SOUTH MANHEIM TOWNSHIP
STORMWATER MANAGEMENT ORDINANCE

ORDINANCE NO. 83

SOUTH MANHEIM TOWNSHIP, SCHUYLKILL COUNTY

PENNSYLVANIA

Adopted at a Public Meeting Held on

December 1, 2008

SOUTH MANHEIM TOWNSHIP PROPOSED STORMWATER MANAGEMENT ORDINANCE

Review Log

Reviewer's Printed Name & Signature	Date and Time of Request	Document to be Reviewed*	Document Available (Y/N - if No Explain)	Time In Time Out	Copies Requested	Office Staff Initials & Time
Jean Mintz	11/7/08 11:00am	Stormwater Ordinance	Y	N/A	1	KH 11:04am

*Note: For review of any document other than the proposed Ordinance, the proposed review shall complete a written request for documents in accordance with the Township's Written Public Records Review Policy as posted on the Bulletin Board and as available on request in the Township office. This Log Book pertains solely to the proposed Ordinance and its exhibits, if any.

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ARTICLE I- GENERAL PROVISIONS

Section 101. Short Title

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

Section 102. Statement of Findings

The governing body of South Manheim Township finds that:

A. Inadequate management of accelerated stormwater runoff resulting from development throughout a watershed increases flood flows and velocities, contributes to erosion and sedimentation, overtaxes the carrying capacity of existing streams and storm sewers, greatly increases the cost of public facilities to convey and manage stormwater, undermines floodplain management and flood reduction efforts in upstream and downstream communities, reduces groundwater recharge, and threatens public health and safety.

B. Inadequate planning and management of stormwater runoff resulting from land development and redevelopment throughout a watershed can also harm surface water resources by changing the natural hydrologic patterns, accelerating stream flows (which increase scour and erosion of stream-beds and stream-banks thereby elevating sedimentation), destroying aquatic habitat and elevating aquatic pollutant concentrations and loadings such as sediments, nutrients, heavy metals and pathogens. Groundwater resources are also impacted through loss of recharge.

C. A comprehensive program of stormwater management (SWM), including minimization of impacts of development, redevelopment and activities causing accelerated erosion, is fundamental to the public health, safety, welfare, and the protection of the people of South Manheim Township and all the people of the Commonwealth, their resources, and the environment.

D. Inadequate management of accelerated stormwater runoff resulting from development throughout a watershed poses a threat to surface and groundwater quality.

E. Stormwater can be an important water resource by providing groundwater recharge for water supplies and base flow of streams, which also protects and maintains surface water quality.

F. Through project design, impacts from stormwater runoff can be minimized to maintain the natural hydrologic regime, and sustain high water quality, groundwater recharge, stream baseflow and aquatic ecosystems. The most cost effective and environmentally advantageous way to manage storm water runoff is through nonstructural project design, minimizing impervious surfaces and sprawl, avoiding sensitive areas (i.e. stream buffers, floodplains, steep slopes), and designing to topography and soils to maintain the natural hydrologic regime.

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

H. 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).

I. Non-stormwater discharges to municipal separate storm sewer systems can contribute to pollution of waters of the Commonwealth by South Manheim Township.

Section 103. Purpose

The purpose of this Ordinance is to promote the public health, safety, and welfare within the Schuylkill River Watershed by maintaining the natural hydrologic regime by minimizing the impacts described in Section 102 of this Ordinance through provisions designed to:

A. Promote alternative project designs and layout that minimizes impacts to surface and ground water.

B. Promote nonstructural Best Management Practices (BMPs).

C. Minimize increases in stormwater volume.

D. Minimize impervious surfaces.

E. Manage accelerated runoff and erosion and sedimentation problems at their source by regulating activities that cause these problems.

F. Provide review procedures and performance standards for stormwater planning and management.

G. Utilize and preserve the existing natural drainage systems.

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

I. Focus on infiltration of stormwater, to maintain groundwater recharge, to prevent degradation of surface and groundwater quality and to otherwise protect water resources.

J. Maintain existing base flows and quality of streams and watercourses, where possible.

K. Meet legal water quality requirements under state law, including regulations at 25 Pa. Code Chapter 93.4a to protect and maintain "existing uses" and maintain the level of water quality to support those uses in all streams, and to protect and maintain water quality in "special protection" streams.

L. Address the quality and quantity of stormwater discharges from the development site.

M. Provide a mechanism to identify controls necessary to meet the NPDES permit requirements.

N. Implement an illegal discharge detection and elimination program to address non-stormwater discharges into South Manheim Township's separate storm sewer system.

O. Preserve and restore the flood-carrying capacity of streams.

P. Prevent scour and erosion of streambanks and streambeds.

Q. Provide performance standards and design criteria for watershed-wide stormwater management and planning.

R. Provide proper operation and maintenance of all permanent stormwater management facilities and BMPs that are implemented in South Manheim Township.

Section 104. Statutory Authority

Primary Authority:

South Manheim Township is empowered to regulate these activities by the authority of the Act of October 4, 1978, P.L. 864 (Act 167), 32 P.S. Section 680.1, et seq., as amended, the "Storm Water Management Act" and the (appropriate municipal code).

Secondary Authority

South Manheim Township also is empowered to regulate land use activities that affect runoff by the authority of the Act of July 31, 1968, P.L. 805, No. 247, The Pennsylvania Municipalities Planning Code, as amended.

Section 105. Applicability/Regulated Activities

A. All Regulated Activities and all activities that may affect stormwater runoff, including Land Development and Earth Disturbance Activity, are subject to regulation by this Ordinance.

Section 106. Repealer

Any ordinance or ordinance provision of South Manheim Township inconsistent with any of the provisions of this Ordinance is hereby repealed to the extent of the inconsistency only.

Section 107. Severability

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

Section 108. Compatibility with Other Ordinance 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 by any other code, law, regulation or ordinance.

ARTICLE II-DEFINITIONS

Section 201. Interpretation

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

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

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

C. The word "person" includes an individual, firm, association, organization, partnership, trust, company, corporation, unit of government, or any other similar entity.

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

E. The words "used or occupied" include the words "intended, designed, maintained, or arranged to be used, occupied or maintained."

Section 202. Definitions

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

Agricultural Activities - The work of producing crops and raising livestock including tillage, plowing, disking, harrowing, pasturing and installation of conservation measures. For purposes

of regulation by this Ordinance construction of new buildings or impervious area is not considered an agