area in acres of proposed regulated activity

2. Second, the WQv shall be calculated as the difference in runoff volume from pre-development to post-development for the 2-year return period storm. The effect of closed depressions on the site shall be considered in this calculation. The larger of these two calculated volumes shall be used as the WQv to be captured and treated. This standard does not limit the volume of infiltration an applicant may propose for purposes of water quantity/peak rate control.

C. The WQv shall be calculated for each post-development drainage direction on a site for sizing BMPs. Site areas having no impervious cover and no proposed disturbance during development may be excluded from the WQv calculations and do not require treatment.

D. If an applicant is proposing to use a dry extended detention basin, wet pond, constructed wetland or other BMP that ponds water on the land surface and may receive direct sunlight, the discharge from that BMP must be treated by infiltration, a vegetated buffer, filter strip, bioretention, vegetated swale, or other BMP that provides a thermal benefit to protect the high-quality waters of the Bushkill Creek, Fry's Run, and Monocacy Creek Watersheds from thermal impacts.

E. The WQv for a site as a result of the regulated activities must either be treated with infiltration or two acceptable BMPs such as those listed in Subsection **O**, except for minor areas on the periphery of the site that cannot reasonably be drained to an infiltration facility or other BMP.

F. Infiltration BMPs shall not be constructed on fill unless the applicant demonstrates that the fill is stable and otherwise meets the infiltration BMP standards of this Ordinance.

G. The applicant shall document the bedrock type(s) present on the site from published sources. Any apparent boundaries between carbonate and noncarbonate bedrock shall be verified through more detailed site evaluations by a qualified geotechnical professional.

H. For each proposed regulated activity in the watershed where an applicant intends to use infiltration BMP, the applicant shall conduct a Preliminary Site Investigation, including gathering data from published sources, a field inspection of the site, a minimum of one test pit and a minimum of two percolation tests, as outlined in Appendix G. This investigation will determine depth to bedrock, depth to the seasonal high-water table, soil permeability, and location of special geologic features, if applicable. This investigation may be done by a certified Sewage Enforcement Officer (SEO) except that the location(s) of special geologic features shall be verified by a qualified geotechnical professional. Additionally, the Township Geotechnical Consultant or its authorized representative shall be notified of the soil testing in order to observe any such testing as determined to be necessary.

I. Sites where applicants intend to use infiltration BMPs must meet the following criteria:

1. Depth to bedrock below the invert of the BMP greater than or equal to two feet;

2. Depth to seasonal high-water table below the invert of the BMP greater than or equal to three feet; except for infiltration of residential roof runoff where the seasonal high-water table must be below the invert of the BMP. (If the depth to bedrock is between two and three feet and the evidence of the seasonal high-water table is not found in the soil, no further testing to locate the depth to seasonal high-water table is required.);

3. Soil permeability (as measured by the adapted 25 PA Code § 73.15. percolation test in Appendix G) greater than or equal to 0.5 inches/hour and less than or equal to 12 inches per hour;

4. Setback distances or buffers as follows:

   a. One hundred feet from water supply wells;

   b. Fifteen feet downgradient or one hundred feet upgradient from building foundations; except for residential development where the required setback is fifteen feet downgradient or forty feet upgradient from building foundations;

   c. Fifty feet from septic system drainfields; except for residential development where the required setback is twenty-five feet from septic system drainfields;

   d. Fifty feet from a geologic contact with carbonate bedrock unless a Preliminary Site Investigation is done in the carbonate bedrock to show the absence of special geologic features within fifty feet of the proposed infiltration area; and

   e. One hundred feet from the property line unless documentation is provided to show that all setbacks from existing or potential future wells, foundations and drainfields on neighboring properties will be met; except for one- and two-family residential dwellings where the required setback is forty feet unless documentation is provided to show that all setbacks from existing or potential future wells, foundations and drainfields on neighboring properties will be met.

   A reduction of the setbacks noted above may be permitted based on the Township Geotechnical Consultant review of the proposal.

J. For entirely noncarbonate sites, the recharge volume (REv) shall be infiltrated unless the applicant demonstrates that it is infeasible to infiltrate the REv for reasons of seasonal high-water table, permeability rate, soil depth or setback distances; or except as provided in Subsection **U**.

1. The REv shall be calculated as follows:

   REv = (0.25)*(I)/12

   Where:

REv	=	Recharge volume in acre-feet
I	=	Impervious area in acres

2. The Preliminary Site Investigation described in Subsection **H** is required and shall continue on different areas of the site until a potentially suitable infiltration location is found or the entire site is determined to be infeasible for infiltration. For infiltration areas that appear to be feasible based on the preliminary site investigation, the additional site investigation and testing as outlined in Appendix G shall be completed;

3. If an applicant proposes infiltration, the Township may determine infiltration to be infeasible if there are known existing conditions or problems that may be worsened by the use of infiltration;

4. The site must meet the conditions listed in Subsection **I**;

5. If it is not feasible to infiltrate the full REv, the applicant shall infiltrate that portion of the REv that is feasible based on the site characteristics. If none of the REv can be infiltrated, REv shall be considered as part of the WQv and shall be captured and treated as described in Subsection **O**; and

6. If REv is infiltrated, it may be subtracted from the WQv required to be captured and treated.

K. In entirely carbonate areas, where the applicant intends to use infiltration BMPs, the Preliminary Site Investigation described in Subsection **H** shall be conducted. For infiltration areas that appear feasible based on the Preliminary Site Investigation, the applicant shall conduct the Additional Site Investigation and testing as outlined in Appendix G. The soil depth, percolation rate and proposed loading rate, each weighted as described in **§ 220-6**, along with the buffer from special geologic features shall be compared to the Recommendation Chart for Infiltration Stormwater Management BMPs in Carbonate Bedrock in Appendix D to determine if the site is recommended for infiltration. In addition to the recommendation from Appendix D, the conditions listed in Subsection **I** are required for infiltration in carbonate areas. Applicants are encouraged to infiltrate the REv, as calculated in Subsection **J**, but are not required to use infiltration BMPs on a carbonate site even if the site falls in the "Recommended" range on the chart in Appendix D. Any amount of volume infiltrated can be subtracted from the WQv to be treated by non-infiltration BMPs. If infiltration is not proposed, the full WQv shall be treated by two acceptable BMPs, as specified in Subsection **O**.

L. If a site has both carbonate and noncarbonate areas, the applicant shall investigate the ability of the noncarbonate portion of the site to fully meet this Ordinance to meet the requirements for REv for the whole site through infiltration. If that proves infeasible, infiltration in the carbonate area as described in Subsection **K** or two other non-infiltration BMPs as described in Subsection **O** must be used. No infiltration structure in the noncarbonate area shall be located within 50 feet of a boundary with carbonate bedrock, except when a preliminary site investigation has been done showing the absence of special geologic features within 50 feet of the proposed infiltration area.

M. If infiltration BMPs are proposed in carbonate areas, the post-development 2-year runoff volume leaving the site shall be 80% or more of the pre-development runoff volume for the carbonate portion of the site to prevent infiltration of volumes far in excess of the pre-development infiltration volume unless otherwise approved by Township Geotechnical Consultant and the Township Engineer.

N. Site areas proposed for infiltration shall be protected from disturbance and compaction except as necessary for construction of infiltration BMPs.

O. If infiltration of the entire WQv is not proposed, the remainder of the WQv shall be treated by two acceptable BMPs in series for each discharge location. Sheet flow draining across a pervious area can be considered as one BMP. Sheet flow across impervious areas and concentrated flow shall flow through two BMPs. If sheet flow from an impervious area is to be drained across a pervious area as one BMP, the length of the pervious area must be equal to or greater than the length of impervious area. In no case may the same BMP be employed consecutively to meet the requirement of this Section. Acceptable BMPs are listed below along with the recommended reference for design.

Best Management Practice	**Design Reference Number[C]**
Bioretention[A]	4, 5, 11, 16
Capture/reuse[B]	4, 14
Constructed wetlands	4, 5, 8, 10, 16
Dry extended detention ponds	4, 5, 8, 12, 18
Minimum disturbance/minimum maintenance practices	1, 9
Significant reduction of existing impervious cover	N/A
Stormwater filtersA (sand, peat, compost, etc.)	4, 5, 10, 16
Vegetated buffers/filter strips	2, 3, 5, 11, 16, 17
Vegetated roofs	4, 13
Vegetated swales[A]	2, 3, 5, 11, 16, 17
Water quality inlets[D]	4, 7, 15, 16, 19
Wet detention ponds	4, 5, 6, 8

NOTES:

A This BMP could be designed with or without an infiltration component. If infiltration is proposed, the site and BMP will be subject to the testing and other infiltration requirements in this Chapter.

B If this BMP is used to treat the entire WQv, then it is the only BMP required because of this BMPs superior water quality performance.

C See table below.

D Water quality inlets include such BMPs as oil/water separators, sediment traps/catch basin sumps, and trash/debris collectors in catch basins.

Design Reference Title

1 "Conservation Design For Stormwater Management — A Design Approach to Reduce Stormwater Impacts From Land Development and Achieve Multiple Objectives Related to Land Use," Delaware Department of Natural Resources and Environmental Control, The Environmental Management Center of the Brandywine Conservancy, September 1997.

2 "A Current Assessment of Urban Best Management Practices: Techniques for Reducing Nonpoint Source Pollution in the Coastal Zone," Schueler, T. R., Kumble, P. and Heraty, M., Metropolitan Washington Council of Governments, 1992.

3 "Design of Roadside Channels with Flexible Linings," Federal Highway Administration, Chen, Y. H. and Cotton, G. K., Hydraulic Engineering Circular 15, FHWA-IP-87-7, McLean Virginia, 1988.

4 "Draft Stormwater Best Management Practices Manual," Pennsylvania Department of Environmental Protection, January 2005.

5 "Evaluation and Management of Highway Runoff Water Quality," Federal Highway Administration, FHWA-PD-96-032, Washington, D.C., 1996.

Best Management Practice	Design Reference Number[C]
6	"Evaporation Maps of the United States," U.S. Weather Bureau (now NOAA/National Weather Service) Technical Paper 37, Published by Department of Commerce, Washington D.C., 1959.
7	"Georgia Stormwater Manual," AMEC Earth and Environmental, Center for Watershed Protection, Debo and Associates, Jordan Jones and Goulding, Atlanta Regional Commission, Atlanta, Georgia, 2001.
8	"Hydraulic Design of Highway Culverts," Federal Highway Administration, FHWA HDS 5, Washington, D.C., 1985 (revised May 2005).
9	"Low Impact Development Design Strategies An Integrated Design Approach," Prince Georges County, Maryland Department of Environmental Resources, June 1999.
10	"Maryland Stormwater Design Manual," Maryland Department of the Environment, Baltimore, Maryland, 2000.
11	"Pennsylvania Handbook of Best Management Practices for Developing Areas," Pennsylvania Department of Environmental Protection, 1998.
12	"Recommended Procedures for Act 167 Drainage Plan Design," Lehigh Valley Planning Commission, Revised 1997.
13	"Roof Gardens History, Design, and Construction," Osmundson, Theodore. New York: W.W. Norton and Company, 1999.
14	"The Texas Manual on Rainwater Harvesting," Texas Water Development Board, Austin, Texas, Third Edition, 2005.
15	"VDOT Manual of Practice for Stormwater Management," Virginia Transportation Research Council, Charlottesville, Virginia, 2004.
16	"Virginia Stormwater Management Handbook," Virginia Department of Conservation and Recreation, Richmond, Virginia, 1999.
17	"Water Resources Engineering," Mays, L. W., John Wiley and Sons, Inc., 2005.
18	"Urban Hydrology for Small Watersheds," Technical Report 55, US Department of Agriculture, Natural Resources Conservation Service, 1986.
19	US EPA, Region 1 New England web site (as of August 2005) http://www.epa.gov/NE/assistance/ceitts/stormwater/techs/html.

P. Stormwater runoff from hot spot land uses shall be pretreated. In no case may the same BMP be employed consecutively to meet this requirement and the requirement in Subsection **O**. Acceptable methods of pretreatment are listed below.

Hot Spot Land Use	Pretreatment Method(s)
Vehicle maintenance and repair facilities, including auto parts stores	Water quality inlets
	Use of drip pans and/or dry sweep material under vehicles/equipment
	Use of absorbent devices to reduce liquid releases
	Spill prevention and response program
Vehicle fueling stations	Water quality inlets
	Spill prevention and response program
Storage areas for public works	Water quality inlets
	Use of drip pans and/or dry sweep material under vehicles/equipment
	Use of absorbent devices to reduce liquid releases
	Spill prevention and response program
	Diversion of stormwater away from potential contamination areas
Outdoor storage of liquids	Spill prevention and response program
Commercial nursery operations	Vegetated swales/filter strips

Hot Spot Land Use	Pretreatment Method(s)
	Constructed wetlands Stormwater collection and reuse
Salvage yards and recycling facilities*	BMPs that are a part of a stormwater pollution prevention plan under an NPDES permit
Fleet storage yards and vehicle cleaning facilities*	BMPs that are a part of a stormwater pollution prevention plan under an NPDES permit
Facilities that store or generate regulated substances*	BMPs that are a part of a stormwater pollution prevention plan under an NPDES permit
Marinas*	BMPs that are a part of a stormwater pollution prevention plan under an NPDES permit
Certain industrial uses (listed under NPDES)*	BMPs that are a part of a stormwater pollution prevention plan under an NPDES permit

NOTES:

* Regulated under the NPDES Stormwater Program

Design references for the pretreatment methods, as necessary, are listed below. If the applicant can demonstrate to the satisfaction of the municipality that the proposed land use is not a hot spot, then the pretreatment requirement would not apply.

Pretreatment Method	Design Reference[A]
Constructed wetlands	4, 5, 8, 10, 16
Diversion of stormwater away from potential contamination areas	4, 11
Stormwater collection and reuse (especially for irrigation)	4, 14
Stormwater filters (sand, peat, compost, etc.)	4, 5, 10, 16
Vegetated swales	2, 3, 5, 11, 16, 17
Water quality inlets	4, 7, 15, 16, 19

NOTES:

A These numbers refer to the Design Reference Title Chart in Subsection **O**, above.

Q. The use of infiltration BMPs is prohibited on hot spot land use areas unless otherwise approved by the Township Geotechnical Consultant and the Township Engineer.

R. Stormwater infiltration BMPs shall not be placed in or on a special geologic feature(s). Additionally, stormwater runoff shall not be discharged into existing on-site sinkholes.

S. Applicants shall request, in writing, public water suppliers to provide the Zone I Wellhead Protection radius, as calculated by the method outlined in the DEP Wellhead Protection regulations, for any public water supply well within 400 feet of the site. In addition to the setback distances specified in Subsection **I**, infiltration is prohibited in the Zone I radius as defined and substantiated by the public water supplier in writing. If the applicant does not receive a response from the public water supplier, the Zone I radius is assumed to be 100 feet.

T. The volume and rate of the net increase in stormwater runoff from the regulated activities must be managed to prevent the physical degradation of receiving waters from such effects as scour and stream bank destabilization, to satisfy state water quality requirements, by controlling the 2-year post-development runoff to a 30% release rate.

U. The Township may, after consultation with DEP, approve alternative methods for meeting the state water quality requirements other than those in this section, provided that they meet the minimum requirements of and do not conflict with state law, including but not limited to the Clean Streams Law.

§ 220-19 GREEN INFRASTRUCTURE AND EXISTING WATER BALANCE PRESERVATION STANDARDS

A. The entire WQv as calculated in **§ 220-18.B** of this Ordinance shall be captured and treated by either Direct Recharge/Subsurface and/or Vegetated/Surface BMPs.

B. As much proposed impervious area as practical shall be directed to water quality BMPs.

C. Existing impervious area that is not proposed to be treated by Direct Recharge/Subsurface BMPs should be excluded from all water balance calculations.

D. Vegetated/Surface BMPs shall be employed "first" for the site to capture the equivalent of a minimum of 0.38 inches of runoff for each square foot of impervious area, unless proven not feasible by the applicant. For proposed impervious cover directed to multiple BMPs, the Vegetated/Surface BMP capture volume chart in Appendix C of this Ordinance shall be used to determine overall site compliance. Direct Recharge/Subsurface BMPs may be used "first" for portions of the impervious cover provided the overall Vegetated/Surface BMP "first" standard is met.

E. A maximum of 30% of the total annual rainfall for a site may be directly recharged to groundwater using Direct Recharge/Subsurface BMPs, for runoff from impervious areas.

1. For development sites with greater than 33% proposed impervious cover:

   a. If all impervious cover is directed to Vegetated/Surface BMPs to capture the entire 2-year, 24 hour event, the Direct Recharge standard is met;

   b. Up to 33% of the site as impervious cover may be directed to Direct Recharge/Subsurface BMPs designed to capture the entire 2-year, 24 hour event provided the overall Vegetated/Surface BMP "first" standard is met. All remaining impervious cover shall be directed to Vegetated/Surface BMPs designed to capture the remainder of the WQv; and

   c. For Vegetated/Surface and/or Direct Recharge/Subsurface BMPs designed for runoff from impervious areas designed to capture less than the entire 2-year, 24 hour event, Appendix C of this Ordinance shall be used to assure that the maximum Direct Recharge standard is met.

2. The maximum 30% Direct Recharge standard applies on an overall site basis, rather than in each drainage direction.

§ 220-20 STORMWATER MANAGEMENT DISTRICTS

A. Mapping of Stormwater Management Districts – To implement the provisions of the Bushkill Creek, Fry's Run, Monocacy Creek, and Nancy Run Watershed Stormwater Management Plans, the Township is hereby divided into Stormwater Management Districts consistent with the Bushkill Creek, Fry's Run, Monocacy Creek, and Nancy Run Release Rate Maps presented in the Plan Update. The boundaries of the Stormwater Management Districts are shown on a Stormwater Management Districts Map which is available for inspection at the Township Municipal Building at 4225 Easton Avenue, Bethlehem, PA 18020. A copy of this Map at a reduced scale is included in Appendix A of this Ordinance for general reference.

B. Release Rate Districts in the Monocacy Creek Watershed – There are six single release rate districts that differ in the extent to which the post-development runoff must be controlled. The release rate districts are 50%, 60%, 70%, 80%, 90% and 100%. Within a given district, the post-development peak rate of storm runoff must be controlled to the stated percentage of the pre-development peak rate of runoff for each of the 10-, 25-, 50- and 100-year return period storms to protect downstream watershed areas. There is one dual release rate district. Within this district, the 10-year return period event needs to meet a 30% release rate, and the 2-year and 25-year and higher return period events need to meet a 100% release rate.

C. Conditional No Detention Districts in the Monocacy Creek Watershed – These watershed areas peak very early with respect to the total watershed peak flow and contribute very minimal flow to the watershed peak flow. For that reason, these watershed areas may discharge post-development peak runoff without detention for the 10- through 100-year return periods without adversely affecting the total watershed peak flow. These areas are designated as "conditional" no detention areas because in certain instances the "local" runoff conveyance facilities, which transport runoff from the site to the main channel, may not have adequate capacity to safely transport the peak flows associated with no detention for a proposed development. In those instances, a 100% release rate control would have to be provided or, alternately, the capacity deficiency(ies) would have to be corrected.

D. Description of Stormwater Management Districts in the Bushkill Creek, Nancy Run, and Fry's Run Watersheds. Two types of Stormwater Management Districts may be applicable to the Township, namely Conditional/Provisional No Detention Districts and Dual Release Rate Districts as described below.

- Conditional/Provisional No Detention Districts. Within these districts, the capacity of the "local" runoff conveyance facilities (as defined in Article 2 of this Ordinance) must be calculated to determine if adequate capacity exists. For this determination, the Developer must calculate peak flows assuming that the site is developed as proposed and that the remainder of the local watershed is in the

existing condition. The Developer must also calculate peak flows assuming that the entire local watershed is developed per current zoning and that all new development would use the runoff controls specified in this Ordinance. The larger of the two peak flows calculated will be used in determining if adequate capacity exists. If adequate capacity exists to safely transport runoff from the site to the main channel (as defined in Article 2 of this Ordinance), these Watershed areas may discharge post-development peak runoff without detention facilities. If the capacity calculations show that the "local" runoff conveyance facilities lack adequate capacity, the Developer shall either use a 100% release rate control or provide increased capacity of downstream elements to convey increased peak flows consistent with **§ 220-21.D** of this Ordinance. Any capacity improvements must be designed to convey runoff from development of all areas tributary to the improvement consistent with the capacity criteria specified in **§ 220-21.D** of this Ordinance. By definition, a storm drainage problem area associated with the "local" runoff conveyance facilities indicates that adequate capacity does not exist. Sites in these districts are still required to meet all of the water quality requirements in **§ 220-18.B** of this Ordinance;

- Dual Release Rate Districts. Within these districts for the Bushkill Creek, Nancy Run, and Fry's Run Watersheds, the 2-year post-development peak discharge must be controlled to 30% of the pre-development 2-year runoff peak. Further, the 10-, 25-, 50- and 100-year post-development peak runoff must be controlled to the stated percentage of the pre-development peak. Release rates associated with the 10- through 100-year events vary from 50% to 100% depending upon location in the Watershed. (For the Monocacy Creek and Nancy Run Watersheds, the original Single Release Rate Districts become Dual Release Rate Districts due to the channel protection standard requiring developments to meet a 2-year 30% release rate.).

§ 220-21 STORMWATER MANAGEMENT DISTRICT IMPLEMENTATION PROVISIONS

A. Applicants shall provide a comparative pre- and post-construction stormwater management hydrograph analysis for each direction of discharge and for the site overall to demonstrate compliance with the provisions of this Ordinance.

B. Any stormwater management controls required by this Ordinance and subject to a dual release rate criteria shall meet the applicable release rate criteria for each of the 2-, 10-, 25-, 50-, and 100-year return period runoff events consistent with the calculation methodology specified in **§ 220-22**.

C. The exact location of the stormwater management district boundaries as they apply to a given development site shall be determined by mapping the boundaries using the two-foot topographic contours provided as part of the Drainage Plan. The district boundaries as originally drawn coincide with topographic divides or, in certain instances, are drawn from the intersection of the watercourse and a physical feature such as the confluence with another watercourse or a potential flow obstruction (e.g., road, culvert, bridge, etc.). The physical feature is the downstream limit of the subarea and the subarea boundary is drawn from that point up slope to each topographic divide along the path perpendicular to the contour lines.

D. Any downstream capacity analysis conducted in accordance with this Ordinance shall use the following criteria for determining adequacy for accepting increased peak flow rates:

1. Natural or man-made channels or swales must be able to convey the increased runoff associated with a 2-year return period event within their banks at velocities consistent with protection of the channels from erosion;

2. Natural or man-made channels or swales must be able to convey the increased 25-year return period runoff without creating any hazard to persons or property; and

3. Culverts, bridges, storm sewers, or any other facilities which must pass or convey flows from the tributary area must be designed in accordance with DEP Chapter 105 regulations (if applicable) and, at minimum, pass the increased 25-year return period runoff.

E. For a proposed development site located within one release rate category subarea, the total runoff from the site shall meet the applicable release rate criteria. For development sites with multiple directions of runoff discharge, individual drainage directions may be designed for up to a 100% release rate so long as the total runoff from the site is controlled to the applicable release rate and no increase in runoff volume is proposed in the 100% release rate direction(s).

F. For a proposed development site located within two or more release category subareas, the peak discharge rate from any subarea shall be the pre-development peak discharge for that subarea multiplied by the applicable release rate. The calculated peak discharges shall apply regardless of whether the grading plan changes the drainage area by subarea. An exception to the above may be granted if discharges from multiple subareas recombine in proximity to the site. In this case, peak discharge in any direction may be a 100% release rate provided that the overall site discharge meets the weighted average release rate and no increase in runoff volume is proposed in the 100% release rate direction(s).

G. For a proposed development site located partially within a release rate category subarea and partially within a conditional/provisional no detention subarea, the size of the pre-development drainage area on a site may not be changed post-development to create potentially adverse conditions on downstream properties except as part of a no harm or hardship waiver procedure.

H. For sites straddling major watershed divides (e.g., Monocacy Creek and Bushkill Creek), runoff volumes shall be managed to prevent diversion of runoff unless peak flow rate and volume controls are proposed which limit post-development peak flow rates to the required release rate criteria and volume discharges to pre-development levels between watersheds, as practicable.

I. No portion of a site may be regraded to redirect runoff onto adjacent property except as part of a no harm or hardship waiver procedure, or unless runoff peak flow rate and volume controls are proposed and implemented which limit post-development peak flow rate and volume discharges to pre-development levels, or all affected downstream property owners have granted express permission in the form of recorded easements.

J. Within a release rate category area, for a proposed development site which has areas which drain to a closed depression(s), the design release from the site will be the lesser of (1) the applicable release rate flow assuming no closed depression(s) or (2) the existing peak flow actually leaving the site. In cases where (2) would result in an unreasonably small design release, the design discharge of less than or equal to the release rate will be determined by the available downstream conveyance capacity to the main channel calculated using Subsection **D** and the minimum orifice criteria.

K. Off-site areas which drain through a proposed development site are not subject to release rate criteria when determining allowable peak runoff rates. However, on-site drainage facilities shall be designed to safely convey off-site flows through the development site using the capacity criteria in Subsection **D** and the detention criteria in **§ 220-22**. In addition to the criteria of Subsection **D** of this Ordinance, on-site conveyance systems designed to carry runoff to a detention basin must be able to transport the basin's 100-year tributary flow either in-system, in-gutter, or overland.

L. For development sites proposed to take place in phases, all detention ponds shall be designed to meet the applicable release rate(s) applied to all site areas tributary to the proposed pond discharge direction. All site tributary areas will be assumed as developed, regardless of whether all site tributary areas are proposed for development at that time. An exception shall be sites with multiple detention ponds in series where only the downstream pond must be designed to the stated release rate.

M. Where the site area to be impacted by a proposed development activity differs significantly from the total site area, only the proposed impact area shall be subject to the release rate criteria. The impact area includes any proposed cover or grading changes.

N. Development proposals which, through groundwater recharge or other means, do not increase either the rate or volume of runoff discharged from the site compared to pre-development are not subject to the release rate provisions of this Ordinance.

O. "No harm" water quantity option. For any proposed development site not located in a conditional/provisional no detention district, the developer has the option of using a less restrictive runoff control (including no detention) if the developer can prove that special circumstances exist for the proposed development site and that no harm would be caused by discharging at a higher runoff rate than that specified by the plan. Special circumstances are defined as any hydrologic or hydraulic aspects of the development itself not specifically considered in the development of the plan runoff control strategy. Proof of no harm would have to be shown from the development site through the remainder of the downstream drainage network to the confluence of the creek with the Delaware or Lehigh River. Proof of no harm must be shown using the capacity criteria specified in Subsection **D** if downstream capacity analysis is a part of the no harm justification. Attempts to prove no harm based upon downstream peak flow versus capacity analysis shall be governed by the following provisions:

1. The peak flow values to be used for downstream areas for the design return period storms (2-, 10-, 25-, 50- and 100-year) shall be the values from the calibrated Penn State Runoff Model (PSRM) Model for the Bushkill Creek, Fry's Run, Monocacy Creek, and Nancy Run or as

calculated by an applicant using an alternate method acceptable to the municipality. The flow values from the PSRM Model would be supplied to the developer by the Lehigh Valley Planning Commission upon request;

2. Any available capacity in the downstream conveyance system as documented by a developer may be used by the developer only in proportion to their development site acreage relative to the total upstream undeveloped acreage from the identified capacity (i.e., if their site is 10% of the upstream undeveloped acreage, they may use up to 10% of the documented downstream available capacity); and

3. Developer-proposed runoff controls which would generate increased peak flow rates at storm drainage problem areas would, by definition, be precluded from successful attempts to prove no harm, except in conjunction with proposed capacity improvements for the problem areas consistent with Subsection Q.

Any no harm justifications shall be submitted by the developer as part of the Drainage Plan submission per Article 4. Developers submitting no harm justifications must still meet all of the water quality requirements in **§ 220-18**.

P. Regional detention alternatives. For certain areas within the study area, it may be more cost-effective to provide one control facility for more than one development site than to provide an individual control facility for each development site. The initiative and funding for any regional runoff control alternatives are the responsibility of prospective developers. The design of any regional control basins must incorporate reasonable development of the entire upstream watershed. The peak outflow of a regional basin would be determined based on the required release rate at the point of discharge.

Q. Capacity improvements. In certain instances, primarily within the conditional/provisional no detention areas, local drainage conditions may dictate more stringent levels of runoff control than those based upon protection of the entire watershed. In these instances, if the developer could prove that it would be feasible to provide capacity improvements to relieve the capacity deficiency in the local drainage network, then the capacity improvements could be provided by the developer in lieu of runoff controls on the development site. Peak flow calculations shall be done assuming that the local watershed is in the existing condition and then assuming that the local watershed is developed per current zoning and using the specified runoff controls. Any capacity improvements would be designed using the larger of the above peak flows and the capacity criteria specified in Subsection **D**. All new development in the entire subarea(s) within which the proposed development site is located shall be assumed to implement the developer's proposed discharge control, if any. Capacity improvements may also be provided as necessary to implement any regional detention alternatives or to implement a modified no harm option which proposes specific capacity improvements to provide that a less stringent discharge control would not create any harm downstream.

R. Compatibility with NPDES requirements. Any proposed regulated activity for which a permanent stormwater quality control detention basin is required under the NPDES regulations shall use the more stringent runoff control criteria between this Ordinance and the NPDES requirements.

S. In any stormwater management district, the Township reserves the right to require a more stringent design release rate for a development site or other amendments to a Drainage Plan to address problems in the local runoff conveyance system downstream of the site. Such problems include existing flooding and erosion problems, inadequate conveyance capacity, poorly defined, or poorly stabilized downstream conveyance systems or other factors; or for other good cause shown; and supported by engineering data of the kind and type commonly accepted by the civil engineering profession in the evaluation and management of stormwater runoff.

T. In any stormwater management district, storm sewer piping, swales, and inlet systems shall be designed for a 25-year return period storm, or a 100-year return period storm where the system is designed to convey 100-year storm flows to a detention facility. Bridges and culverts along roadways shall be designed to convey the 100-year return period storm. Flows from off-site upstream areas shall be determined in accordance with the procedure identified in **§ 220-14.0.**

U. Release Rates need to be met year-round. Designs involving BMPs that function differently in winter versus non-winter conditions (e.g., capture/reuse with spray irrigation shut off for the winter) must still meet release rates during the winter.

§ 220-22 CALCULATION METHODOLOGY

A. Stormwater runoff from all development sites shall be calculated using either the Rational Method or the Soil-Cover-Complex methodology.

B. At a minimum, the applicant shall prove to the satisfaction of the Township Engineer that during earthmoving, construction or after development, peak stormwater discharge rates will not exceed the allowable release rate(s) for the stormwater management district(s) in which the site is situated when compared with those that occurred prior to any of these activities (see **§ 220-14.Z** of this Ordinance).

The following conditions and storm frequencies (considered individually) shall apply, unless any more restrictive requirements of an applicable official Stormwater Management Plan are adopted by DEP and the county pursuant to state Act 167 of 1978, as amended:

1. Two-year storm;
2. Ten-year storm;
3. Twenty-five-year storm;
4. Fifty-year storm; and
5. One-hundred-year storm.

C. Infiltration BMP loading rate percentages in the Recommendation Chart for Infiltration Stormwater Management BMPs in Carbonate Bedrock in Appendix D shall be calculated as follows:

(Area Tributary to infiltration BMP) ***100%**
Base area of infiltration BMP

The area tributary to the infiltration BMP shall be weighted as follows:

All disturbed areas to be made impervious:	weight at 100%
All disturbed areas to be made pervious:	weight at 50%
All undisturbed pervious areas:	weight at 0%
All existing impervious areas:	weight at 100%

D. Soil thickness is to be measured from the bottom of any proposed infiltration system. The effective soil thickness in the Recommendation Chart for Infiltration Stormwater Management BMPs in Carbonate Bedrock in Appendix D is the measured soil thickness multiplied by the thickness factor based on soil permeability (as measured by double ring infiltration percolation testing as described in the BMP Manual), as follows:

Permeability Range*	**Thickness Factor**
6.0 to 12.0 inches/hour	0.8
2.0 to 6.0 inches/hour	1.0
1.0 to 2.0 inches/hour	1.4
0.75 to 1.0 inches/hour	1.2
0.5 to 0.75 inches/hour	1.0

NOTES:

* If the permeability rate (as measured by the double ring infiltration percolation testing as described in the BMP Manual) falls on a break between two thickness factors, the smaller thickness factor shall be used.

Sites with soil permeability greater than 12.0 in/hr or less than 0.5 in/hr, as measured by the double ring infiltration percolation testing as described in the BMP Manual are not recommended for infiltration.

E. The design of any detention basin intended to meet the requirements of this Ordinance shall be verified by routing the design storm hydrograph through the proposed basin using the storage indication method or other methodology demonstrated to be more appropriate. For basins designed using the Rational Method technique, the design hydrograph for routing shall be the Universal Rational Hydrograph unless another methodology is approved by the Township. For detention basins with an outlet control structure, the basin routings using the Universal Rational Hydrograph should begin at the elevation of the lowest gravity outlet. For basins proposing zero (0) discharge, the design hydrograph shall be based on a 24 hour storm event (using the 24 hour rainfall depth identified in **§ 220.22.K** of this Ordinance).

F. BMPs designed to store or infiltrate runoff and discharge to surface runoff or pipe flow shall be routed using the storage indication method.

G. BMPs designed to store or infiltrate runoff and discharge to surface runoff or pipe flow shall provide storage volume for the full WQv below the lowest outlet invert.

H. Wet detention ponds designed to have a permanent pool for the WQv shall assume that the permanent pool volume below the primary outlet is full at the beginning of design event routing unless it is documented that the permanent pond elevation is maintained year round by gravity or a mechanical

pump system for the purpose of elevating peak outflows. All wet detention ponds shall be subject to review by the Township Geotechnical Consultant.

I. All above-ground Stormwater Detention facilities shall provide a minimum 0.5 feet of freeboard above the maximum pool elevation associated with the 2- through 100-year runoff events, or an additional 10% of the 100-year storage volume as freeboard volume, whichever is greater. All below-ground Stormwater Detention and infiltration facilities shall have an additional ten percent of the 100-year storage volume available within the storage medium, as well as a minimum of 0.5 feet of freeboard. The freeboard shall be measured from the maximum pool elevation to the invert of the emergency spillway for above-ground facilities, and from the maximum pool elevation to the lowest overflow elevation for below-ground facilities. The 2- through 100-year storm events shall be controlled by the primary outlet structure. An emergency spillway for each above-ground basin shall be designed to pass the 100-year return frequency storm peak basin inflow rate with a minimum 0.5-foot freeboard measured to the top of basin. The freeboard criteria shall be met considering any off-site areas tributary to the basin as developed, as applicable. Exceptions to the freeboard requirements are as follows:

1. Bioretention BMPs with a ponded depth less than or equal to 0.5 feet are exempt from the freeboard requirements;

2. Small Detention Basins, with a ponded depth less than or equal to 1.5 feet or having a depth to the top of the berm less than or equal to 2.5 feet, may provide 20% additional storage volume measured from the maximum ponded depth to the invert of the emergency spillway in lieu of the above requirements. The depth of the emergency spillway must be sufficient to pass either two times the 100-year peak or the 100-year peak with 0.2' of freeboard to the top of berm, whichever is greater; and

3. Small infiltration basins, with a ponded depth less than or equal to 1.5 feet or having a depth to the top of the berm less than or equal to 2.5 feet, may provide 20% additional storage volume measured from the maximum ponded depth to the top of the berm in lieu of the above requirements. In this case, an emergency spillway is only necessary if runoff in excess of the Detention Basin volume would cause harm to downstream owners. If a spillway is necessary, it must be sufficiently sized to pass the 100-year peak inflow.

   If this detention facility is considered to be a dam as per DEP Chapter 105, the design of the facility must be consistent with the DEP Chapter 105 regulations and may be required to pass a storm greater than the 100-year event.

J. The minimum circular orifice diameter for controlling discharge rates from detention facilities shall be three inches. Designs where a lesser size orifice would be required to fully meet release rates shall be acceptable with a 3-inch orifice provided that as much of the site runoff as practical is directed to the detention facilities. The minimum 3-inch diameter does not apply to the control of the WQv.

K. Runoff calculations using the Soil-Cover-Complex Method shall use the Natural Resources Conservation Service Type II 24 hour rainfall distribution. The 24 hour rainfall depths for the various return periods to be used consistent with this Chapter may be taken from the latest version of the Field Manual for Pennsylvania Design Rainfall Intensity Charts from NOAA Atlas 14.

Return Period	**24 Hour Rainfall Depth**
2-year	3.00 inches
10-year	4.56 inches
25-year	5.52 inches
50-year	6.48 inches
100-year	7.44 inches

NOTES:

A graphical and tabular presentation of the Type II 24 hour distribution is included in Appendix C.

L. Runoff calculations using the Rational Method shall use rainfall intensities consistent with appropriate times of concentration and return periods and NOAA Atlas 14, and the Atlas of the United States Precipitation and Precipitation Frequency Charts, current version.

M. Runoff Curve Numbers (CN's) to be used in the Soil-Cover-Complex method shall be based upon the matrix presented in Appendix C.

N. Runoff coefficients for use in the Rational Method shall be based upon the table presented in Appendix C.

O. The stormwater calculations shall include the following:

1. Pre- and post-development drainage maps showing existing and proposed grades and including any and all off-site tributary areas;
2. Pre- and post-development runoff calculations;
3. Detention Basin design calculations (as applicable);
4. Pipe and swale sizing calculations;
5. All other information that is needed to construct proposed Stormwater Drainage facilities including, but not limited to, slopes, proposed elevations, and typical cross sections;
6. The stormwater management district(s) in which the site is located and the applicable release rate (s); and
7. Such information as the Township Engineer determines is needed to determine compliance with this Section.

P. Where crop farming or disturbed earth exists on the Site prior to Development, meadow in good condition shall be used as the starting base for the calculation.

Q. Where a factor in a calculation is not definitive, the strictest value shall be used.

R. Any post development areas which may be designed to initially be semipervious (e.g., uncompacted aggregate, porous pavement, etc.) shall be considered impervious areas unless the Developer or landowner shall guarantee that the semipervious surface shall be maintained as such to the satisfaction of the Township.

S. All time of concentration calculations shall use a segmental approach which may include one or all of the flow types below:

1. Sheet Flow (overland flow) calculations shall use either the NRCS average velocity chart (Figure 3-1, Technical Release-55, 1975) or the modified kinematic wave travel time equation (equation 3-3, NRCS TR-55, June 1986). If using the modified kinematic wave travel time equation, the sheet flow length shall be limited to 50 feet for designs using the Rational Method and limited to 150 feet for designs using the Soil-Cover-Complex method;
2. Shallow concentrated flow travel times shall be determined from the watercourse slope, type of surface and the velocity from Figure 3-1 of TR-55, June 1986;
3. Open channel flow travel times shall be determined from velocities calculated by the Manning's Equation. Bankfull flows shall be used for determining velocities. Manning's "n" values shall be based on the table presented in Appendix C; and
4. Pipe flow travel times shall be determined from velocities calculated using the Manning's Equation assuming full flow and the Manning's "n" values from Appendix C.

T. If using the Rational Method, all pre-development calculations for a given discharge direction shall be based on a common time of concentration considering both on-site and off-site drainage areas. All post-development calculations for a given discharge direction shall be based on a common time of concentration considering both on-site and any off-site drainage areas.

U. The Manning's Equation shall be used to calculate the capacity of watercourses. Manning's "n" values used in the calculations shall be consistent with the table presented in Appendix C or other appropriate standard engineering "n" value resources. Pipe capacities shall be determined by methods acceptable to the Township Engineer.

V. The DEP, Chapter 105, Rules and Regulations, applies to the construction, modification, operation or maintenance of both existing and proposed dams, water obstructions and encroachments throughout the watershed. Criteria for design and construction of stormwater management facilities according to this Ordinance may differ from the criteria that are used in the permitting of dams under the Dam Safety Program.

W. When conditions exist such that a proposed detention facility may experience a tailwater effect, the basin shall be analyzed without any tailwater effect for all storm events for comparison against the required Release Rates. An additional routing of the 100-year storm with the full tailwater effect shall be performed to check that the basin has sufficient storage to contain the 100-year tributary inflow and meet freeboard requirements.

X. Storm sewer piping, roadside swales, and inlet systems shall be designed for a 24-hour Type II rainfall if using the SCS method. The openings of culverts and under bridges shall be designed for a 100-year, 24-hour Type II rainfall. All conveyance swales shall be designed to handle a 100-year storm, with the flow of such a 100-year storm contained within the lines of a drainage easement, and with all structures located at least 25 feet from such an easement.

Y. Within the 100-year floodplain, any stormwater management structures and systems shall be designed to handle 100-year storm (based upon a 24-hour Type II storm if using the Soil-Cover-Complex Method).

Z. The Drainage Plan shall show that a 100-year, 24-hour storm can be safely conveyed without jeopardizing any property on or off the site.

AA. Storm Drainage

1. General Requirements. Stormwater management facilities shall be provided where necessary to adequately control storm runoff in accordance with all applicable state and local laws and to protect the general public, and prevent undue damage to public and private property. To the extent that the provisions of this Section conflict with any Stormwater Management Plan adopted by the Township, the more stringent criteria shall prevail.

    a. Any proposed storm Drainage Plans which affect the drainage basin of any river or stream shall be approved by the DEP if the drainage basin so affected has an area of at least one-half (0.5) square mile;

    b. Storm sewers, culverts, and related installations shall be provided to permit the unimpeded flow of natural watercourses, to ensure the drainage of all low points on the reasonably related to the extent and grade of the area drained. The system shall also be designed in accordance with **§ 220-21.T** and **§ 220-29**:

        i. Developers shall dedicate easements, pipe collection systems and structures for storm drainage to the Township.

    c. No stormwater runoff or natural drainage water shall be so diverted as to overload existing drainage systems or create flooding or the need for additional drainage structures on other private or public lands, without proper and approved provisions being made for taking care of these conditions:

        i. The Township Board of Commissioners with the advice of the Township Engineer shall decide what provisions, including but not limited to suitable detention basins shall be made. Where stormwater management facilities are permitted, adequate assurances of maintenance, indemnification, liability insurance and security shall be provided by agreement with the Township, which agreement shall be approved by the Township Solicitor.

    d. In areas in which street curbs are not required by the Township Board of Commissioners or Township Engineer, drainage may be accomplished by natural or artificial swales and culverts. Special structures such as check dams, drop-outlets, permanent detention basins, or other energy dissipating structures or riprap may be required to prevent scour or erosion in locations with large run-off quantities or high velocities:

        i. Developers shall dedicate easements and/or structures for storm drainage to the Township where swales and/or culverts traverse or enter onto private property; and

        ii. The Township Board of Commissioners may require a fixed pipe collection system with catch basins.

    e. A subsurface collection system with catch basins shall be used in all areas in which street curbs and gutters are required.

        i. Underdrain pipe systems shall be required where soil conditions warrant their installation, as determined by the Township Geotechnical Consultant.

    f. Developer shall grade and install all necessary drainage facilities to ensure the drainage of all low points on subdivided lots or within the subdivision.

g. Designs Of Storm Drainage Systems:

i. Designs shall be prepared, signed, and sealed by a licensed professional engineer;

ii. Complete detailed calculations shall be submitted to the Township Engineer for approval;

iii. All designs must be reviewed and approved by the Township Engineer; and

iv. Any storm sewers shall be constructed to Township specifications and shall not interconnect with sanitary sewers.

2. Collection System. The collection system shall be designed by the Rational Method of Design in accordance with American Society of Civil Engineers Manual No. 37 except as noted using the formula Q=CiA, as amplified by the following sections.

a. "Q" is the required capacity in cubic feet per second for the collection system at the point of design;

b. "C" is the runoff coefficient applicable to the entire drainage area. It shall be based on consideration of soil conditions, average slope of the drainage area, and the ultimate development of the entire drainage area according to comprehensive plans. For various types of ultimate development, the runoff coefficient shall be within the ranges specified in accordance with **§ 220-22.N**;

c. "i" is the rainfall intensity in inches per hour and shall be determined from a calculated time of concentration and specified storm frequency. Time of concentration shall be computed in accordance with the requirements contained in **§ 220-22.L**. Design storm frequencies shall be 25-year for residential and all other developments. Rainfall intensities shall be in accordance with **§ 220-22.L**. Any conveyance system designed to transport runoff from a tributary area of greater than 100 acres shall be designed for the 100-year frequency design storm;

d. "A" is the drainage area, in acres, tributary to the point of design, and shall include tributary from outside sources as well as from within the subdivision itself. All calculations shall be accompanied by a drainage area map showing all areas tributary to each structure or discharge point;

e. Pipes and conduits shall be designed on the basis of Manning's formula and the Continuity Equation:

$v=1.486n*r^{2/3}*\sqrt{s}$

"v" is the mean velocity of flow in feet per second
"n" is the coefficient of roughness
n equals 0.013 for concrete pipe
n equals 0.021 for asphalt coated corrugated metal pipe, 25 percent (25%) paved
"r" is the hydraulic radius in feet
"s" is the slope of the energy grade line
"Q" equals VA where "A" equals cross-sectional area in square feet
$Q = V * A$

f. Culverts shall be designed on the basis of inlet or outlet control as appropriate, except where a more detailed backwater analysis is deemed warranted by the Township Engineer;

g. Manholes shall be spaced at intervals not exceeding four hundred (400) feet and shall be located wherever branches are connected or sizes are changed and wherever there is a change in alignment or grade;

h. For storm sewer lines of at least thirty-six (36) inches diameter, manholes may be spaced at intervals greater than four hundred (400) feet with the approval of the Township Engineer;

i. Storm sewer lines shall be located between the centerline of the street and the curb line and shall parallel the centerline of the street as far as practical. Sufficient number

of structures shall be provided such that unnecessary crossings of other utility lines and passage beneath curbs are eliminated; and

j. Culvert and/or hydraulic grade analysis, and inlet grate capacity calculations, shall be provided with storm sewerage system design calculations.

3. Swales. Swales used for outlets shall be designed on the basis of Manning's formula with the following considerations:

a. The roughness coefficient shall be: 0.040 for earth swales, and 0.015 for paved swales;

b. Design velocity in earth swales shall not exceed four (4) feet per second;

c. A swale right-of-way of sufficient minimum width to include a ten (10) foot access strip in addition to the width of the swale from bank top, shall be offered for dedication to the Township for drainage purposes. The Township Engineer may, under unusual conditions, require a wider swale right-of-way; and

d. Side or rear yard swales upstream or downstream of pipe culverts will be permitted only under the following conditions. If any one of these conditions cannot be met, the stormwater shall be piped in an underground system:

i. The diameter of the pipe culvert does not exceed 18 inches and the depth of flow in the swale for a 25-year frequency storm is less than 1 foot;

ii. The side slopes of the swale are not steeper than 4 horizontal to 1 vertical (4:1). An easement of sufficient width to encompasses the design full flow cross section plus 1 foot of freeboard at the design cross slope shall be offered for dedication to the Township;

iii. A note shall be added to the plan to be recorded that the ground surface elevations in any such drainage easements may not be altered by the property owner without the express, advance, written permission of the Township Board of Commissioners; and

iv. Flared end sections shall be provided on the open pipe ends in lieu of headwalls. The pipe shall be extended as far as is necessary to achieve a maximum 4:1 slope on the roadway embankment commencing at the edge of right-of-way in the case of a curbed roadway or at the edge of shoulder in the case of a non-curbed roadway.

4. Detention Basins:

a. Permanent detention basins may be required by the Township Engineer or Board of Commissioners as part of a Storm Water Drainage Plan when the rate of runoff after development will exceed the pre-development condition;

b. Fencing shall be required around detention basins in the following cases:

i. The maximum depth of water in the basin for a 10-year or a storm of greater intensity design storm is greater than 30";

ii. The side slopes of the basin are steeper than four (4) horizontal to one (1) vertical;

iii. The time to empty the basin is longer than 3 hours;

iv. The detention basin is to be dedicated to Bethlehem Township, and fencing is requested by the Township; or

v. The Board of Commissioners determines that the public safety would be endangered if the basin is not fenced.

c. Fencing and associated warning signs shall be in accordance with the Township Standard Construction Documents (latest revision);

d. Waiving of fencing of a detention basin may be considered by the Township if the nearest residential zoning district, school, existing dwelling, or recreation facility is at least 1,500 feet away in walking distance from the basin;

e. Detention basin design shall be based upon the general design requirements provided in this Ordinance (see **§ 220-27**);

f. The rate of outflow from the basin shall be restricted in accordance with the provisions of this Ordinance;

g. A minimum 12-foot wide ramp at a maximum 10% slope shall be constructed near the basin access fence to permit access to the bottom of basin for maintenance; and

h. In sinkhole prone soils, detention basins shall be lined with a material in accordance with **§ 220-14.T.**

5. Soil Erosion and Sedimentation Control:

a. No changes shall be made in the contour of the land, no grading, excavation, removal, or destruction of the topsoil, trees, or other vegetative cover of the land shall be commenced until such time that a plan for minimizing erosion and sedimentation has been reviewed and approved by the representative for NCCD, Bethlehem Township, and the Board of Commissioners.

b No subdivision plan shall be approved unless (1) there has been a plan approved by the representative for the NCCD and the Bethlehem Township Board of Commissioners that provides in the opinion of the Bethlehem Township Board of Commissioners for minimizing erosion and sedimentation and acceptable securities are deposited with the Township in the form of an escrow guarantee which will ensure installation and completion of the required improvements; or (2) there has been a determination by the representative for the NCCD and the Bethlehem Township Board of Commissioners that a plan for minimizing erosion and sedimentation is not necessary;

c. Measures used to control erosion and reduce sedimentation shall comply with the standards and specifications of the NCCD and receive the approval of the District. Once the subdivision plans have been finally approved, the District shall ensure compliance with the appropriate specifications and plans;

d. Whenever sedimentation is caused by stripping vegetation, regrading, or other development, it shall be the responsibility of the person, corporation, or other entity causing such sedimentation to remove it from all adjoining surfaces, drainage systems, watercourses, roads, and rights-of-way, and to repair any damage at this expense within twenty-four (24) hours of the occurrence;

e. Each person, corporation or other entity which makes any surface changes shall be required to:

i. Collect on-site surface runoff and dispose of it to the point of discharge into the common natural watercourse of the drainage area;

ii. Handle existing and potential off-site runoff through their development by designing to adequately handle storm runoff from a fully developed area upstream; and

iii. Provide and install at their expense, in accordance with Township requirement, all drainage and erosion control improvements (temporary and permanent) as required by the Erosion and Sediment Control Plan.

f. **SMO § 220-17** also contains requirements associated with Soil Erosion and Sedimentation Control Plans.

6. General Design Standards:

a. Curb inlets shall be located at curb tangents on the uphill side of street intersections. The Township Engineer shall approve design and location of curb inlets;

b. Drainage structures that are located on state highway rights-of-way shall be approved by the PENNDOT, and a letter from that office indicating such approval shall be directed to the Bethlehem Township Board of Commissioners; and

c. The design of the storm sewerage system shall be in accordance with the Township Standard Construction Documents (latest revision).

7. Construction Specifications. Township Standard Construction Documents (latest revision) as adopted by the Township will govern. Copies are available at the Township Building upon request and payment of cost of reproduction (see **§ 220-28**).

8. The following statements shall be provided on the plans to be recorded:

"Notwithstanding any provisions of the Township Stormwater Management Ordinance, including exemption and waiver provisions, any landowner and any person engaged in the alteration or development of land which may affect stormwater runoff characteristics shall implement such measures as are reasonably necessary to prevent injury to health, safety, or other property. Such measures shall include such actions as are required to manage the rate, volume, direction, and quality of resulting stormwater runoff in a manner which otherwise adequately protects health and property from injury and damage."

"Township review and approval of the Drainage Plan or the subsequent observation and approval of stormwater management facilities, shall not constitute land development on behalf of or by the Township or otherwise cause the Township to be engaged in the alteration or development of land. By submitting an application under the Township Stormwater Management Ordinance, the Developer hereby agrees to indemnify, defend, and hold harmless the Township and all its representatives, servants, employees, officials and consultants of and from any and all claims demands, causes of action or suits which arise out of or relate to the review, approval, construction or observation of the Developer's Drainage Plan and stormwater management facilities."

§ 220-23 METHODS OF DETENTION AND FLOW DELAY

Methods of detention or flow delay devices that may be found to be acceptable by the Township Engineer are:

A. Wet or dry ponds and detention basins.

B. Roof storage and increased roof roughness.

C. Infiltration trenches.

D. Porous pavements, grassed channels, and vegetated strips.

E. Cisterns, underground reservoirs or covered ponds.

F. Increasing the roughness coefficients on the development's surface area.

G. Decrease percentage of impervious area.

H. Groundwater recharge.

I. Routing flow over lawns in swales within stormwater easements.

J. Detention storage within the storm sewer.

K. Another method that may be preapproved by the Township Engineer.

§ 220-24 ROOFTOP STORAGE

If a roof is to be used for detention, a condition of such use shall be that the applicant shall submit appropriate calculations and a signed statement from a registered architect or Pennsylvania-registered (professional) engineer assuring that the structure will be able to support the roof loadings. This statement shall be required prior to issuance of the building permit.

§ 220-25 POROUS PAVEMENT

Where porous pavement is used to reduce runoff, the developer or landowner shall guarantee that the paved surface shall be maintained to the satisfaction of the Township, and that any resurfacing of the paved area shall utilize a porous material. Such a guarantee shall be lettered as a covenant on the recorded plan and shall be signed and notarized. Porous pavement shall not be utilized in construction of facilities to be dedicated to the Township. Porous pavement can only be used when the underlying subgrade soils have proved to be capable of infiltrating stormwater and provisions have been made to accommodate the excess runoff.

§ 220-26 GROUNDWATER RECHARGE

For any Groundwater Recharge proposal, proper precautions shall be taken to prevent pollution of the groundwater, prevent the formation of sinkholes and to promote safety.

Groundwater recharge methods shall not be permitted without written approval of the Township Geotechnical Engineer.

§ 220-27 DETENTION BASINS STANDARDS

A. For the purpose of this Section, a retention basin shall be required to meet the same standards as a Detention Basin.

B. Emergency spillways. All Detention Basins shall be designed with an emergency spillway:

1. These spillways at a minimum shall be able to handle a 100-year post development peak discharge of the principal pipe barrel and the emergency spillway;
2. Whenever possible, the emergency spillway for Detention Basins shall be constructed on undisturbed ground. If the emergency spillway cannot be constructed on undisturbed ground, it shall be constructed of suitable material adequately compacted in accordance with specifications preapproved by the Township Geotechnical Consultant;
3. Emergency spillways shall be constructed of reinforced concrete or stabilized vegetated earth as approved by the Township Geotechnical Consultant. All emergency spillways shall be constructed so that the Detention Basin Berm is protected against erosion;
4. The emergency spillway shall be designed to pass the 100-year storm return frequency storm peak basin inflow rate with a minimum 0.5 feet freeboard measured to the top of Detention Basin. The emergency spillway shall convey the 100-year storm at a maximum depth of one foot over the spillway;
5. The downstream slope of the spillway shall as a minimum extended to the toe of the berm embankment. The edge of the Detention Basin grading shall be within the subject property; and
6. All Detention Basin outflow structures shall be designed with trash racks over the outflows where practicable. Outflow pipes shall be provided with child-proof screening.

C. Slope of Detention Basin embankment. The maximum inside slope of earthen Detention Basin embankments shall be four horizontal to one vertical. The maximum outside slope shall be three horizontal to one vertical. The top or toe of any slope shall be located a minimum of five feet from any property line. Whenever possible the side slopes and Detention Basin shape shall be amenable to the natural topography. Straight side slopes are prohibited.

D. Width and height of berm. The minimum top width of Detention Basin berms shall be 10 feet, unless the Township Engineer and/or Geotechnical Consultant determines that a greater width is needed for maintenance and/or structural purposes. The berm shall initially be built at least six inches higher than the design elevation to allow for soil settlement within the berm.

E. Slope and lining of basin bottom. In order to ensure proper drainage of the Detention Basin, a minimum grade of 2% shall be maintained for all sheet flow. A minimum grade of 1% shall be maintained for all channel flow, provided that a synthetic low flow channel of suitable materials is provided. In areas of carbonate geology, detention basins shall be provided with an impervious liner of clay, suitable compacted soil or approved artificial material, with the type of liner approved by the Township Geotechnical Consultant. Any Detention Basin that is proposed to be dedicated to the Township shall be lined with a synthetic, impervious liner, with the type of liner approved by the Township Geotechnical Consultant.

F. Anti-seep collars. Anti-seep collars shall be installed around the principal pipe barrel within the normal saturation zone of the detention basin berms in accordance with the requirements of the Conservation District.

G. Landscaped screening:

1. A Detention Basin shall be screened from view of existing residences, a residential zoning district or a public street, unless the basin would meet both of the following conditions:

a. It would have an average slope of less than five to one on the outside of the Detention Basin and both the inside and outside would be planted in grass and intended to be mowed or would be designed to closely resemble a natural pond; and

b. It would not be surrounded by a primarily metal fence.

2. Any required screening shall meet the standards of Chapter 275, Zoning, of the Code of the Township of Bethlehem. This landscaping shall not be required along an area where natural vegetation that will completely fulfill this purpose is to be maintained.

H. Multiple Detention Basins. The use of multiple Detention Basins should be investigated over the use of one larger storage facility; however, the Township Engineer shall be consulted prior to design of multiple Detention Basins.

I. All outflow structures from storage facilities shall be equipped with a regulatory device that will permit modification to regulate the amount of outflow. Suitable antivortex and/or velocity retarders shall be used.

J. An outflow control structure shall be provided at the outlet of all Detention Basins. This structure shall be constructed of metal or concrete and shall be designed so that the rate of outflow is controlled by the pipe barrel through the Detention Basin berm when the depth of water within the basin exceeds the height of the structure. A trash rack or similar device shall be provided to prevent debris from entering the outflow structure. The crest elevation shall be set at a minimum of 12 inches below the emergency spillway.

K. Retention Basins. Aeration devices may be required, dependent upon the quality of the influent and retention time.

L. Recreation. When reasonable, efforts should be made to allow suitable recreational uses of portions of detention areas. This might include designing a Detention Basin so that only a portion would be wet after a minor storm, and the remainder would be well drained during all except the most serious storm. These areas may be acceptable, at the discretion of the Township, as part of any recreation land that may be required under any Township ordinance.

M. Sinkholes and other subsidence hazards, of Chapter 230, Subdivision and Land Development, of the Code of the Township of Bethlehem regarding placement of Detention Basins within or near sinkholes or areas vulnerable to sinkholes.

N. The design of any Detention Basin intended to meet the requirements of this Section shall be verified by routing the design storm hydrograph through the proposed Detention Basin. Detention Basin routing calculations based on the rational, modified rational or universal rational methods shall not be accepted without the written preapproval of the Township Engineer. For Detention Basins designed using the Modified Rational Method, or other rational based technique, the detention volume shall, at minimum, equal the volume derived from the approximate routing process as contained in SCS Technical Release Number 55 (TR55, most recent addition).

O. An outlet structure must be provided to permit draining the Detention or Retention Basin to a completely dry condition within 24 hours, unless approved as a wet pond.

§ 220-28 CONSTRUCTION STANDARDS

Construction and materials of storm drainage and control facilities (including pipes) and erosion control facilities shall be in accordance with the approved plans and any accompanying specifications. The construction details and standards of the following publications or their successor publications, in their most recent revision shall be used:

A. County Erosion and Sedimentation Control Handbook.

B. PENNDOT, Form 408, Specifications.

C PENNDOT, RC Series, Roadway Construction Standards.

D. In cases where the above documents conflict with Township specifications, the Township's specifications shall supersede.

§ 220-29 DRAINAGE PIPE, CULVERT AND CATCH BASIN DESIGN

A. In any stormwater management district, storm sewer piping, and inlet systems shall be designed for a 25-year return period storm, or a 100-year return period storm where the system is designed to convey 100-year storm flows to or from a detention facility. Bridges and culverts along roadways shall be designed to convey the 100-year return period storm. Flows from off-site upstream areas shall be determined in accordance with the procedure identified in **§ 220-14** of this Ordinance.

B. The minimum diameter of any cross-drainage or culvert pipe shall be 15 inches. Pipe material should conform to the requirements of the Bethlehem Township Standard Construction Documents.

C. Storm sewer pipes, culverts, manholes, inlets, endwalls, and end-sections proposed for dedication, or located along streets, shall conform to the requirements of the Bethlehem Township Standard Construction Documents and PENNDOT, Bureau of Design, Standards for Roadway Construction, Publication No. 72, in effect at the time the design is submitted, as modified by the Bethlehem Township Standard Construction Documents.

D. The capacities of the pipes, gutters, inlets, culverts, outlet structures, and swales shall consider all possible hydraulic conditions. The following are minimum design standards:

1. Grass swales and roadside gutters shall consider both the channel velocity and stability based upon a low degree of retardant ("n" of 0.03), and the channel capacity based upon a high degree of retardant ("n" of 0.05); and

2. The velocity to be used in the design of any piped stormwater conveyance system shall be based on the maximum velocity obtainable. The capacity shall be based upon 100-year storm conditions. In all cases where drainage is collected by a headwall or catch basin where inlet or outlet control may govern, the pipe shall be designed as a culvert, as outlined in Hydraulic Engineering Design Series No. 5, latest edition of the U.S. Department of Transportation Federal Highway Administration, Washington, DC. The allowable headwater should be determined by the specific entrance conditions and sound engineering. The capacities of pipes shall be computed from the Manning's Equation. The design of culverts shall not create excessive headwater depths.

E. Open pipe ends shall be fitted with concrete end walls or prefabricated end sections.

F. Drainage pipes shall have a minimum slope of 0.5%. At minimum, the tops of all pipes shall be at the same elevation when changing pipe size.

G. Grass-lined channels shall be designed with a minimum longitudinal slope of 2% and shall be designed to accommodate design velocities without erosion.

H. Pipe sizes with nominal diameters greater than seventy-two inches (72") shall require structural design submittals for review and approval.

I. All culvert structures shall require submission of construction drawings, to assure compliance to HS-25 loading, and flow design capacity.

J. All storm sewer pipes and culverts shall be laid to a minimum depth specified by the pipe manufacturer.

K. Inlets shall normally be along the curb line at or beyond the curb radius points. Manholes may be substituted for inlets at locations where inlets are not required to handle surface runoff.

L. The capacities of open channels shall be computed from the Manning's equation.

M. Flow velocities from any storm sewer may not result in a deflection of the receiving channel.

N. Storm sewers shall be designed with a maximum flow velocity of 15 feet per second.

O. Energy dissipaters shall be provided at all storm sewer outlets and shall be designed in accordance with DEP, Office of Water Management, Erosion and Sediment Pollution Control Program Manual, latest edition.

P. Manholes or inlets shall be used at all changes in horizontal alignment, at changes of vertical grade and at all pipe intersections. No run of pipe shall exceed 400 feet in length without appropriate measures to allow cleanout. Trash tracks shall be placed on all stormwater entrance structures.

Q. Bridges and culverts shall meet PENNDOT constructions standards. DEP shall be contacted to determine if a dams and waterways permit is required.

R. Grating. Appropriate safety grates shall be attached to all catch basins, stormwater inlets, pipe openings and other stormwater receiving structures needed, to ensure that maximum openings do not exceed 25 square inches. Along streets and pedestrians' areas, safety grates shall be used as needed for bicycle safety.

S. Storm sewer outfall. Storm sewer outfalls shall be designed, with respect to the elevation of the invert or other features, that when the receiving watercourse is experiencing a 25-year storm, the storm sewer will continue to drain the area it is designed to serve.

T. Street drainage:

1. To minimize sheet flow of stormwater across lots located on the lower side of streets, and to divert flow away from building areas, the cross section of the street as constructed shall provide for parallel ditches or swales or curbing on the lower side which shall discharge only at drainage easements; and

2. Inlet spacing shall be designed such that in a 25-year storm, one traffic lane of at least 10 feet in width shall be free from stormwater.

§ 220-30 STORMWATER EASEMENTS

A. Where a Subdivision or development is traversed by a watercourse, drainageway, channel, or stream, there shall be provided a drainage easement conforming substantially with the high water line of such watercourse attributable to a flood of a 100-year frequency, in order to preserve the unimpeded flow of natural drainage and to provide for future possible widening, deepening, relocating, improving, or protecting of such drainage facilities.

B. Structures and other obstructions to flow (except fences that are made of approved materials and are placed so as to not obstruct flow) shall be prohibited within the easements. Off-street parking is specifically prohibited within the easements.

C. The applicant shall grant the Township the right to enter the easement to accomplish maintenance work, although the Township assumes no responsibility for such work. Such grant shall be in the form of a signed and notarized covenant placed on the record drawing.

D. It shall be the responsibility of the applicant to obtain all the easements on, over or through other properties when such easements are needed to carry out the proposed Drainage Plan.

E. Areas where the easements have been or will be granted shall not be obstructed during or after construction.

F. See the Standard Drainage Covenants Agreement form in the Appendixes of Chapter 230, Subdivision and Land Development, of the Code of the Township of Bethlehem.

§ 220-31 SURFACE WATERS

A. All-natural streams, channels, swales, drainage systems, and/or areas of concentration of surface water shall be maintained in their existing condition unless alteration is approved by the Township Engineer. The applicant shall be responsible to obtain all necessary DEP permits (see Chapter 105 of Title 25 of the state Regulations).

B. Creek alignments. No watercourse shall be realigned, blocked, impeded, or redirected without the prior written approval of DEP and the Township Engineer.

C. Piping of surface water. Natural surface watercourses which have sustained perennial flows averaging at least five cubic feet per second shall remain open to sky and shall not be piped or covered.

D. No activities requiring a permit from DEP, the U.S. Army Corps of Engineers and/or other governmental agency shall be conducted (e.g., in freshwater wetlands) unless the Developer has obtained all necessary permits.

§ 220-32 OWNERSHIP AND MAINTENANCE OF STORMWATER MANAGEMENT FACILITIES

A system for the ownership and maintenance responsibility of all temporary and permanent Stormwater Management Facilities and erosion and sedimentation control facilities that is satisfactory to the Board of Commissioners of the Township shall be established prior to the final plan approval.

A. Detention Ponds shall be designed and laid out in accordance with Township requirements so that the area can be dedicated to the Township. Each Developer shall make an offer of dedication to the Township. All maintenance and upkeep of ponds dedicated to and accepted by the Township shall be the responsibility of the Township in accordance with the following provisions:

1. That a Detention Pond maintenance escrow account shall be established by the Township, and all required contributions from Developers for such maintenance and upkeep of Detention Ponds shall be maintained within this escrow account; and

2. That the contribution formula from each Developer shall be based on the following formula:

    a. That the cost of crew (size to be initially determined) cutting grass once every two weeks at (x hours per cutting) for a period from May 1st through October 15th of each year;

    b. That the cost for a spring and fall cleanup of (x) hours for (x) workers, including any costs for equipment (front loader and trucks);

    c. That an amount be established for certain major reconstruction of components such as: outlet structures, beams, fencing, etc., during the first 25 years;

    d. That the total contribution shall be calculated on the annual cost contained in Subsection A(2) (a), (b) and (c) with the contribution to the Detention Pond escrow being drawn down over 25 years and assuming an annual interest rate of 6%; and

    e. That the total contribution to the Detention Pond escrow account for each proposed development shall be clearly defined prior to final plan approval for the development and shall be made a part of the developer's agreement.

B. Suitable easements shall be provided for all stormwater facilities.

C. Stormwater Management Facilities shall be designed to require minimal maintenance and shall be designed to be accessible for maintenance.

D. An easement shall be provided to guarantee access for maintenance purposes if the Stormwater Management Facilities cannot be accessed from a public road. Such grant of easement shall be in the form of a signed and notarized covenant placed on the record development plan.

E. Stormwater Management Facilities located on private property(ies).

1. Stormwater Management Facilities located on private property shall be maintained by the owner(s) thereof. The maintenance obligation shall be acknowledged in the form of a signed and notarized covenant placed on the record development plan and in the form of a separate signed and notarized covenants agreement with the Township which shall be recorded in the Northampton County Recorder of Deeds;

2. Should a Stormwater Management Facility not be maintained in proper working order, the Board of Commissioners may, after due notice to the responsible party, arrange for the needed maintenance to be accomplished with all such expenses charged to the responsible party. These expenses shall be collectible as municipal liens are now collected by law; and

3. The Township Engineer and Code Enforcement staff shall have the right to enter private property to inspect Stormwater Management Facilities with reasonable notice to the property owner prior to any such inspection.

§ 220-33 LOT AREA AND IMPROVEMENTS COVERAGE INCENTIVES FOR RESOLVING EXISTING STORMWATER PROBLEMS

See **§ 275-183** of Chapter 275, Zoning, of the Code of the Township of Bethlehem.

ARTICLE 4
DRAINAGE PLAN REQUIREMENTS

§ 220-34 GENERAL REQUIREMENTS

For any of the regulated activities of this Ordinance, prior to the final approval of subdivision and/or land development plans, or the issuance of any permit, or the commencement of any land disturbance activity, the owner, subdivider, developer, or agent shall submit a Drainage Plan for approval.

§ 220-35 DRAINAGE PLAN EXEMPTIONS

A. Impervious Cover – Any proposed Regulated Activity, except those defined in **§ 220-5.D.5** through **§ 220-5.D.8** of this Ordinance, which would create 5,000 square feet or less of additional impervious cover is exempt from the Drainage Plan preparation provisions of this Ordinance, subject to the provisions noted below.

1. The date of the Township Ordinance adoption of the original Bushkill Creek, Fry's Run , Monocacy Creek, and Nancy Run Act 167 Stormwater Management Ordinances (May 1992, February 1999, March 1989, and March 1989 respectively), shall be the site conditions starting point from which to define tracts as 'Parent Tracts'. The starting point conditions are established as pre-development conditions, the baseline upon which future subdivisions and respective impervious area computations on these tracts shall be cumulatively considered;

2. If a 'Parent Tract' has received a prior exemption of the provisions of this Ordinance, or there is no evidence of a prior stormwater management plan approval, and additional development is proposed (with at least 1,000 square feet of new impervious cover) such that all existing impervious cover installed on that tract since original ordinance adoption, as identified in **§ 220-35.A.1**, plus the proposed impervious cover on the 'Parent Tract' exceeds 5,000 square feet, a Drainage Plan shall be required. The Drainage Plan shall consider the proposed impervious cover as well as all existing impervious cover installed on that tract since original ordinance adoption, as identified in **§ 220-35.A.1**, as new impervious cover;

3. For new development proposed on a lot created from a subdivided 'Parent Tract', which had received a prior exemption, and which would create greater than 5,000 square feet of impervious cover in the aggregate on the 'Parent Tract', the current Drainage Plan shall control runoff from only the impervious cover on the lot with the proposed new development. If any impervious cover is proposed on any previously developed, prior exempted lot, and the 'Parent Tract' aggregate impervious cover exceeds 5,000 square feet, all impervious cover on that building lot since original ordinance adoption shall meet the Ordinance provisions;

4. Refer to **§ 220-21.S** for requirements associated with 'Parent Tracts' with existing drainage problems. For development taking place in stages, the entire development plan must be used in determining conformance with the criteria of this Section of the Ordinance;

5. Additional impervious cover shall include, but not be limited to, additional indoor living spaces, decks, patios, garages, driveways, storage sheds and similar structures, and roof, parking or driveway areas, and any new streets and sidewalks constructed as part of or for the proposed Regulated Activity; and

6. Any additional areas proposed initially to be gravel, crushed stone, porous pavement, etc., shall be assumed to be impervious for the purposes of comparison to the Exemption criteria of this Ordinance. Any existing gravel, crushed stone or hard-packed soil areas on a site shall be considered as pervious cover for the purpose of Exemption evaluation of this Ordinance.

If a Drainage Plan is required, the pre- and post-development calculations should be based on actual cover conditions regardless of any assumptions made for purposes of Exemption evaluation of this Ordinance.

B. Prior Drainage Plan Approval – Any Regulated Activity for which a Drainage Plan was previously prepared as part of a subdivision or land development proposal that received at least preliminary plan approval (the "Approval") from the Township prior to the effective date of this Ordinance is exempt from the Drainage Plan preparation provisions of this Ordinance, except as cited in **§ 220-35.C** of this Ordinance, provided that the approved Drainage Plan included design of stormwater facilities to control runoff from the site currently proposed for Regulated Activities consistent with the Ordinance provisions in effect at the time of the Approval, and the Approval has not lapsed under the MPC. If significant revisions are made to the Drainage Plan after both the Approval and the effective date of this Ordinance, preparation of a new Drainage Plan, subject to the provisions of this Ordinance, shall be required. Significant revisions would include a change in control methods or techniques, relocation or redesign of control measures, or changes necessary because soil or other conditions are not as stated on the original Drainage Plan.

C. These Exemptions shall not relieve the applicant from implementing such measures as are necessary to protect health, safety, and property, and to meet state Water Quality Requirements. These measures include adequate and safe conveyance of stormwater on the site and as it leaves the site. These Exemptions do not relieve the applicant from the responsibility to secure permits or approvals for activities regulated by any other applicable code, rule, act, or ordinance of the Township.

D. No Exemptions shall be provided for Regulated Activities as defined in **§ 220-5.E** through **§ 220-5.G** of this Ordinance.

E. Agricultural Activity is Exempt from the rate control and Drainage Plan preparation requirements of this Ordinance provided the activities are performed according to the requirements of 25 PA Code § 102.

F. Timber Harvesting Activities are Exempt from the rate control and Drainage Plan preparation requirements of this Ordinance provided the activities are performed according to the requirements of 25 PA Code § 102.

G. The Township may deny or revoke any Exemption pursuant to this Section at any time for any project that the Township believes may pose a threat to public health, safety, property, or the environment.

H. Drainage Plan exemptions where recognized and granted shall be noted on a Plan to be recorded, including a reference to **§ 220-35** of this Ordinance for requirements associated with any future improvements.

§ 220-36 DESIGN SUBMISSION

A. All plans showing the proposed stormwater control system (including any storm sewer construction) shall be accompanied by a complete design signed, stamped, and certified by a Pennsylvania registered (professional) engineer and shall be submitted along with any required preliminary or final plan under Chapter 230, Subdivision and Land Development, of the Code of the Township of Bethlehem.

B. When subdivisions or land developments are submitted to the Township for approval in sections, a complete general stormwater control system (including any storm sewer construction) design for the proposed subdivision or land development shall be submitted with the preliminary plan. The proposed design shall take into account the entire tract and the watershed.

C. All stormwater controls shall be designed to function adequately after the completion of each phase of a subdivision or land development. This may require the use of temporary structures, which shall be shown on submitted development plans.

D. The construction of stormwater controls in areas of future phases of a development shall be required prior to construction of earlier phases if the Township Engineer determines that is necessary to make sure that the stormwater system will work after the completion of each phase. This shall, for example, include the extension of the main outfall line.

E. A set of approved stormwater design plans shall be maintained on file at the Site during construction, as record drawings.

F. Drainage structures that are located on PENNDOT rights-of-way shall be found to be acceptable to PENNDOT and PENNDOT approval shall be a condition of any final approval of the Township.

G. Submission requirements:

1. The submission requirements for Drainage Plans for preliminary and final development plans within Articles V and VI of Chapter 230, Subdivision and Land Development, of the Code of the Township of Bethlehem shall apply to all required submissions under this Section; and

2. In addition to the above-referenced requirements, when any activity that would result in the addition of greater than 5,000 square feet of impervious cover is specifically regulated by Article 4 of this Ordinance. Drainage Plans shall be submitted to the Lehigh Valley Planning Commission for review. Such Drainage Plans shall also contain the following:

    a. General.

        i. General description of project;

        ii. General description of proposed permanent stormwater controls; and

        iii. The name and address of the project site, the name and address of the owner of the property and the name of the individual or firm preparing the Drainage Plan.

    b. Map(s) of the project area showing:

        i. The location of the project relative to highways, municipalities, or other identifiable landmarks;

        ii. Existing contours at intervals of two feet. In areas of steep slopes (greater than 15%), five-foot contour intervals may be used. Off-site drainage areas impacting the project including topographic detail;

        iii. Streams, lakes, ponds, or other bodies of water within the project area;

        iv. Other features, including flood hazard boundaries, existing drainage swales, wetlands, closed depressions, sinkholes and areas of natural vegetation to be preserved;

        v. Locations of proposed underground utilities, sewers, and water lines waterlines. The locations of all existing and proposed utilities, sanitary sewers, and water lines waterlines within 50 feet of property lines of the project site;

        vi. An overlay showing soil types and boundaries based on the Northampton County Soil Survey, as applicable, latest edition. Any hydric soils present on the site should be identified as such;

        vii. Proposed changes to land surface and vegetative cover;

        viii. Proposed structures, roads, paved areas and buildings;

        ix. Final contours at intervals of two feet. In areas of steep slopes (greater than 15%), five-foot contour intervals may be used;

        x. Stormwater management district boundaries applicable to the site;

        xi A schematic showing all tributaries contributing flow to the site and all existing man-made features beyond the property boundary that would be affected by the project;

        xii. Clear identification of the location and nature of permanent stormwater BMPs;

        xiii. An adequate access easement around all stormwater BMPs that would provide Township ingress to and egress from a public right-of-way;

        xiv. The location of all public water supply wells within 400 feet of the project and all private water supply wells within 100 feet of the project; and

xv. An overlay showing geologic types, boundaries, and any special geologic features present on the site.

c. Stormwater management controls and BMPs:

i. All stormwater management controls must be shown on a map and described, including:

(a) Groundwater recharge methods such as seepage pits, beds, or trenches (When these structures are used, the locations of septic tank infiltration areas and wells shall be shown); and

(b) Other control devices or methods such as rooftop storage, semipervious paving materials, grass swales, parking lot ponding, vegetated strips, Detention or Retention Ponds, storm sewers, etc.

ii. All calculations, assumptions, and criteria used in the design of the control device or method must be shown;

iii. A chart describing the maximum allowable impervious cover per lot based upon the stormwater management calculations;

iv. All site testing data used to determine the feasibility of infiltration on a site; and

v. All details and specifications for the construction of the stormwater management controls and BMPs.

d. The BMP Operations and Management Plan, as required in Article 8, describing how each permanent stormwater BMP will be operated and maintained and the identity of the person(s) responsible for Operations and Maintenance. A statement must be included, signed by the landowner, acknowledging that the stormwater BMPs are fixtures that cannot be altered or removed without approval by the Township.

e. An environmental resources site design assessment that describes the following:

i. The extent to which the proposed grading and impervious cover avoid disturbance of significant environmental resources and preserve existing site hydrology;

ii. An assessment of whether alternative grading and impervious cover site design could lessen the disturbance of significant environmental resources and/or make better use of the site hydrologic resources; and

iii. A description of how the proposed stormwater management controls and BMPs serve to mitigate any adverse impacts on environmental resources on the site.

Significant environmental resources considered in the site design assessment include, but are not limited to, steep slopes, ponds, lakes, streams, wetlands, hydric soils, floodplains, riparian vegetation, native vegetation, and special geologic features.

f. The maximum allowable impervious coverage on a per lot basis as considered in the stormwater management design for the site shall be identified on a BMP Operations and Management Plan and also on the Subdivision and Land Development Plan to be recorded. These record plans shall identify each property owner's responsibility and basis for paying Municipal Stormwater Fees in accordance with the Bethlehem Township Stormwater Fee Ordinance, latest edition.

§ 220-37 PLAN SUBMISSION

A. For regulated activities specified in **§ 220-5D (1)** and **(2)**:

1. The Drainage Plan shall be submitted by the developer to the Township as part of the Preliminary Plan submission for the subdivision or land development;

2. Five copies of the Drainage Plan shall be submitted;

3. Distribution of the drainage plan will be as follows:

   a. One copy to the Township Planning Commission;

   b. Two copies to the Township Engineer; and

   c. Two copies to the Lehigh Valley Planning Commission, except for Drainage Plans involving less than 10,000 square feet of additional impervious cover.

4. Drainage Plans involving more than 10,000 square feet of additional impervious cover shall be submitted by the developer (possibly through the Township) to the Lehigh Valley Planning Commission as part of the preliminary plan submission. The Lehigh Valley Planning Commission will conduct an advisory review of the Drainage Plan for consistency with the Bushkill Watershed, Fry's Run Watershed, Monocacy Creek Watershed, or the Nancy Run Watershed Stormwater Management Ordinance. The Lehigh Valley Planning Commission will not review details of the erosion and sedimentation plan or the BMP Operations and Maintenance Plan:

   a. Two copies of the Drainage Plan shall be submitted; and

   b. The Lehigh Valley Planning Commission will provide written comments to the developer and the Township, within a time frame consistent with established procedures under the Municipalities Planning Code, as to whether the Drainage Plan has been found to be consistent with the Stormwater Management Ordinance.

B. For regulated activities specified in **§ 220-5D (3)** and **(4)**, the Drainage Plan shall be submitted by the developer to the Township Building Permit Officer, or designee, as part of the building permit application.

C. For regulated activities specified in **§ 220-5D (5)**, **(6)**, and **(7)**:

   1. The Drainage Plan shall be submitted by the developer to the Lehigh Valley Planning Commission for coordination with the DEP permit application process under Chapter 105 (Dam Safety and Waterway Management) or Chapter 106 (Floodplain Management) of DEP's rules and regulations; and

   2. One copy of the Drainage Plan shall be submitted.

D. Earthmoving for all regulated activities under **§ 220-5D** shall be conducted in accordance with the current federal and state regulations relative to the NPDES and DEP Chapter 102 regulations.

§ 220-38 DRAINAGE PLAN REVIEW

A. The Township Engineer shall review the Drainage Plan, including the BMP Operations and Maintenance Plan, for consistency with the adopted stormwater management plan as embodied by this Ordinance and with any permits issued by DEP.

B. The Township shall not approve any subdivision or land development [regulated activities **§ 220-5D (1)** and **(2)**] or building permit application [regulated activities **§ 220-5D (3)** and **(4)**] if the Drainage Plan has been found to be inconsistent with this Ordinance.

C. The Township shall notify the applicant in writing whether the Drainage Plan, including the BMP Operations and Maintenance Plan, is approved, consistent with time frames as established by the current Pennsylvania Municipalities Planning Code.

D. The Township may require an "As-Built Survey" of all stormwater BMPs including a survey of any detention/retention basin prior to installation of liner and/or topsoil as applicable, as well as basin stage storage calculations, and an explanation of any discrepancies with the Drainage Plan.

§ 220-39 MODIFICATIONS OF PLANS

A modification to a submitted Drainage Plan for a proposed development site which involves a change in control methods or techniques, or which involves the relocation or redesign of control measures, or which is necessary because soil or other conditions are not as stated on the Drainage Plan (as determined by the

Township Engineer) shall require a resubmission of the modified Drainage Plan consistent with **§ 220-37** subject to review per **§ 220-38** of this Ordinance.

§ 220-40 HARDSHIP WAIVER PROCEDURE

A. The Township Board of Commissioners, after receiving the recommendation from the Planning Commission, may hear requests for waivers where it is alleged that the provisions of this Ordinance inflict unnecessary hardship upon the applicant. The waiver request shall be in writing and accompanied by the requisite fee based upon a fee schedule adopted by the Township Board of Commissioners. A copy of the waiver request shall be provided to each of the following: Township Manager, Township Zoning Hearing Board, Township Engineer, Director of Community Development, Township Solicitor and Lehigh Valley Planning Commission. The request shall fully document the nature of the alleged hardship.

B. The Township may grant a waiver, provided, that all of the following findings are made in a given case:

1. That there are unique physical circumstances or conditions, including irregularity of lot size or shape, or exceptional topographical or other physical conditions peculiar to the particular property, and that the unnecessary hardship is due to such conditions, and not the circumstances or conditions generally created by the provisions of this Ordinance in the Stormwater Management District in which the property is located;

2. That because of such physical circumstances or conditions there is no possibility that the property can be developed in strict conformity with the provisions of this Ordinance, including the no harm provision, and that the authorization of a waiver is therefore necessary to enable the reasonable use of the property;

3. That such unnecessary hardship has not been created by the applicant;

4. That the waiver, if authorized, will represent the minimum waiver that will afford relief and will represent the least modification possible of the regulation in issue; and

5. That financial hardship is not the criteria for granting a hardship waiver.

C. In granting any waiver, the Township Board of Commissioners or Zoning Hearing Board may attach such reasonable conditions and safeguards as it may deem necessary to implement the purposes of this Ordinance. Such conditions may include, but not be limited to (if recommended by the Township Engineer), a requirement that comparable detention be located by the applicant on lands other than those on which the waiver has been requested, to assure that the overall detention capability of a given subarea is not diminished and that the overall rate of runoff is not increased as a result of the waiver. If a hardship waiver is granted, the applicant must still manage the quantity, velocity quality, and direction of resulting storm runoff as is reasonably necessary to prevent injury to health, safety, or other property:

1. For regulated activities described in **§ 220-5D (1)** and **(2)**, the Township Board of Commissioners shall hear requests for and decide on hardship waiver requests on behalf of the Township;

2. For regulated activities in **§ 220-5D (3), (4), (5),** and **(6)**, the Zoning Hearing Board shall hear requests for and decide on hardship waiver requests on behalf of the Township;

3. The Township shall not waive the water quality provisions of this Ordinance; and

4. The Township will process all eligible waiver requests in accordance with the provision of **§ 220-8** of this Ordinance.

§ 220-41 VOLUME CONTROLS

Water volume controls shall be implemented using the *Design Storm Method* in Subsection A. For regulated activity areas equal or less than one acre that do not require hydrologic routing to design the stormwater facilities, this Ordinance establishes no preference for either methodology; therefore, the applicant may select either methodology on the basis of economic considerations, the intrinsic limitations on applicability of the analytical procedures associated with each methodology and other factors:

A. The Design *Storm Method* (CG-1 in the BMP Manual[4]) is applicable to any size of regulated activity. This method requires detailed modeling based on site conditions:

1. Do not increase the post-development total runoff volume for all storms equal to or less than the 2-year 24 hour duration precipitation; and

2. For modeling purposes:

   a. Existing (pre-development) non-forested pervious areas must be considered meadow in good condition; and

   b. Twenty percent (20%) of existing impervious area, when present, shall be considered meadow in good condition in the model for existing conditions.

§ 220-42 RATE CONTROLS

A. For areas not covered by a release rate map from an approved Act 167 Stormwater Management Plan:

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

B. For areas covered by a release rate map from an approved Act 167 Stormwater Management Plan:

For the 2-, 10-, 25-, 50-, and 100-year, 24-hour storm events, the post-development peak discharge rates will follow the applicable approved release rate maps. For any areas not shown on the release rate maps, the post-development discharge rates shall not exceed the pre-development discharge rates.

§ 220-43 RIPARIAN BUFFERS

A. In order to protect and improve water quality, a Riparian Buffer Easement shall be created and recorded as of any subdivision or land development that encompasses a Riparian Buffer.

B. Except as required by Chapter 102, the Riparian Buffer Easement shall be measured to be the greater of the 100-year floodplain or a minimum of 35 feet from the top of the streambank (on each side).

C. Minimum Management Requirements for Riparian Buffers:

1. Existing native vegetation shall be protected and maintained within the Riparian Buffer Easement; and

2. Whenever practicable invasive vegetation shall be actively removed, and the Riparian Buffer Easement shall be planted with native trees, shrubs, and other vegetation to create a diverse native plant community appropriate to the intended ecological context of the site.

D. The Riparian Buffer Easement shall be enforceable by the Township and shall be recorded in the appropriate County Recorder of Deeds Office, so that it shall run with the land and shall limit the use of the property located therein. The easement shall allow for the continued private ownership and shall count toward the minimum lot area required by Zoning, unless otherwise specified in the Township Zoning Ordinance.

E. Any permitted use within the Riparian Buffer Easement shall be conducted in a manner that will maintain the extent of the existing 100-year floodplain, improve or maintain the stream stability, and preserve and protect the ecological function of the floodplain.

F. The following conditions shall apply when public and/or private recreation trails are permitted within Riparian Buffers:

1. Trails shall be for nonmotorized use only; and

2. Trails shall be designed to have the least impact on native plant species and other sensitive environmental features.

G. Septic drainfields and sewage disposal systems shall not be permitted within the Riparian Buffer Easement and shall comply with setback requirements established under 25 Pa. Code Chapter 73 25 PA Code § 73.

ARTICLE 5
INSPECTIONS

§ 220-44 SCHEDULE OF INSPECTIONS

A. The Township Engineer or their designee shall observe all phases of the installation of the permanent stormwater control facilities and the completed installation. For each phase of development, the developer shall provide notification to the Township Engineer and Township a minimum of three days prior to the installation of the permanent Stormwater Control Facilities so that general observation of the work by the Township can be scheduled. The developer shall furnish to the Township record drawings of the subject facilities which are certified by a registered land surveyor. Full acceptance and approval of the Stormwater Management Facilities will not occur until the installation is observed to be acceptable and record plans are approved.

B. If at any stage of the work the Township Engineer determines that the permanent stormwater control facilities are not being installed in accordance with the approved development plan, the Township shall revoke any existing permits until a revised development plan is submitted and approved as required by **§ 220-39**.

C. DEP or its designees (e.g., County Conservation District) normally ensure compliance with any permits issued, including those for stormwater management. In addition to DEP compliance programs, the Township or its designee may inspect all phases of the construction, operations, maintenance, and any other implementation of stormwater BMPs; and

D. During any stage of the Regulated Earth Disturbance Activities, if the Township or its designee determines that any BMPs are not being implemented in accordance with permit conditions or this Ordinance, the Township may suspend or revoke any existing permits issued by the Township or other approvals issued by the Township until the deficiencies are corrected.

ARTICLE 6
FEES AND EXPENSES

§ 220-45 GENERAL

A. A fee shall be established by the Township Board of Commissioners to defray all Township costs incurred in the review fee charged to an applicant. The applicant shall pay all such fees.

B. Applicants shall be subject to Municipal Stormwater Fees in accordance with the Bethlehem Township Stormwater Fee Ordinance, latest edition.

§220-46 EXPENSES COVERED BY FEES

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

A. Administrative and clerical costs. Unless otherwise required to provide an escrow account as part of a subdivision or land development application, the developer shall establish an escrow account as defined in the Township Fee Schedule and execute a professional services agreement with the Township to cover the costs connected with Drainage Plan review and inspection.

B. The review of the Drainage Plan, including the BMP Operations and Maintenance Plan, by the Township.

C. Attendance at meetings.

D. The site inspection.

E. The inspection of required controls and improvements during construction.

F. The final inspection upon completion of the controls and improvements required in the Drainage Plan.

G. Any additional work required to monitor and enforce any permit provisions, regulated by this Ordinance, correct violations, and assure the completion of stipulated remedial actions.

H. The Township may require an "As-Built Survey" of all stormwater BMPs including a survey of any detention/retention basin prior to installation of liner and/or topsoil as applicable, as well as basin stage storage calculations, and an explanation of any discrepancies with the Drainage Plan.

ARTICLE 7
STORMWATER MANAGEMENT SITE PLAN REQUIREMENTS

§ 220-47 PLAN REQUIREMENTS

In cases where stormwater management improvements are proposed and the design review would not be covered under a Subdivision or Land Development Plan application and the accompanying Drainage Plan, a Stormwater Management Site Plan as described in this Article shall be provided.

The following items shall be included in the Stormwater Management Site Plan:

A. Appropriate sections from the Township's Subdivision and Land Development Ordinance, and other applicable local ordinances, shall be followed in preparing the Stormwater Management Site Plans

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

C. Provisions for permanent access or maintenance easements for all physical stormwater management BMPs, such as ponds and infiltration structures, as necessary to implement the Operations and Maintenance Plan discussed in paragraph D.9 below.

D. The Stormwater Management Site Plan shall provide the following information:

1. The overall stormwater management concept for the project;

2. A determination of site conditions in accordance with the BMP Manual[4]. A detailed site evaluation shall be completed for projects proposed in areas of carbonate geology or karst topography, and other environmentally sensitive areas, such as brownfields;

3. Stormwater runoff design computations and documentation as specified in this Ordinance, or as otherwise necessary to demonstrate that the maximum practicable measures have been taken to meet the requirements of this Ordinance, including the recommendations and general requirements in **§ 220-14**;

4. Expected project time schedule;

5. A soil erosion and sediment control plan, where applicable, as prepared for and submitted to the approval authority;

6. The effect of the project (in terms of runoff volumes, water quality, and peak flows) on surrounding properties and aquatic features and on any existing stormwater conveyance system that may be affected by the project;

7. Plan and profile drawings of all stormwater management BMPs, including drainage structures, pipes, open channels, and swales;

8. The Stormwater Management Site Plan shall show the locations of existing and proposed on-lot wastewater facilities and water supply wells; and

9. The Stormwater Management Site Plan shall include an Operations and Maintenance Plan for all existing and proposed physical stormwater management facilities. This plan shall address long-term ownership and responsibilities for Operations and Maintenance as well as schedules and costs for Operations and Maintenance activities.

§ 220-48 PLAN SUBMISSION

A. The Stormwater Management Site Plan shall be submitted by the developer to the Township as part of the building and/or zoning permit application.

1. One copy to the Township Planning Commission; and

2. Two copies to the Township Engineer (when applicable).

B. Earthmoving for all regulated activities under **§ 220-5D** shall be conducted in accordance with the current Federal and State regulations relative to the NPDES and DEP Chapter 102 regulations.

§ 220-49 PLAN REVIEW

A. Stormwater Management Site Plans, including the BMP Operations and Maintenance Plans shall be reviewed by the Township Engineer for consistency with the provisions of this Ordinance and any permits issued by DEP. The Township Engineer shall also review the Stormwater Management Site Plan against any additional storm drainage provisions contained in Chapter 230, Township Subdivision and Land Development, and Chapter 275, Zoning, as applicable.

B. The Township shall notify the applicant in writing within 45 days whether the Stormwater Management Site Plan, including the BMP Operations and Maintenance Plan is approved or disapproved. If the Stormwater Management Site Plan involves a Subdivision and Land Development Plan, the notification shall occur within the time period allowed by the Township's Planning Code (90 days). If a longer notification period is provided by other statute, regulation, or ordinance, the applicant will be so notified by the Township.

C. If the Township disapproves the Stormwater Management Site Plan, the Township will state the reasons for the disapproval in writing. The Township also may approve the Stormwater Management Site Plan with conditions and, if so, shall provide the acceptable conditions for approval in writing.

D. The Township may require an as-built survey of all stormwater BMPs and an explanation of any discrepancies with the drainage plan Stormwater Management Site Plan.

§ 220-50 MODIFICATION OF PLANS

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

§ 220-51 RESUBMISSION OF DISAPPROVED STORMWATER MANAGEMENT SITE PLANS

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

§ 220-52 AUTHORIZATION TO CONSTRUCT AND TERM OF VALIDITY

The Township's approval of a Stormwater Management Site Plan authorizes the regulated activities contained in the Stormwater Management Site Plan for a maximum term of validity of 5 years following the date of approval. The Township may specify a term of validity shorter than 5 years in the approval for any specific Stormwater Management Site Plan. Terms of validity shall commence on the date the Township signs the approval for an Stormwater Management Site Plan. If an approved Stormwater Management Site Plan is not completed according to **§ 220-52** within the term of validity, then the Township may consider the Stormwater Management Site Plan disapproved and may revoke any and all permits. Stormwater Management Site Plans that are considered disapproved by the Township shall be resubmitted in accordance with **§ 220-51** of this Ordinance.

§ 220-53 AS-BUILT PLANS, COMPLETION CERTIFICATE, AND FINAL INSPECTION

A. The developer shall be responsible for providing as-built plans of all stormwater management BMPs included in the approved Stormwater Management Site Plan. The as-built plans and an explanation of any discrepancies with the construction plans shall be submitted to the Municipality.

B. The as-built submission shall include a certification of completion signed by a qualified professional verifying that all permanent stormwater management BMPs have been constructed according to the approved plans and specifications. The latitude and longitude coordinates for all permanent stormwater management BMPs must also be submitted, at the central location of the BMPs. If any licensed qualified professionals contributed to the construction plans, then a licensed qualified professional must sign the completion certificate.

C. After receipt of the completion certification by the Township, the Township may conduct a final inspection.

ARTICLE 8
STORMWATER BMP OPERATIONS AND MAINTENANCE PLAN GENERAL REQUIREMENTS

§ 220-54 GENERAL REQUIREMENTS

No regulated earth disturbance activities within the Township shall commence until approval by the Township of the BMP Operations and Maintenance Plan which describes how the permanent (e.g., post-construction) stormwater BMPs will be properly operated and maintained.

§ 220-55 RESPONSIBILITIES FOR OPERATIONS AND MAINTENANCE OF BMPS

A. BMP Operations and Maintenance Plan for the project site shall establish responsibilities for the continuing operations and maintenance of all permanent stormwater BMPs, as follows:

1. Ownership at Discretion of Township.

   The Township has no objection to own stormwater BMPs as ownership of permanent stormwater BMPs shall be at the option of the Township.

2. Ownership by the Township.

   Where an approved Plan provides for the dedication of permanent stormwater BMPs to the Township on a separate lot, the BMPs shall be operated and maintained by the Township. Nothing contained herein shall require the municipality to accept dedication of the BMP until the Township determines that it is constructed and operates in accordance with the requirements of the approved BMP Operation and Maintenance Plan and any other requirements of the Township.

3. If a BMP Operations and Maintenance Plan includes structures or lots which are to be separately owned and in which streets, sewers and other public improvements are to be dedicated to the Township, stormwater BMPs may also be dedicated to and maintained by the Township; and

4. If a BMP Operations and Maintenance Plan includes operations and maintenance by a single owner or if sewers and other public improvements are to be privately owned and maintained, then the operation and maintenance of stormwater BMPs shall be the responsibility of the owner or private management entity.

B. Township shall make the final determination on the continuing operations and maintenance responsibilities. The Township reserves the right to accept or reject the operations and maintenance responsibility for any or all of the stormwater BMPs.

§ 220-56 MAINTENANCE RESPONSIBILITIES

The maintenance responsibilities for permanent stormwater runoff control facilities shall be determined based upon the type of ownership of the property which is controlled by the facilities.

A. Single entity ownership. In all cases where the permanent stormwater runoff control facilities are designed to manage runoff from property in a single entity ownership as defined below, the maintenance responsibility for the stormwater control facilities shall be with the single entity owner. The single entity owner shall enter into an agreement with the Township which specifies that the owner will properly maintain the facilities consistent with accepted practice as determined by the Township Engineer. The agreement shall provide for regular inspections by the Township, shall contain such provisions as are necessary to ensure timely correction of any maintenance deficiencies by the single entity owner, and shall be recorded in the miscellaneous docket in the Office of the Recorder of Deeds of Northampton County, Pennsylvania. For the purposes of this Chapter, the term

"single entity" shall be defined as an individual, association, public or private corporation, partnership firm, trust, estate, or any other legal entity empowered to own real estate.

B. Multiple ownership. In cases where the property controlled by the permanent stormwater control facilities shall be in multiple ownership (i.e., many individual owners of various portions of the property), the developer shall dedicate the permanent stormwater control facilities to the Township for maintenance unless, in the opinion of the Board of Commissioners, another ownership and maintenance alternative, as permitted in Subsection **C**, below, will better serve the public interest. The developer shall pay a fee to the Township corresponding to the present worth of maintenance of the facilities in perpetuity. The estimated annual maintenance cost for the facilities shall be based on a fee schedule provided by the Township Engineer and adopted by the Township Board of Commissioners. The fee schedule must be reasonable.

C. In certain multiple ownership situations, the public may benefit should the Township require that maintenance responsibilities be borne by an individual or other legal entity. In these instances, the Township and the responsible individual or entity shall, at the Township's opinion, enter into a formal agreement regarding such maintenance obligation.

D. The following BMP Maintenance Responsibility statements shall be provided on the plans to be recorded above a comprehensive list of all BMPs by location (as may be part of the project's NPDES Permit):

1. An annual report shall be submitted by the entity having maintenance responsibilities to the Township Public Works Department each March 1st indicating all operations and maintenance that have been performed for each BMP listed below upon its installation;

2. The PCSM Plan, BMP inspection reports, and BMP monitoring records shall be made available by the entity having maintenance responsibilities for review by DEP, NCCD, and the Township upon request;

3. The entity having maintenance responsibilities is responsible to provide an annual report to the Township, and for record keeping of monitoring the listed BMPs in perpetuity; and

4. Access to the site via Agreements and/or Easements satisfactory to the Township shall be provided for Township stormwater inspection and maintenance.

§ 220-57 ADHERENCE TO APPROVED BMP OPERATIONS AND MAINTENANCE PLAN

It shall be unlawful to alter or remove any permanent stormwater BMP required by an approved BMP Operations and Maintenance Plan or to allow the property to remain in a condition which does not conform to an approved BMP Operations and Maintenance Plan unless an exception is granted in writing by the Township.

§ 220-58 OPERATIONS AND MAINTENANCE AGREEMENT FOR PRIVATELY OWNED STORMWATER BMPS

A. The entity having maintenance responsibilities shall sign an Operations and Maintenance Agreement with the Township covering all stormwater BMPs that are to be privately owned. The agreement shall include the terms of the format agreement referenced in Appendix E of this Ordinance.

B. Other terms may be included in the agreement where determined by the Township to be reasonable or necessary to guarantee the satisfactory operation and maintenance of all permanent stormwater BMPs. The agreement shall be subject to the review and approval of the Township.

C. The BMP Operations and Maintenance Agreement shall run with the land and bind the owner and all subsequent owners, transferees, and occupants of the land. Any violation of the BMP Operations and Maintenance Agreement is prohibited and shall constitute a violation of this Ordinance.

D. Unreasonable delays in allowing the Township access to a BMP pursuant to **§ 220-61** of this Ordinance is a violation of the Ordinance. The failure of any person to grant entry or to undertake any action which impedes entry shall be prohibited and constitute a violation of this Ordinance.

§ 220-59 STORMWATER MANAGEMENT EASEMENTS

Stormwater management easements shall be provided by the property owner if necessary for access for inspections and maintenance or for preservation of stormwater conveyance, infiltration, detention areas,

and other BMPs by persons other than the property owner. The purpose of the easement shall be specified in any agreement under **§ 220-58.**

§ 220-60 RECORDING OF APPROVED BMP OPERATIONS AND MAINTENANCE PLAN AND RELATED AGREEMENTS

A. The owner of any land upon which permanent BMPs will be placed, constructed, or implements, as described in the BMP Operations and Maintenance Plan, shall record the following documents in the Office of the Recorder of Deeds for Northampton County, within 90 days of approval of the BMP Operations and Maintenance Plan by the Township:

1. Operations and Maintenance Plan or a summary thereof;
2. Operations and Maintenance Agreements under **§ 220-58; and**
3. Easements under **§ 220-59**.

B. The Township may suspend or revoke any approvals granted for the project site upon discovery of the failure of the owner to comply with this section.

C. The agreement shall be subject to the review and approval of the Township.

D. The agreement and the obligations thereunder shall constitute covenants running with the land, and it shall be the obligation of every owner, grantor or transferor of property covered in whole or in part by the agreement to provide a copy of the agreement to every subsequent owner, grantee, or transferee.

E. All recording costs shall be paid by the applicant.

§ 220-61 TOWNSHIP STORMWATER BMP OPERATION AND MAINTENANCE FUND

A. The Township may require persons installing stormwater BMPs to pay a specified amount to the Township Stormwater BMP Operations and Maintenance Fund to help defray costs of inspections and/or operations and maintenance activities. The amount may be determined as follows:

1. If the BMP is to be privately owned and maintained, the amount shall cover the cost of periodic inspections by the Township in perpetuity, as determined by the Township;

2. If the BMP is to be owned and maintained by the Township, the amount shall cover the estimated costs for operation and maintenance in perpetuity, as determined by the Township; and

3. The amount shall then be converted to present worth of the annual series values.

B. If a BMP is proposed that also serves as a recreation facility (e.g., ball field, lake) the Township may adjust the amount due accordingly.

ARTICLE 9
OPERATION AND MAINTENANCE

§ 220-62 RESPONSIBILITIES OF DEVELOPERS AND LANDOWNERS

A. The Township shall make the final determination on the continuing maintenance responsibilities prior to final approval of the Drainage Plan or Stormwater Management Site Plan. The Township may require a dedication of such facilities as part of the requirements for approval of the Drainage Plan or Stormwater Management Site Plan. Such a requirement is not an indication that the Township will accept the facilities. The Township reserves the right to accept or reject the ownership and operating responsibility for any portion of the stormwater management controls.

B. Facilities, areas, or structures used as stormwater management BMPs shall be enumerated as permanent real estate appurtenances and recorded as deed restrictions or conservation easements that run with the land.

C. The BMP Operations and Maintenance Plan shall be recorded as a restrictive deed covenant that runs with the land.

D. The Township may take enforcement actions against an owner for any failure to satisfy the provisions of this Ordinance.

§ 220-63 OPERATIONS AND MAINTENANCE AGREEMENTS

A. Prior to final approval of the Drainage Plan or Stormwater Management Site Plan, the property owner shall sign and record an Operations and Maintenance Agreement (see Appendix E) covering all stormwater control facilities which are to be privately owned:

1. The owner, successor and assigns shall maintain all facilities in accordance with the approved maintenance schedule in the Operations and Maintenance Agreement;

2. The owner shall convey to the Township conservation easements to assure access for periodic inspections by the Township and maintenance, as necessary.

3. The owner shall keep on file with the Township the name, address, and telephone number of the person or company responsible for maintenance activities; in the event of a change, new information shall be submitted by the owner to the Township within ten (10) working days of the change.

B. The owner is responsible for Operations and Maintenance of the stormwater management BMPs. If the owner fails to adhere to the Operations and Maintenance Plan Agreement, the Township may perform the services required and charge the owner appropriate fees. Nonpayment of fees may result in a lien against the property.

§ 220-64 PERFORMANCE GUARANTEE

For SWM Site Plans that involve subdivision and land development, the applicant shall provide a financial guarantee to the Township for the timely installation and proper construction of all stormwater management controls as required by the approved Drainage Plan or SWM Site Plan and this Ordinance in accordance with the provisions of § 509, 510, and 511 of the Pennsylvania Municipalities Planning Code (MPC).

§ 220-65 PERFORMANCE INSPECTIONS

The landowner or the owner's designee (including the Township for dedicated and owned facilities) shall inspect stormwater management BMPs, facilities and/or structures installed under this Ordinance according to the following frequencies, at a minimum, to ensure the BMPs, facilities and/or structures continue to function as intended:

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

Inspections should be conducted during or immediately following precipitation events. A written inspection report shall be created to document each inspection. The inspection report shall contain the date and time of the inspection, the individual(s) who completed the inspection, the location of the BMP, facility or structure inspected, observations on performance, and recommendations for improving performance, if applicable. Inspection reports shall be submitted to the Township within 30 days following completion of the inspection.

ARTICLE 10
PROHIBITIONS

§ 220-66 PROHIBITED DISCHARGES AND CONNECTIONS

A. Any drain or conveyance, whether on the surface or subsurface, that allows any non-stormwater discharge including sewage, process wastewater, and wash water to enter the Township's regulated small MS4 or to enter the surface waters of the Commonwealth is prohibited.

B. Any drain or conveyance connected from a commercial or industrial land use to the separate storm sewerage system which has not been documented in plans, maps, or equivalent records and approved by the Township is prohibited.

C. No person shall allow, or cause to allow, discharges into the Township's regulated small MS4, or discharges into waters of the Commonwealth, which are not composed entirely of stormwater, except (1) as provided in paragraph D below and (2) discharges authorized under a state or federal permit.

D. The following discharges are authorized unless they are determined to be significant contributors to pollution of the Township's regulated small MS4 or to the waters of the Commonwealth:

1. Discharges or flows from firefighting activities;

2. Discharges from potable water sources including water line flushing, and fire hydrant flushing, if such discharges do not contain detectable concentrations of Total Residual Chlorine (TRC);

3. Non-contaminated irrigation water, water from lawn maintenance, landscape drainage and flows from riparian habitats and wetlands;

4. Diverted stream flows and springs;

5. Non-contaminated pumped ground water and water from foundation and footing drains and crawl space pumps;

6. Non-contaminated HVAC condensation and water from geothermal systems;

7. Residential (i.e., non-commercial) vehicle wash water where cleaning agents are not utilized;

8. Non-contaminated hydrostatic test water discharges if such discharges do not contain detectable concentrations of TRC;

9. Routine external building wash down which does not use detergents or other compounds;

10. Pavement wash waters where spills or leaks of toxic or hazardous materials have not occurred (unless all spill material has been removed) and where detergents are not used;

11. Riparian habitats and wetlands; and

12. Dechlorinated swimming pool discharges.

E. In the event that the Township or DEP determines that any of the discharges identified in Subsection D significantly contribute pollutants to the Township's regulated small MS4 or to the waters of the Commonwealth, the Township, or DEP will notify the responsible person(s) to cease discharge.

F. Upon notice provided by the Township under Subsection E, the discharger will have a reasonable time, as determined by the Township, to cease the discharge consistent with the degree of pollution caused by the discharge.

G. Nothing in this section shall affect a discharger's responsibilities under state law.

H. The following connections are prohibited, except as provided in **§ 220-66D** above:

1. Any drain or similar conveyance, whether on the surface or subsurface, which allows any non-stormwater discharge, including sewage, process wastewater and wash water to enter the separate storm sewerage system and any connections to the storm drain system from indoor drains and sinks; and

2. Any drains or similar conveyances connected from a non-residential land use to the separate storm sewerage system which has not been documented in plans, maps, or equivalent records and approved by the Township.

§ 220-67 ROOF DRAINS AND SUMP PUMPS

A. Roof drains and sump pumps shall discharge to infiltration area or vegetative BMPs to the maximum extent wherever feasible.

B. Roof drains shall not be connected to streets, sanitary, or storm sewers or roadside ditches, except as provided in Subsection **C.**

C. When it is more advantageous to connect directly to streets or storm sewers, connections of roof drains to streets or roadside ditches may be permitted by the Township.

§ 220-68 ALTERATION OF STORMWATER MANAGEMENT BMPS

A. No person shall modify, remove, fill, landscape, or alter any stormwater management BMP, facilities, areas, or structures that were installed as a requirement of this Ordinance without the written approval of the Township, unless it is part of an approved maintenance program. A note which indicates these requirements shall be included on the plan(s) to be recorded.

B. No person shall place any structure, fill, landscaping, or vegetation into a stormwater management BMP or within a drainage easement, which would limit or alter the functioning of the BMP, without the written approval of the Township.

ARTICLE 11
ENFORCEMENT AND PENALTIES

§ 220-69 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 Section or provisions of this Ordinance.

§ 220-70 RIGHT-OF-ENTRY

A. Upon presentation of proper credentials, the Township, or its designated agent with the consent of owners and operators subject to a BMP Operations and Maintenance Plan, may enter at reasonable times upon any property within the Township to inspect the implementation, condition or operation and maintenance of the stormwater structures and facilities or to investigate or ascertain the condition of the subject property in regard to any aspect regulated by this Ordinance.

B. In accordance with Subsection A above, owners and operators subject to a BMP Operations and Maintenance Plan shall allow persons working on behalf of the Township readily access to all parts of the premises for the purposes of determining compliance with this Ordinance.

C. In accordance with Subsection A above, persons working on behalf of the Township shall have the right to temporarily locate on any BMP Site subject of a BMP Operations and Maintenance Plan in the Township such devices as are necessary to conduct monitoring and/or sampling of the discharges from such BMPs.

D. In accordance with Subsection A above, owners and operators subject to a BMP Operations and Maintenance Plan shall not cause unreasonable delays in allowing the Township access to a BMP.

E. In the event that the landowner refuses admission to the property, duly authorized representatives of the Township may seek an administrative search warrant issued by a Magisterial District Judge to gain access to the property.

§ 220-71 NOTIFICATION

A. Whenever the Township finds that a person has violated a prohibition or failed to meet a requirement of this Ordinance, the Township may order compliance by written notice to the responsible person. Such notice may require without limitation:

1. The name of the owner of record and any other person against whom the Township intends to take action;

2. The location of the property in violation;

3. The performance of monitoring, analyses, and reporting;

4. The elimination of prohibited connections, or discharges;

5. Cessation of any violating discharges, practices, or operations;

6. The abatement or remediation of stormwater pollution or contamination hazards and the restoration of any affected property;

7. Payment of a fine to cover administrative and remediation costs;

8. The implementation of stormwater BMPs; and

9. Operations and maintenance of stormwater BMPs.

B. Such notification shall set forth the nature of the violation(s) and establish a time limit for correction of the violation(s). Said notice may further advise that should the violator fail to take the required action within the established deadline, the work will be done by the Township or designee and the expense thereof, together with all related lien and enforcement fees, charges, and expenses, shall be charged to the violator.

C. Failure to comply with the time specified shall also subject such person to the penalty provisions of this Ordinance. All such penalties shall be deemed cumulative and shall not prevent the Township from pursuing any and all other remedies available in law or equity.

§ 220-72 PUBLIC NUISANCE

A. The violation of any provision of this Ordinance is hereby deemed a Public Nuisance.

B. Each day that an offense continues shall constitute a separate violation.

§ 220-73 ENFORCEMENT

A. It shall be unlawful for a person to undertake any regulated activity except as provided in an approved SWM Drainage Plan, unless specifically exempted in **§ 220-15** and **§ 220-35**.

B. It shall be unlawful to violate **§ 220-68** of this Ordinance.

C. Inspections regarding compliance with the Drainage Plan and/or Stormwater Management Site Plan are a responsibility of the Township.

§ 220-74 SUSPENSION AND REVOCATION OF PERMITS AND APPROVALS

A. Any approval or permit issued by the Township pursuant to this Ordinance may be suspended or revoked for:

1. Noncompliance with or failure to implement any provision of the approved Stormwater Management Site Plan or Operations and Maintenance Agreement;

2. A violation of any provision of this Ordinance or any other applicable law, ordinance, rule, or regulation related to Regulated Activity; and

3. The creation of any condition or the commission of any act during the Regulated Activity which constitutes or creates a hazard or nuisance, pollution, or endangers the life or property of others.

B. A suspended permit or approval shall be reinstated by the Township when:

1. The Township or designee has inspected and approved the corrections to the violations that caused the suspension;

2. The Township is satisfied that the violation of the ordinance, law, or rule and regulations has been corrected; and

3. Payment of all Township fees, costs and expenses related to or arising from the violation have been satisfied.

C. A permit or approval that has been revoked by the Township cannot be reinstated. The applicant may apply for a new permit or approval under the provisions of this Ordinance.

D. If a violation causes no immediate danger to life, public health, or property, at its sole discretion, the Township may provide a limited time period for the owner to correct the violation. In these cases, the Township will provide the owner, or the owner's designee, with a written notice of the violation and the time period allowed for the owner to correct the violation. If the owner does not correct the violation within the allowed time period, the Township may revoke or suspend any, or all, applicable approvals and permits pertaining to any provision of this Ordinance.

§ 220-75 PENALTIES

A. Any person, partnership or corporation violating the provisions of this Ordinance shall be guilty of a summary offense, and upon conviction shall be subject to a fine of not more than $1,000 for each violation, recoverable with costs, or imprisonment of not more than 30 days, or both. Each day that a violation continues shall be a separate offense and penalties shall be cumulative.

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

§ 220-76 APPEALS

A. Any person aggrieved by any action of the Township or its designee, relevant to the provisions of this Ordinance, may appeal to the Township within 30 days of that action by using the appeal procedures established in the Pennsylvania Municipalities Planning Code.

B. Any person aggrieved by any decision of the Township, relevant to the provisions of this Ordinance, may appeal to the Northampton County Court of Common Pleas within 30 days of the Township's decision.

§ 220-77 FAILURE TO ENFORCE NOT A WAIVER

The failure of the Township to enforce any provision of this Ordinance shall not constitute a waiver by the Township of its rights of future enforcement hereunder.

ARTICLE 12
REFERENCES

1. U.S. Department of Agriculture, National Resources Conservation Service (NRCS). *National Engineering Handbook.* Part 630: Hydrology, 1969-2001. Originally published as the *National Engineering Handbook*, Section 4: Hydrology. Available from the NRCS online at: http://www.nrcs.usda.gov/.

2. U.S. Department of Agriculture, Natural Resources Conservation Service. 1986. *Technical Release 55: Urban Hydrology for Small Watersheds*, 2nd Edition. Washington, D.C.

3. Pennsylvania Department of Environmental Protection. No. 363-0300-002 (December 2006), as amended and updated. *Pennsylvania Stormwater Best Management Practices Manual.* Harrisburg, PA.

4. Pennsylvania Department of Environmental Protection. No. 363-2134-008 (March 31, 2012), as amended and updated. *Erosion and Sediment Pollution Control Program Manual.* Harrisburg, PA.

5. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service, Hydrometeorological Design Studies Center. 2004-2006. *Precipitation-Frequency Atlas of the United States, Atlas 14*, Volume 2, Version 3.0, Silver Spring, Maryland. Internet address: http://hdsc.nws.noaa.gov/hdsc/pfds/.

ARTICLE 13
ENACTMENT

§ 220-78 REPEALER

Any ordinance, resolution and/or other regulation of the Township, or any parts of ordinances, resolutions and/or other regulations of the Township, including but not limited to all prior stormwater management ordinances and amendments or parts of prior zoning ordinances and amendments, including prior zoning maps, which are inconsistent herewith are hereby repealed. All other provisions of the ordinances, resolutions and/or other regulations of the Township of Bethlehem, Northampton County, Pennsylvania shall remain in full force and effect.

§ 220-79 ADOPTION

This Ordinance shall become effective on five (5) days after the date of adoption by the Board of Commissioners and shall remain in force until modified, amended, or rescinded.

ARTICLE 13
ENACTMENT

§ 220-78 REPEALER

Any ordinance, resolution and/or other regulation of the Township, or any parts of ordinances, resolutions and/or other regulations of the Township, including but not limited to all prior stormwater management ordinances and amendments or parts of prior zoning ordinances and amendments, including prior zoning maps, which are inconsistent herewith are hereby repealed. All other provisions of the ordinances, resolutions and/or other regulations of the Township of Bethlehem, Northampton Comity, Pennsylvania shall remain in full force and effect.

§ 220-79 ADOPTION

This Ordinance shall become effective on five (5) days after the date of adoption by the Board of Commissioners and shall remain in force until modified, amended, or rescinded.

DULY ENACTED AND ORDAINED as an Ordinance this 21st day of August, 2023 by a majority of the Board of Commissioners of Bethlehem Township, Northampton County, Pennsylvania, at a duly advertised meeting of the Board of Commissioners at which a quorum was present. As part of this Ordinance, the Board of Commissioners has directed that the President, or Vice-President in the absence of the President, execute this Ordinance on behalf of the Board.

BOARD OF COMMISSIONERS
OF BETHLEHEM TOWNSHIP

John J. Merhottein
President

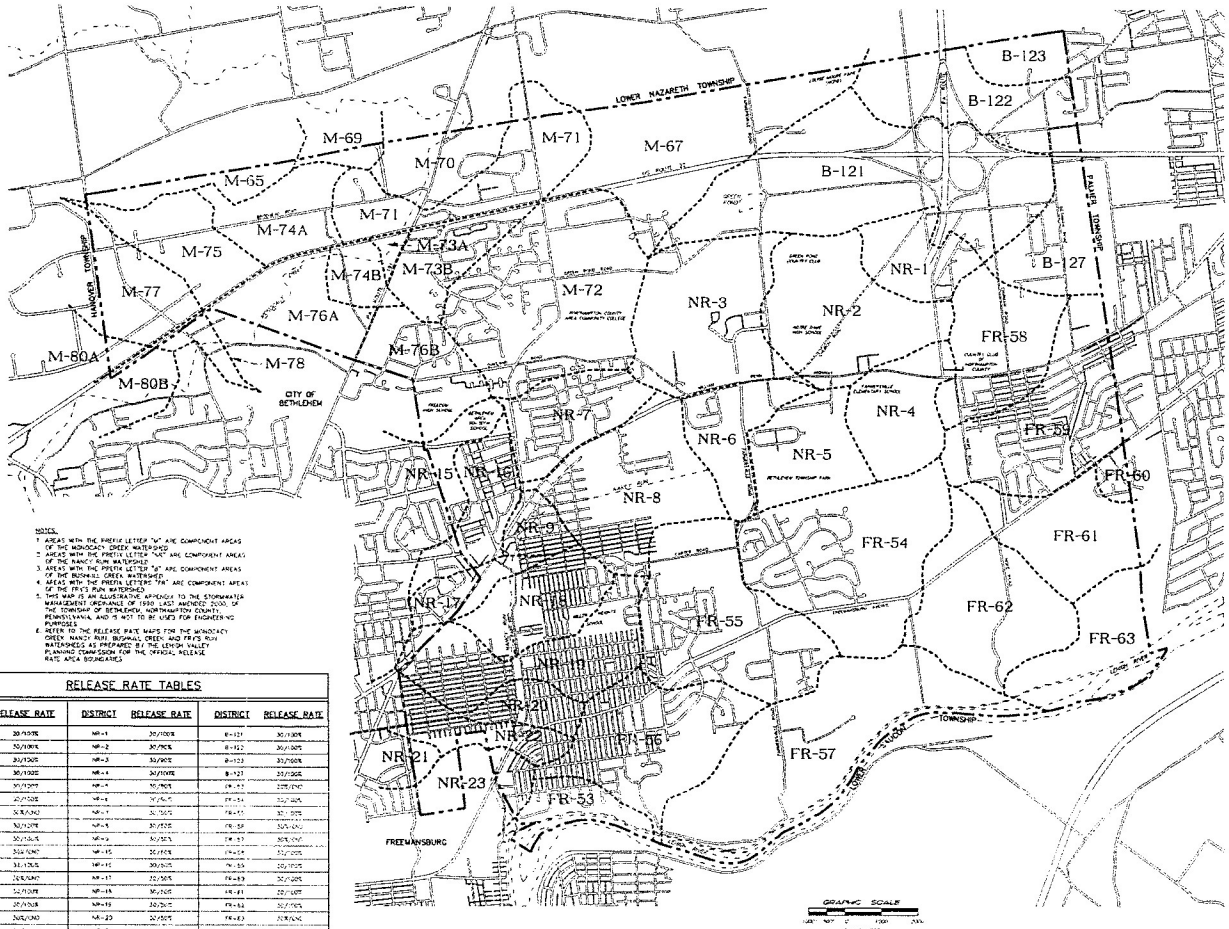
ATTEST:

Laura Zapata
Secretary

220 Attachment 1

Township of Bethlehem
(Part 1, Stormwater Control, of Chapter 220)

Appendix A
Stormwater Management Districts Map
[Amended 8-21-2023 by Ordinance No. 05-23]



NOTES:
1. AREAS WITH THE PREFIX LETTER "M" ARE COMPONENT AREAS OF THE MONOCACY CREEK WATERSHED
2. AREAS WITH THE PREFIX LETTER "NR" ARE COMPONENT AREAS OF THE NANCY RUN WATERSHED
3. AREAS WITH THE PREFIX LETTER "B" ARE COMPONENT AREAS OF THE BUSHKILL CREEK WATERSHED
4. AREAS WITH THE PREFIX LETTERS "FR" ARE COMPONENT AREAS OF THE FRY'S RUN WATERSHED
5. THIS MAP IS AN ILLUSTRATIVE APPENDIX TO THE STORMWATER MANAGEMENT ORDINANCE OF 1990 (LAST AMENDED 2006) OF THE TOWNSHIP OF BETHLEHEM, NORTHAMPTON COUNTY, PENNSYLVANIA, AND IS NOT TO BE USED FOR ENGINEERING PURPOSES
6. REFER TO THE RELEASE RATE MAPS FOR THE MONOCACY CREEK, NANCY RUN, BUSHKILL CREEK, AND FRY'S RUN WATERSHEDS AS PREPARED BY THE LEHIGH VALLEY PLANNING COMMISSION FOR THE OFFICIAL RELEASE RATE AREA BOUNDARIES

RELEASE RATE TABLES

DISTRICT	RELEASE RATE	DISTRICT	RELEASE RATE	DISTRICT	RELEASE RATE
M-65	30/100E	NR-1	30/100E	B-121	30/100E
M-67	30/100E	NR-2	30/100E	B-122	30/100E
M-69	30/100E	NR-3	30/90E	B-123	30/100E
M-70	30/100E	NR-4	30/100E	B-127	30/100E
M-71	30/100E	NR-5	30/90E	FR-53	30/100E
M-72	30/100E	NR-6	30/90E	FR-54	30/90E
M-73A	30/100E	NR-7	30/90E	FR-55	30/90E
M-73B	30/100E	NR-8	30/90E	FR-56	30/90E
M-74A	30/100E	NR-9	30/90E	FR-57	30/90E
M-74B	30/100E	NR-15	30/90E	FR-58	30/90E
M-75	30/100E	NR-16	30/90E	FR-59	30/90E
M-76A	30/100E	NR-17	30/90E	FR-60	30/90E
M-76B	30/100E	NR-18	30/90E	FR-61	30/90E
M-77	30/100E	NR-19	30/90E	FR-62	30/90E
M-78	30/100E	NR-20	30/90E	FR-63	30/90E
M-80A	30/100E	NR-21	30/90E		
M-80B	30/100E	NR-22	30/90E		
		NR-23	30/90E		

DIC = CONDITIONAL PROVISIONAL NO DETENTION

RELEASED FOR
JULY 15th CONSTRUCTION

SSM
SCOTT S. STEVENS MACOY

TOWNSHIP OF BETHLEHEM
NORTHAMPTON COUNTY, PENNSYLVANIA
STORMWATER MANAGEMENT DISTRICTS
RELEASE RATE MAP

03-13-07
7217.001
C.0-01

220 Attachment 2

Township of Bethlehem
(Part 1, Stormwater Control, of Chapter 220)

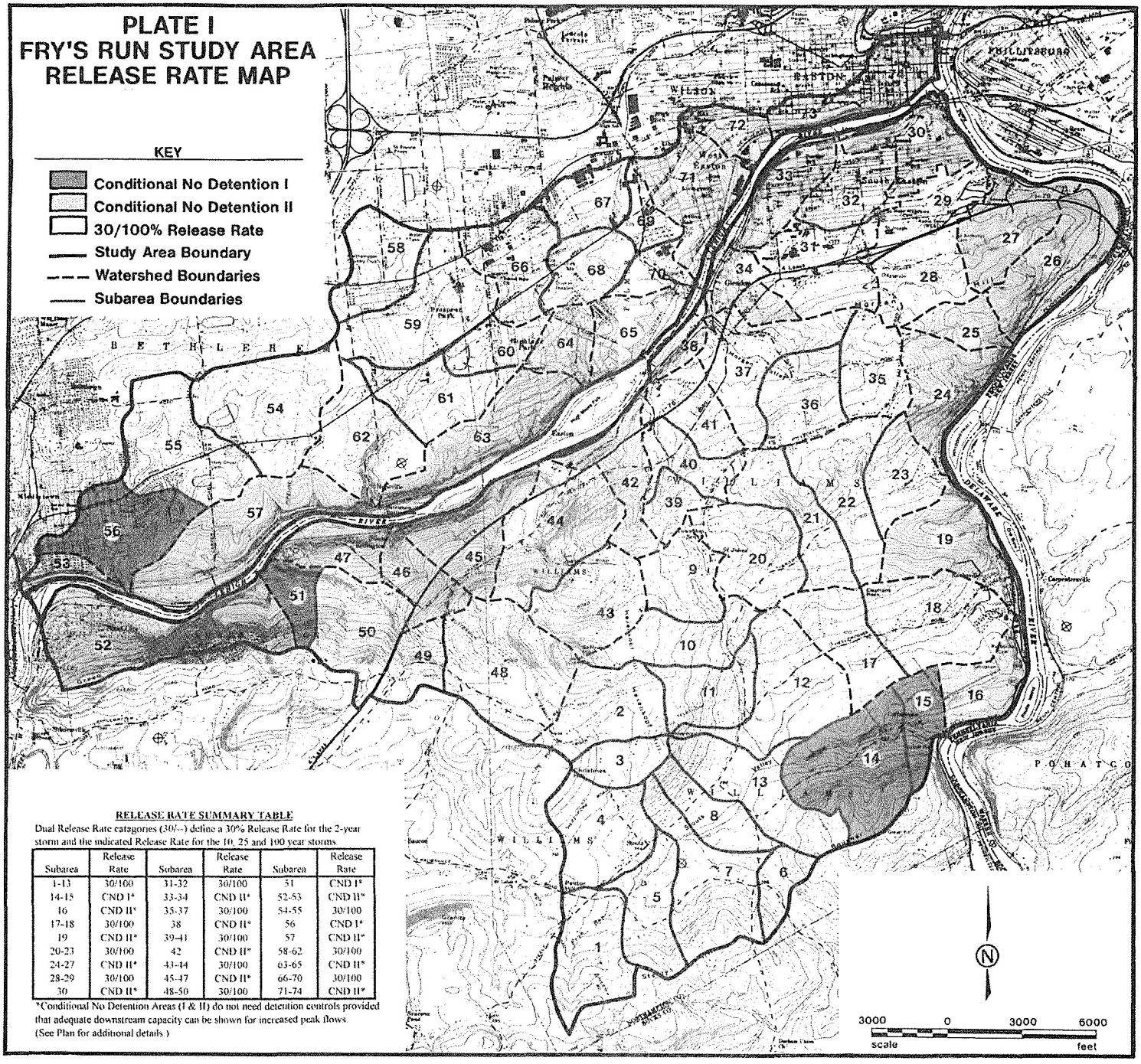
Appendix B
Stormwater Management Districts Release Rate Maps

[Amended 6-21-1993 by Ord. No. 6-93; 5-1-2000 by Ord. No. 2-00; 8-21-2023 by Ord. No. 05-23]

Note: The Stormwater Management Districts Release Rate Maps are included as an enclosure to this chapter. These maps are schematic only and shall not be used for engineering purposes. All parties shall refer to the applicable release rate maps prepared by the LVPC in determining allowable rates for postdevelopment stormwater discharge.

The drawings entitled "Plate I Fry's Run Study Area Release Rate Map," "Plate I Nancy Run Watershed Release Rate Map", "Plate I Bushkill Creek Watershed Release Rate Map" and "Monocacy Creek Watershed Release Rate Map", as prepared by the Lehigh Valley Planning Commission, are hereby adopted and incorporated herein by reference as part of Appendix B of Chapter 220, Stormwater Management, Part 1, Stormwater Control, of the Code of the Township of Bethlehem.

PLATE I
FRY'S RUN STUDY AREA
RELEASE RATE MAP



RELEASE RATE SUMMARY TABLE

Dual Release Rate catagories (30/--) define a 30% Release Rate for the 2-year storm and the indicated Release Rate for the 10, 25 and 100 year storms

Subarea	Release Rate	Subarea	Release Rate	Subarea	Release Rate
1-13	30/100	31-32	30/100	51	CND I*
14-15	CND I*	33-34	CND II*	52-53	CND II*
16	CND II*	35-37	30/100	54-55	30/100
17-18	30/100	38	CND II*	56	CND I*
19	CND II*	39-41	30/100	57	CND II*
20-23	30/100	42	CND II*	58-62	30/100
24-27	CND II*	43-44	30/100	63-65	CND II*
28-29	30/100	45-47	CND II*	66-70	30/100
30	CND II*	48-50	30/100	71-74	CND II*

*Conditional No Detention Areas (I & II) do not need detention controls provided that adequate downstream capacity can be shown for increased peak flows. (See Plan for additional details.)

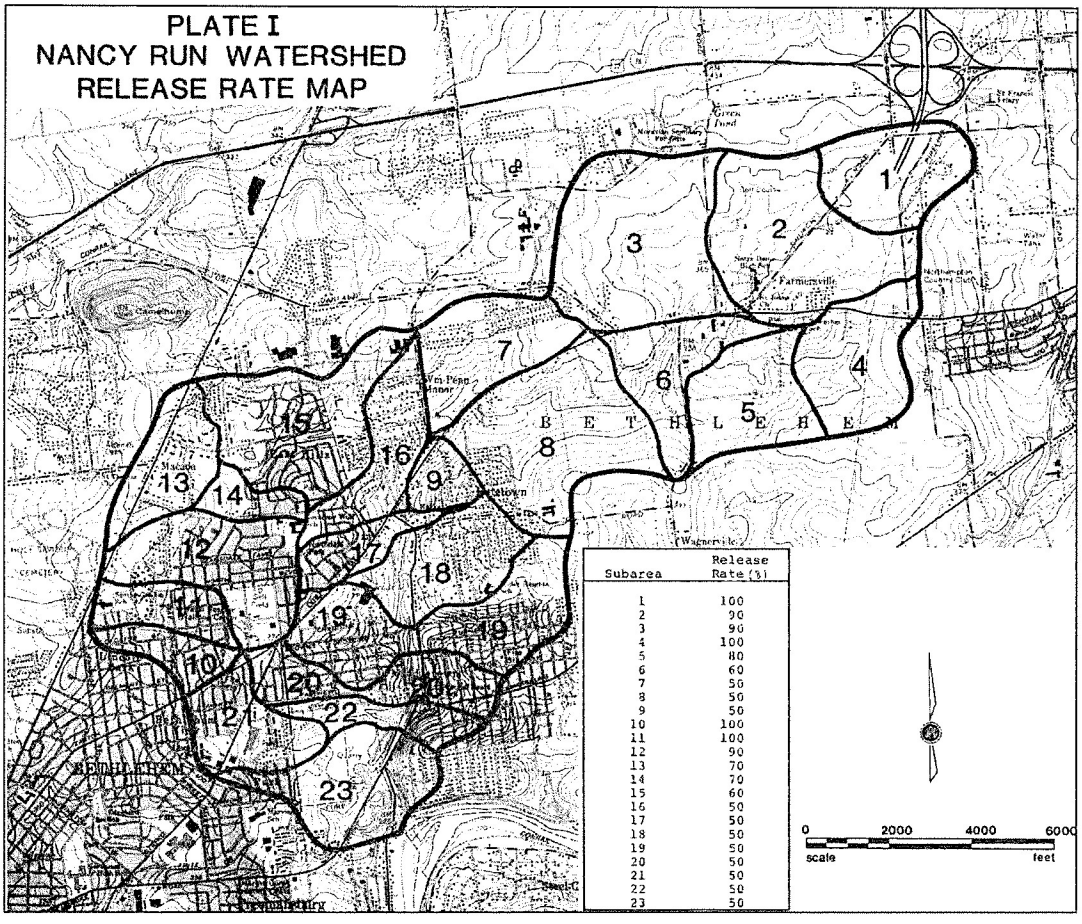
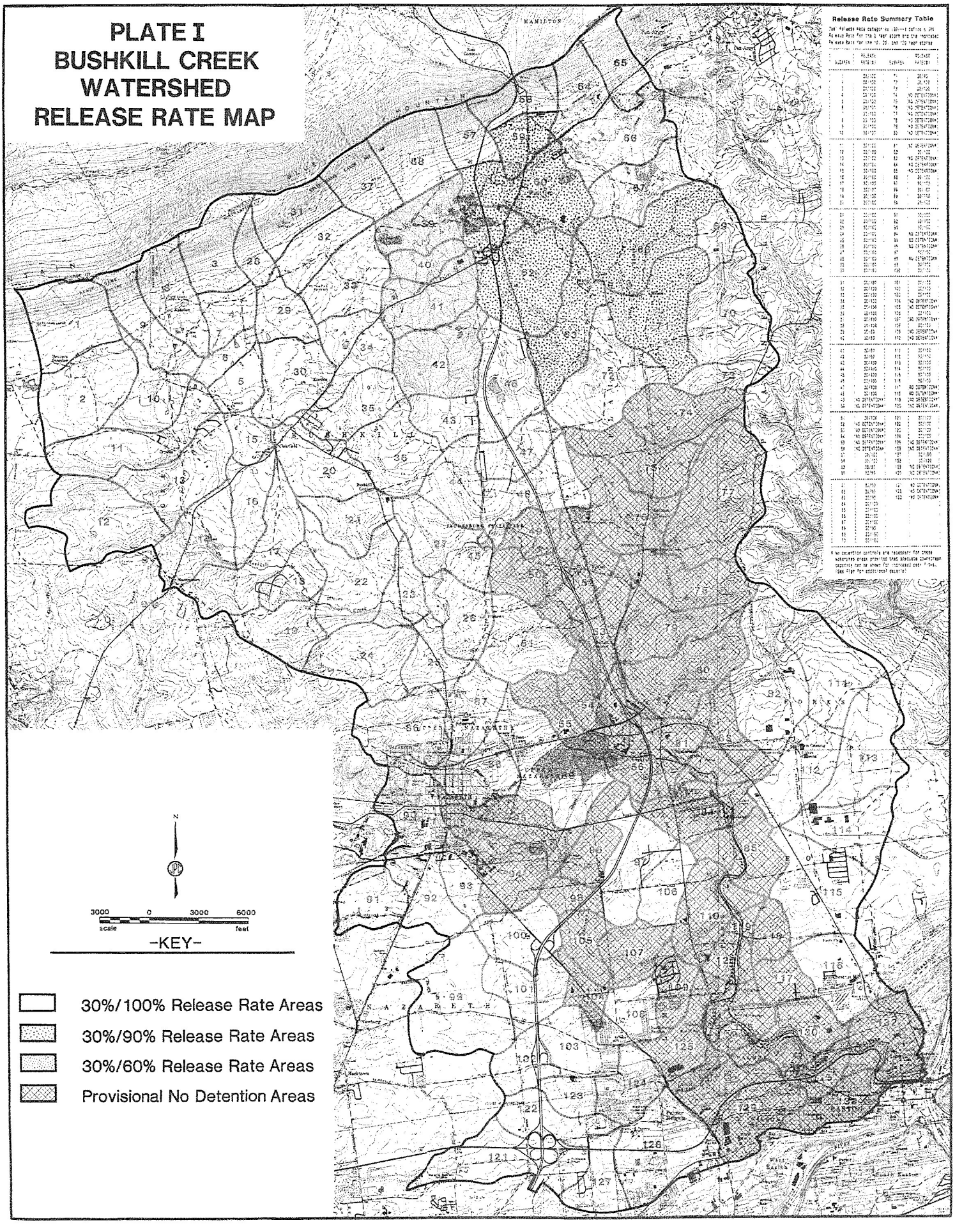
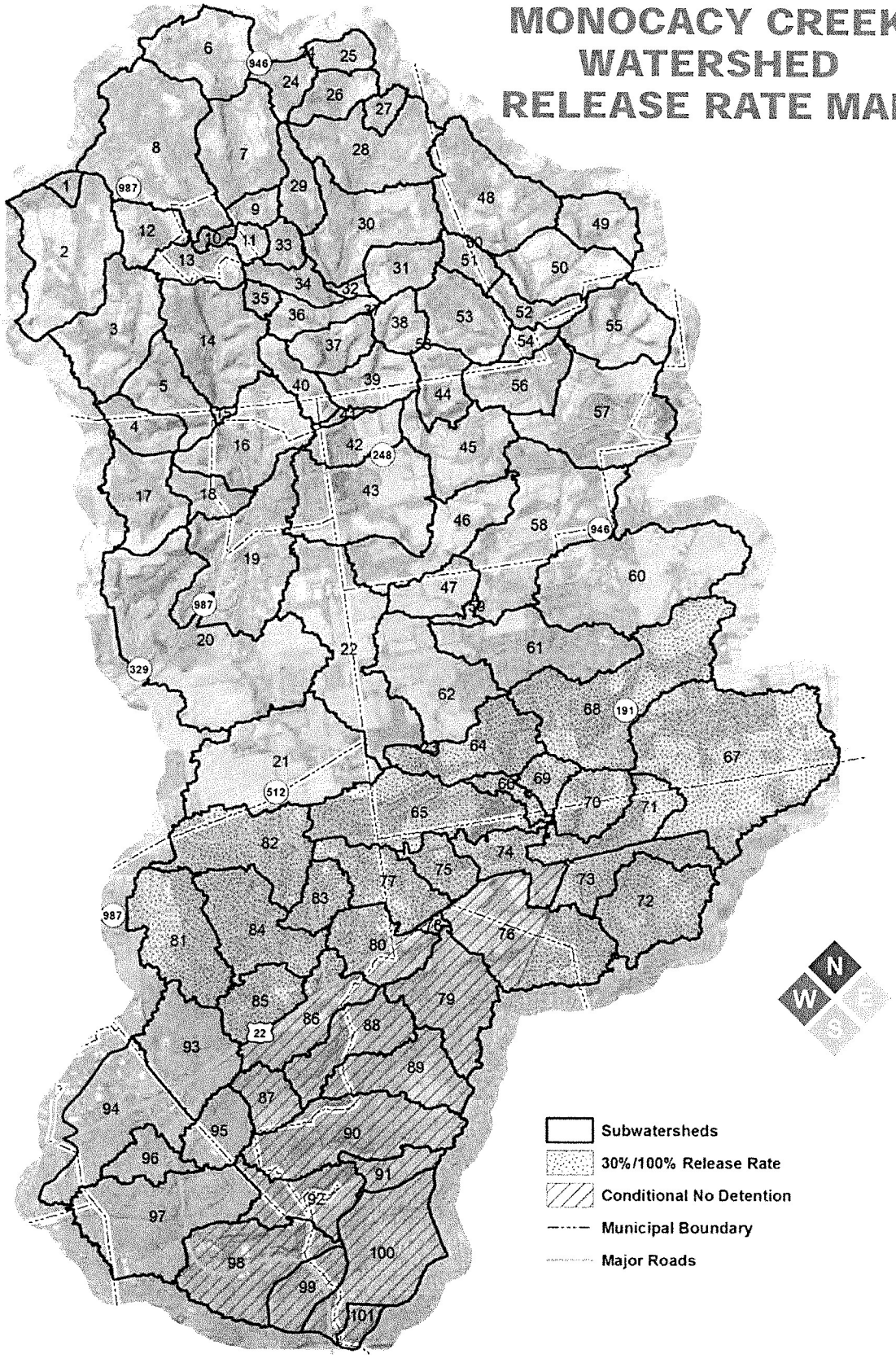


PLATE I
NANCY RUN WATERSHED
RELEASE RATE MAP
Subarea
Release Rate (%)
1 100
2 90
3 90
4 100
5 80
6 60
7 50
8 50
9 50
10 100
11 100
12 90
13 70
14 70
15 60
16 50
17 50
18 50
19 50
20 50
21 50
22 50
23 50
0
2000
4000
6000
scale
feet

PLATE I
BUSHKILL CREEK WATERSHED RELEASE RATE MAP



MONOCACY CREEK WATERSHED RELEASE RATE MAP



APPENDIX C

C-1 NRCS Type II 24-Hour Rainfall Distribution (Graphic & Tabular)

C-2 Intensity-Duration-Frequency Curves

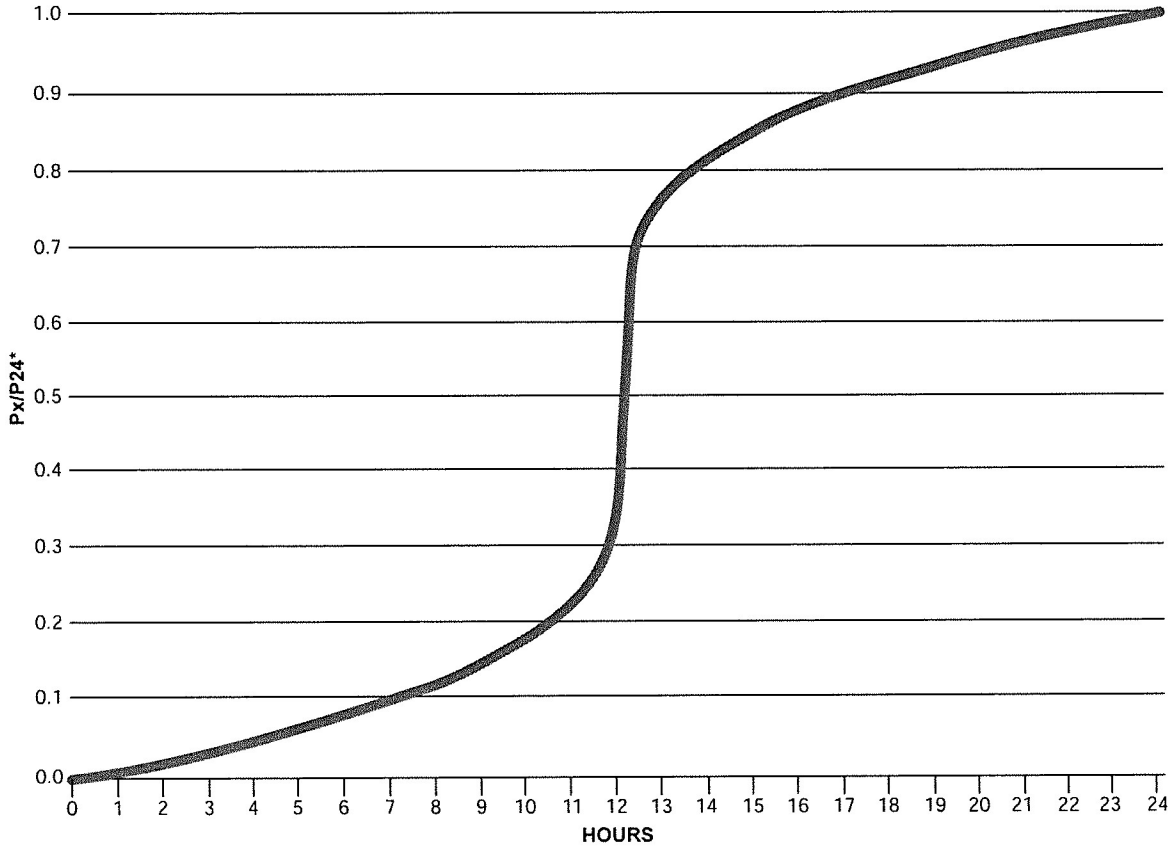
C-3 Runoff Curve Numbers and Percent Imperviousness Values

C-4 Runoff Coefficients for the Rational Method

C-5 Manning 'n' Values

APPENDIX C

NRCS TYPE II RAINFALL DISTRIBUTION



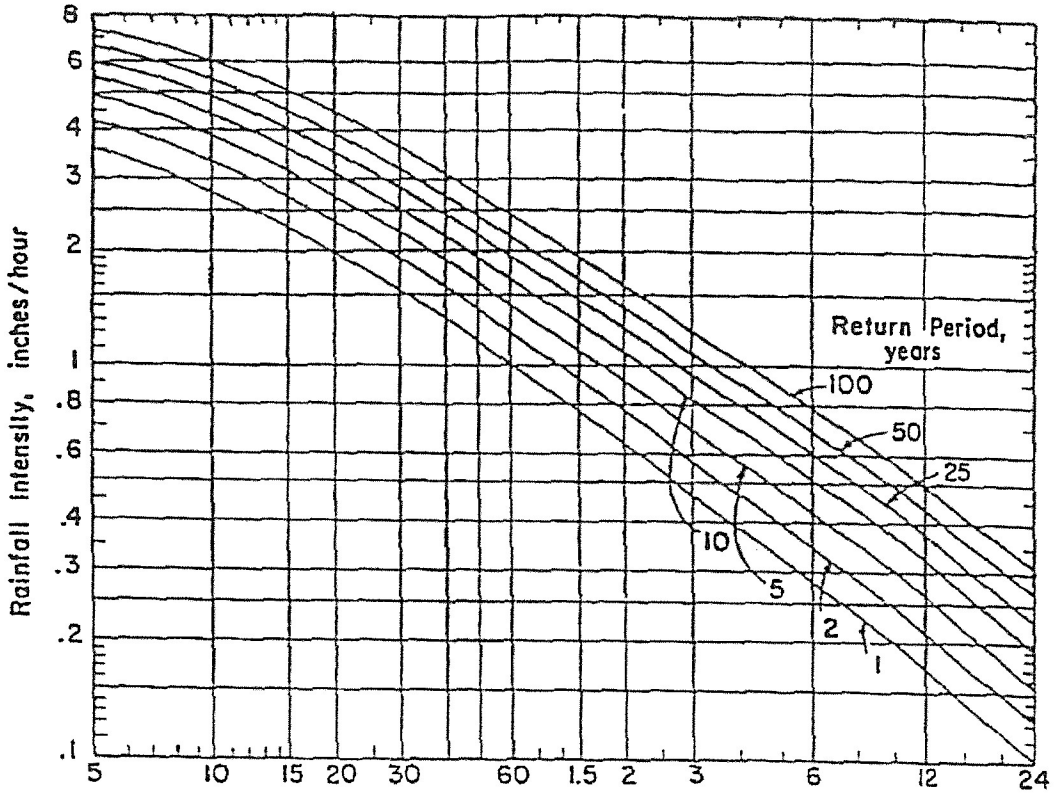
* Px/P24 equals cumulative percentage rainfall as a fraction of the total 24 hour rainfall

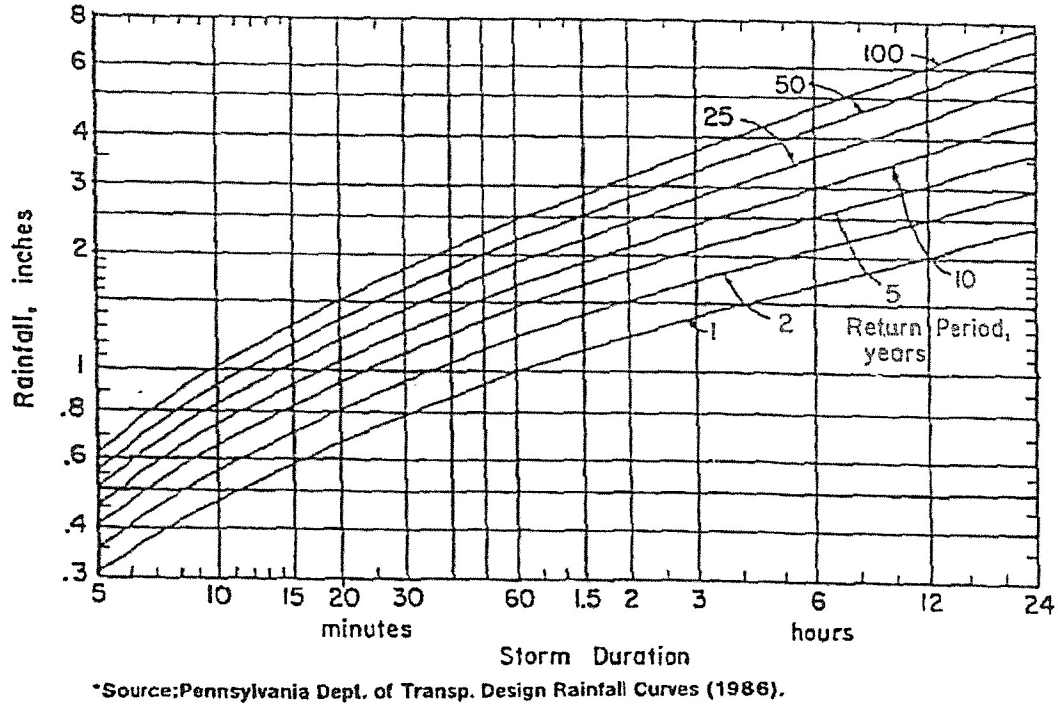
Hour/Min	Px/P24	Hour/Min	Px/P24
1 00	.0107	8 20	.1270
2 00	.0222	8 40	.1356
3 00	.0345	9 00	.1449
4 00	.0479	9 20	.1549
5 00	.0626	9 40	.1659
6 00	.0790	10 00	.1781
6 20	.0849	10 20	.1918
6 40	.0910	10 40	.2077
7 00	.0975	11 00	.2266
7 20	.1043	11 20	.2506
7 40	.1114	11 40	.2843
8 00	.1190	12 00	.3773

Hour/Min	Px/P24	Hour/Min	Px/P24
12 20	.6925	16 20	.8866
12 40	.7361	16 40	.8940
13 00	.7639	17 00	.9009
13 20	.7850	17 20	.9075
13 40	.8023	17 40	.9138
14 00	.8170	18 00	.9199
14 20	.8299	19 00	.9365
14 40	.8415	20 00	.9515
15 00	.8520	21 00	.9651
15 20	.8616	22 00	.9776
15 40	.8705	23 00	.9892
16 00	.8788	24 00	1.0000

NRCS TYPE II RAINFALL DISTRIBUTION

INTENSITY–DURATION–FREQUENCY CURVES*





*Source:Pennsylvania Dept. of Transp. Design Rainfall Curves (1986).

RUNOFF CURVE NUMBERS AND PERCENT IMPERVIOUSNESS VALUES*

Cover Description		Curve numbers for hydrologic soil group**			
Land Use/Cover Type	**Average Percent Impervious Area**	**A**	**B**	**C**	**D**
Open space (lawns, parks, golf courses, cemeteries, etc.): Good condition (grass cover greater than 75%		39	61	74	80
Impervious areas: Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
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 (townhouses)	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 acre	12%	46	65	77	82
Woods		30	55	70	77
Agriculture		Refer to Table 2-2b in source document (TR55) by crop type and treatment			
Meadow: Continuous grass, protected from grazing and generally mowed for hay		30	58	71	78

*Source: Natural Resources Conservation Service Technical Release No. 55, Second Edition, June 1986

**Hydrologic Soil Group based on the USDA Soil Survey

RUNOFF COEFFICIENTS FOR THE RATIONAL METHOD*

HYDROLOGIC SOIL GROUP AND SLOPE RANGE**

	A			B			C			D		
Land Use	**0-2%**	**2-6%**	**6%+**	**0-2%**	**2-6%**	**6%+**	**0-2%**	**2-6%**	**6%+**	**0-2%**	**2-6%**	**6%+**
Cultivated[A]	0.18[a]	0.23	0.28	0.24	0.29	0.33	0.30	0.34	0.38	0.33	0.37	0.41
	0.23[b]	0.29	0.34	0.30	0.36	0.40	0.36	0.41	0.45	0.39	0.44	0.48
Pasture[B]	0.09	0.13	0.17	0.19	0.24	0.29	0.27	0.31	0.36	0.31	0.35	0.39
	0.12	0.17	0.23	0.24	0.30	0.36	0.33	0.38	0.43	0.37	0.42	0.46
Meadow, Lawn[C]	0.05	0.08	0.12	0.15	0.20	0.24	0.23	0.28	0.32	0.28	0.32	0.36
	0.07	0.12	0.17	0.19	0.25	0.30	0.28	0.34	0.39	0.33	0.39	0.43
Forest, Woods	0.03	0.05	0.08	0.11	0.16	0.20	0.20	0.25	0.29	0.25	0.30	0.34
	0.04	0.08	0.12	0.15	0.21	0.26	0.25	0.31	0.36	0.31	0.37	0.41
Gravel	0.24	0.29	0.33	0.32	0.36	0.40	0.35	0.39	0.43	0.37	0.41	0.44
	0.30	0.36	0.40	0.38	0.43	0.47	0.42	0.46	0.50	0.44	0.48	0.51
Parking, other Impervious	0.85	0.86	0.87	0.85	0.86	0.87	0.85	0.86	0.87	0.85	0.86	0.87
	0.95	0.96	0.97	0.95	0.96	0.97	0.95	0.96	0.97	0.95	0.96	0.97
Residential, Commercial, Industrial and Other "Developed"	Runoff coefficients should be calculated based upon weighted average of impervious area coefficients and pervious area coefficients from above based upon soil type, slope and the particular development proposal.											

*Coefficients for all land uses except parking and other impervious cover are based on the Rossmiller Equation for translating NRCS curve numbers into Rational Method 'c' values. The source for the parking and other impervious cover coefficients is RAWLS, W.J., S.L. WONG and R.H. McCUEN, 1981. Comparison of urban flood frequency procedures. Preliminary draft report prepared for the Soil Conservation Service, Beltsville, M.D.

**Hydrologic Soil Group based on the USDA Soil Survey.

[a] Runoff coefficients for storm recurrence intervals less than 25 years.

[b] Runoff coefficients for storm recurrence intervals of 25 years or more.

[A] Represents average of cultivated land with and without conservation treatment from TR-55, January 1975. These values are consistent with several categories of cultivated lands from TR-55, June 1986.

[B] Represents grasslands in fair condition with 50% to 75% grass cover.

[C] Represents grasslands in good condition with greater than 75% grass cover.

MANNING 'n' VALUES BY TYPICAL REACH DESCRIPTION

Reach Description	Manning 'n'
Natural stream, clean, straight, no rifts or pools	0.030
Natural stream, clean, winding, some pools and shoals	0.040
Natural stream, winding, pools, shoals stony with some weeds	0.050
Natural stream, sluggish with deep pools and weeds	0.070
Natural stream, or swale, very weedy or with timber under brush	0.100
Concrete pipe, culvert or channel	0.012
Corrugated metal pipe	0.012-0.027*

*Depending upon type and diameter

ROUGHNESS COEFFICIENTS (MANNING 'n') FOR SHEET FLOW

Surface Description	Manning 'n'[1]
Smooth surfaces (concrete, asphalt, gravel, or bare soil)	0.011
Fallow (no residue)	0.050
Cultivated soils:	
Residue cover <= 20%	0.060
Residue cover > 20%	0.170
Grass:	
Short grass prairie	0.150
Dense grasses[2]	0.240
Bermuda grass	0.410
Range (natural)	0.130
Woods:[3]	
Light underbrush	0.400
Dense underbrush	0.800

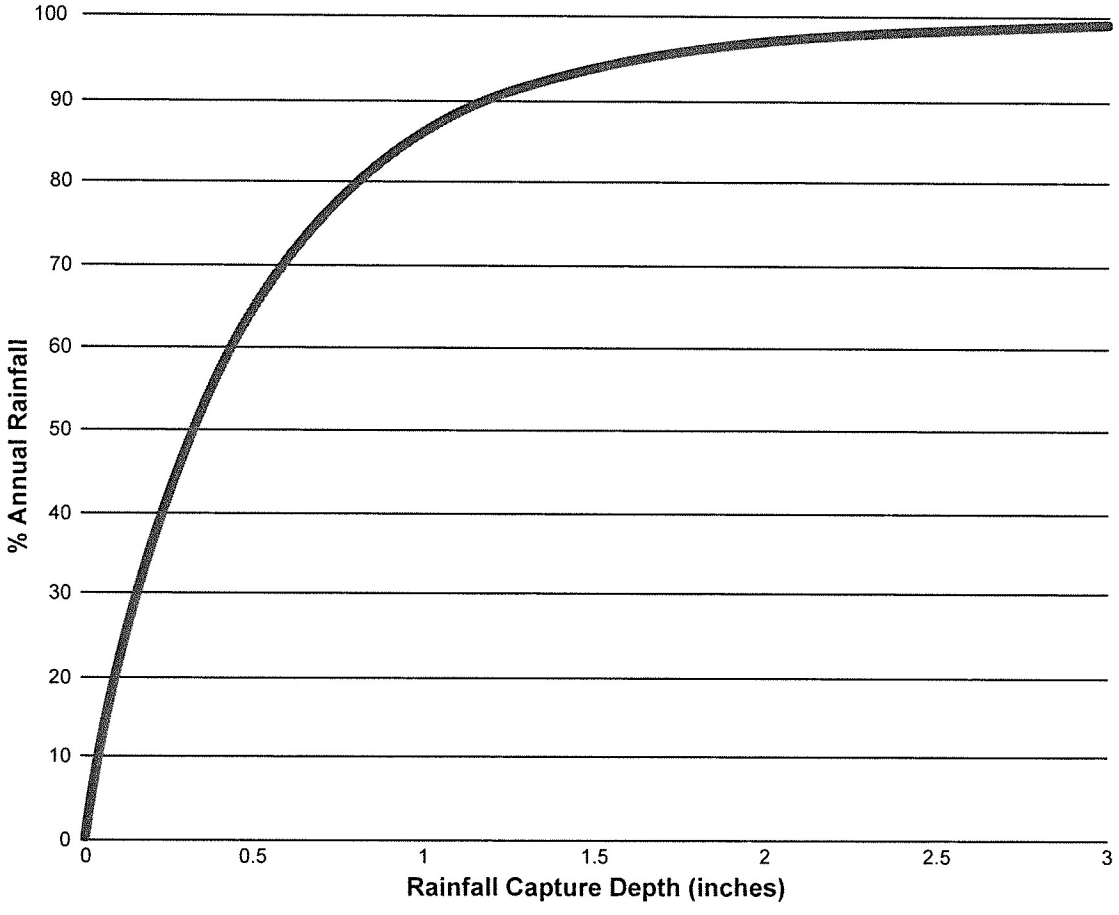
[1] The 'n' values are a composite of information compiled by Engman (1986).

[2] Includes species such as weeping lovegrass, bluegrass, bufffalo grass, blue grama grass and native grass mixtures.

[3] When selecting 'n', consider cover to a height of about 0.1 ft. This is the only part of the plant cover that will obstruct sheet flow.

PERCENT ANNUAL RAINFALL VERSUS VEGETATED/SURFACE BMP DESIGN RUNOFF CHART

To use this chart, for a given fraction of site impervious directed to a Vegetated/Surface BMP, calculate the runoff capture depth over the impervious in inches, use the curve to find % annual rainfall. The weighted average of % annual rainfall considering all impervious cover to all BMPs must be a minimum of 56%.



APPENDIX D

APPENDIX D

Recommendation Chart for Infiltration Stormwater Management BMPs in Carbonate Bedrock*

SITE RISK FACTORS	Geology Type	CARBONATE BEDROCK																														
	Effective Soil Thickness	Less than 2 Feet	2 to 4 Feet									Over 4 Feet to 8 Feet									Over 8 Feet											
	Special Geologic Features**	Low/Med/High Buffer	Low Buffer			Medium Buffer			High Buffer			Low Buffer			Medium Buffer			High Buffer			Low Buffer			Medium Buffer			High Buffer				
SITE INVESTIGATION RECOMMENDED		(Unacceptable)	Preliminary			Preliminary			Preliminary			Preliminary			Preliminary			Preliminary			Preliminary			Preliminary			Preliminary				
DESIGN FACTORS	Infiltration Loading Rates (% Increase) ***	(Unacceptable)	0-100%	100-300%	300 - 500%	0-100%	100-300%	300 - 500%	0-100%	100-300%	300 - 500%	0-100%	100-300%	300 - 500%	0-100%	100-300%	300 - 500%	0-100%	100-300%	300 - 500%	0-100%	100-300%	300 - 500%	0-100%	100-300%	300 - 500%	0-100%	100-300%	300 - 500%	0-100%	100-300%	300 - 500%
PROGRAM SUMMARY GUIDANCE ****						1	1				1	2								1	2					1					

RECOMMENDED

NOT RECOMMENDED

* Source: Developed by Cahill Associates based on information in "Technical Best Management Practice Manual & Infiltration Feasibility Report", November 2002 and input from the LVPC, 2003.

** Special Geologic Feature Buffer widths are as follows:

Low Buffer is less than 50 feet
Medium Buffer is 50 feet to 100 feet
High Buffer is greater than 100 feet

*** Rates greater than 500% not recommended.

**** Assumes adequately permeable soils and lack of natural constraints as required for all infiltration systems.

1 Infiltration systems may be allowed at the determination of the Engineer and/or Geologist, provided that a Detailed Site Investigation is undertaken which confirms nature of rock, location of Special Geologic Features, and adequacy of the buffer between the SGF and the proposed stormwater system(s).

2 In these Special Geologic Features: Low Buffer situations, infiltration systems may be allowed at the determination of the Engineer and/or Geologist, provided that a Detailed Site Investigation is undertaken and a 25 foot buffer from SGFs is maintained.

APPENDIX E

STORMWATER BEST MANAGEMENT PRACTICES
OPERATIONS AND MAINTENANCE AGREEMENT

THIS AGREEMENT, made and entered into this _____ day of _____, 202__, by and between _____ (hereinafter the "Landowner"), and the Township of Bethlehem, County of Northampton, and Commonwealth of Pennsylvania (hereinafter "Township");

WITNESSETH

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

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

WHEREAS, the stormwater management BMP Operations and Maintenance Plan approved by the Township (hereinafter referred to as the "Plan") for the property identified herein, which is attached hereto as Appendix A and made part hereof, as approved by the Township, provides for management of stormwater within the confines of the Property through the use of Best Management Practices (BMP's); and

WHEREAS, the Township, and the Landowner, his successors and assigns, agree that the health, safety, and welfare of the residents of the Township and the protection and maintenance of water quality require that on-site stormwater Best Management Practices be constructed and maintained on the Property; and

WHEREAS, for the purposes of this agreement, the following definitions shall apply:

BMP – "Best Management Practice;" activities, facilities, designs, measures or procedures used to manage stormwater impacts from land development, to protect and maintain water quality and groundwater recharge and to otherwise meet the purposes of the Municipal Stormwater Management Ordinance, including but not limited to infiltration trenches, seepage pits, filter strips, bioretention, wet ponds, permeable paving, rain gardens, grassed swales, forested buffers, sand filters and detention basins.

Infiltration Trench – A BMP surface structure designed, constructed, and maintained for the purpose of providing infiltration or recharge of stormwater into the soil and/or groundwater aquifer.

Seepage Pit – An underground BMP structure designed, constructed, and maintained for the purpose of providing infiltration or recharge of stormwater into the soil and/or groundwater aquifer.
Rain Garden – A BMP overlain with appropriate mulch and suitable vegetation designed, constructed, and maintained for the purpose of providing infiltration or recharge of stormwater into the soil and/or

underground aquifer.

; and

WHEREAS, the Township requires, through the implementation of the Plan, that stormwater management BMPs as required by said Plan and the Municipal Stormwater Management Ordinance be constructed and adequately operated and maintained by the Landowner, his successors and assigns, and

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

1. The BMPs shall be constructed by the Landowner in accordance with the plans and specifications identified in the Plan.

2. The Landowner shall operate and maintain the BMP(s) as shown on the Plan in good working order acceptable to the Township and in accordance with the specific maintenance requirements noted on the Plan.

3. The Landowner hereby grants permission to the Township, its authorized agents and employees, to enter upon the property, at reasonable times and upon presentation of proper identification, to inspect the BMP(s) whenever it deems necessary. Whenever possible, the Township shall notify the Landowner prior to entering the property.

4 In the event the Landowner fails to operate and maintain the BMP(s) as shown on the Plan in good working order acceptable to the Township, the Township or its representatives may enter upon the Property and take whatever action is deemed necessary to maintain said BMP(s). This provision shall not be construed to allow the Township to erect any permanent structure on the land of the Landowner. It is expressly understood and agreed that the Township is under no obligation to maintain or repair said facilities, and in no event shall this Agreement be construed to impose any such obligation on the Township.

5. In the event the Township, pursuant to this Agreement, performs work of any nature, or expends any funds in performance of said work for labor, use of equipment, supplies, materials, and the like, the Landowner shall reimburse the Township for all expenses (direct and indirect) incurred within 10 days of receipt of invoice from the Township and if not timely paid, a municipal lien shall be placed upon the premises for 110% of the invoice amount, plus statutorily allowed fees, expenses and costs.

6. The intent and purpose of this Agreement is to ensure the proper maintenance of the onsite BMP(s) by the Landowner; provided, however, that this Agreement shall not be deemed to create or effect any additional liability of any party for damage alleged to result from or be caused by stormwater runoff.

7. The Landowner, its executors, administrators, assigns, and other successors in interests,

hereby release and hold harmless the Township's employees and designated representatives from all damages, accidents, casualties, occurrences or claims which might arise or be asserted against said employees and representatives from the construction, presence, existence, or maintenance of the BMP(s) by the Landowner or Township. In the event that a claim is asserted against the Township, its designated representatives or employees, the Township shall promptly notify the Landowner and the Landowner shall defend, at his own expense, any suit based on the claim. If any judgment or claims against the Township's employees or designated representatives shall be allowed, the Landowner shall pay all costs and expenses regarding said judgment or claim.

8. The Township shall inspect the BMP(s) as necessary to ensure their continued functioning.

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

ATTEST:

_____ _____ (SEAL)

President

ATTEST: *TOWNSHIP OF BETHLEHEM*

_____ _____ (SEAL)

Manager/Secretary *President*
Board of Commissioners

COMMONWEALTH OF PENNSYLVANIA)
) ss:
COUNTY OF NORTHAMPTON)

On this, the ____ day of _____, 202___, before me, the undersigned officer, personally appeared _____, who acknowledged himself to be the President of _____, a Pennsylvania business corporation, and that he as such President, being authorized to do so, executed the same for the purposes therein contained by signing the name of the corporation by himself as President.

IN WITNESS WHEREOF, I have hereunto set my hand and notarial seal.

_____

COMMONWEALTH OF PENNSYLVANIA)
) ss:
COUNTY OF NORTHAMPTON)

On this, the ____ day of _____, 202__, before me, the undersigned officer, personally appeared _____, who acknowledged himself to be the President of the Board of Commissioners of the Township of Bethlehem, a municipal corporation organized and existing as a township of the first class, and that he as such President, being authorized to do so, executed the same for the purposes therein contained by signing the name of the Township of Bethlehem by himself as President of the Board of Commissioners.

IN WITNESS WHEREOF, I have hereunto set my hand and notarial seal.

_____

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

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

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

- **Preserving Natural Drainage Features**. Protecting natural drainage features, particularly vegetated drainage swales and channels, is desirable because of their ability to infiltrate and attenuate flows and to filter pollutants. However, this objective is often not accomplished in land development. In fact, commonly held drainage philosophy encourages just the opposite pattern—streets and adjacent storm sewers typically are located in the natural headwater valleys and swales, thereby replacing natural drainage functions with a completely impervious system. As a result, runoff and pollutants generated from impervious surfaces flow directly into storm sewers with no opportunity for attenuation, infiltration, or filtration. Developments designed to fit site topography also minimize the amount of grading on site.

- **Protecting Natural Depression Storage Areas**. Depression storage areas have no surface outlet, or drain very slowly following a storm event. They can be commonly seen as ponded areas in farm fields during the wet season or after large runoff events. Traditional development practices eliminate these depressions by filling or draining, thereby obliterating their ability to reduce surface runoff volumes and trap pollutants. The volume and release rate characteristics of depressions should be protected in the design of the development site. The depressions can be protected by simply avoiding the depression or by incorporating its storage as additional capacity in required detention facilities.

- **Avoiding Introduction of Impervious Areas**. Careful site planning should consider reducing impervious coverage to the maximum extent possible. Building footprints, sidewalks, driveways and other features producing impervious surfaces should be evaluated to minimize impacts on runoff.

- **Reducing the Hydraulic Connectivity of Impervious Surfaces**. Impervious surfaces are significantly less of a problem if they are not directly connected to an impervious conveyance system (such as storm sewer). Two basic ways to reduce hydraulic connectivity are routing of roof runoff over lawns and reducing the use of storm sewers. Site grading should promote

increasing travel time of stormwater runoff, and should help reduce concentration of runoff to a single point in the development.

- **Routing Roof Runoff over Lawns**. Roof runoff can be easily routed over lawns in most site designs. The practice discourages direct connections of downspouts to storm sewers or parking lots. The practice also discourages sloping driveways and parking lots to the street. By routing roof drains and crowning the driveway to run off to the lawn, the lawn is essentially used as a filter strip.

- **Reducing the Use of Storm Sewers**. By reducing use of storm sewers for draining streets, parking lots, and back yards, the potential for accelerating runoff from the development can be greatly reduced. The practice requires greater use of swales and may not be practical for some development sites, especially if there are concerns for areas that do not drain in a "reasonable" time. The practice requires educating local citizens and public works officials, who expect runoff to disappear shortly after a rainfall event.

- **Reducing Street Widths**. Street widths can be reduced by either eliminating on-street parking or by reducing roadway widths. Municipal planners and traffic designers should encourage narrower neighborhood streets which ultimately could lower maintenance.

- **Limiting Sidewalks to One Side of the Street**. A sidewalk on one side of the street may suffice in low-traffic neighborhoods. The lost sidewalk could be replaced with bicycle/recreational trails that follow back-of-lot lines. Where appropriate, backyard trails should be constructed using pervious materials.

- **Using Permeable Paving Materials**. These materials include permeable interlocking concrete paving blocks or porous bituminous concrete. Such materials should be considered as alternatives to conventional pavement surfaces, especially for low use surfaces such as driveways, overflow parking lots, and emergency access roads.

- **Reducing Building Setbacks**. Reducing building setbacks reduces driveway and entry walks and is most readily accomplished along low-traffic streets where traffic noise is not a problem.

- **Constructing Cluster Developments**. Cluster developments can also reduce the amount of impervious area for a given number of lots. The biggest savings is in street length, which also will reduce costs of the development. Cluster development clusters the construction activity onto less-sensitive areas without substantially affecting the gross density of development.

APPENDIX G

PRELIMINARY SITE INVESTIGATION AND TESTING REQUIREMENTS

Required Data and Site Information: The following data shall be gathered utilizing standard testing procedures as part of a Preliminary Site Investigation (Carbonate Study):

- Bedrock composition – Any apparent boundaries between carbonate and non-carbonate bedrock must be verified by a qualified geotechnical professional.
- Bedrock structural geology – This includes the possible presence of faults and mapping of conspicuous fracture traces or lineaments.
- Overburden and soil mantle composition and thickness.
- Permeability of the soil.
- Depth to the seasonal high water table.
- Presence of special geologic features – This includes sinkholes, closed depressions, fracture traces, lineaments, joints, faults, caves, pinnacles and geologic contacts between carbonate and non-carbonate bedrock.

Preliminary Site Investigation Required for Sites Intending to Use Infiltration

Review of Available Data, Maps and Reports: Some of the required information, as listed above, can be found in existing published data. Suggested resources include the following:

- Geologic maps and references for the development area.
- The Little Lehigh Creek Basin Carbonate Prototype Area Closed Depression Map – available at the LVPC.
- USGS topographic maps.
- Lehigh and Northampton County soil survey maps.
- Aerial photographs from the LVPC or other sources.
- Relevant Pennsylvania Geologic Survey Open File Reports that provide maps of sinkholes and Karst features for Lehigh County (OF 87-01) and Northampton County (OF 87-02).
- Kochanov and Reese (2003). Density of Mapped Karst Feature in South-Central and Southeastern Pennsylvania (Map 68).
- DCNR Online Sinkhole Inventory - (http://www.dcnr.state.pa.us/topogeo/hazards/sinkhole/default.asp).

Field Inspections: In addition to gathering data from published sources, a field inspection of the proposed site is required. A field inspection can provide additional information relating to site features such as carbonate bedrock features, indicators of seasonal high stream-level or water table levels, streams, springs, etc.

After completion of the Preliminary Site Investigation (Carbonate Study) and determination of the applicability of infiltrating stormwater on the site, additional field testing is required to determine an infiltration rate for each proposed stormwater facility on-site:

Soil Test Pit and Double Ring Infiltrometer Test requirements: A minimum of one test pit and a minimum of 2 double ring infiltrometer tests (in each test pit) are required for every site. A test pit is a trench excavated with a backhoe for observing subsurface conditions. The test pits will be used to describe soil depth and quality, including soil horizons, and testing of permeability or double ring infiltrometer rates and can be conducted by a certified Sewage Enforcement Officer or representatives of a Professional Engineer or Professional Geologist, registered in the Commonwealth of Pennsylvania. The test pits shall extend to a depth of at least 2 feet beyond the planned infiltration elevation to explore limiting zones. The width of the test pit is governed by OSHA requirements for trench safety. If the trench depth or width cannot be reasonably achieved, alternate infiltration tests, such as down-hole tests, may be used at the discretion of the designer, with the approval of the Township's geotechnical consultant.

Double ring infiltrometer tests or alternative down-hole infiltration tests are to be conducted in accordance with the requirements contained in the Pennsylvania Department of Environmental Protection (PADEP) Stormwater Best Management Practices (BMP) Manual (Latest Edition).

Additional Site Investigation and Testing Required if Infiltration is Proposed

Soil Test Pit Requirements: The required number of test pits varies with Effective Soil Thickness. As risk factors increase, the number of test pits increases. A minimum of 2 test pits, uniformly spaced within the proposed infiltration area (e.g., the 2 pits should be centered on each half of the proposed infiltration area), are required for any site proposing infiltration unless the applicant can demonstrate that one test pit is adequately representative of the area proposed for infiltration. For larger infiltration areas, multiple test pits shall be developed at the densities as listed below:

Effective Soil Thickness (ft.)	Test Pit Density (per acre of proposed infiltration area)*	Double Ring Infiltrometer (per acre of proposed infiltration area)**	Auger Grid Spacing (Feet On-Center)***
8	4	8	50
4 to 8	6	12	35
2 to 4	8	16	25

*No. of Test Pits required = Infiltration sq. ft./43,560 sq. ft. x test pit density from chart rounded up to the nearest whole number

** No. of Double Ring Infiltrometer Tests required = Infiltration sq. ft./43,560 sq. ft. x double ring infiltrometer tests from chart rounded up to the nearest whole number

***Auger testing is only required on Carbonate sites.

Soil Auger Testing Requirements for Carbonate Areas: Because soil depth is not uniform in many carbonate areas, test pits may not be sufficient to accurately determine the depth to bedrock. Augering or air-track probing provides this essential data as inexpensively as possible. These test methods allow relatively inexpensive, qualitative determination of the presence of overburden voids and will generally penetrate to the top-of-bedrock. Augers typically extend to depths of 20 feet. Special augers extend to as much as 50 feet. Augers do not extend into the bedrock. Auger testing should be performed in a grid pattern across the proposed infiltration area, spaced as indicated in the above table.

Double Ring Infiltrometer Testing Requirements: For each proposed infiltration area, a minimum of six double ring infiltrometer tests shall be conducted with a vertical component permeability test unless the applicant can demonstrate that fewer tests accurately represent the double ring infiltrometer rate of the proposed infiltration area. Additional testing shall be required if the initial test results show significant variability in the vertical component double ring infiltrometer rate. For larger infiltration areas, double ring infiltrometer tests shall be conducted at the densities listed in the table above. The determination of a design infiltration rate, a factor of safety versus the field measured rate, and the mean field measured rate, shall be determined based on the requirements of the PADEP BMP Manual (latest Ed.).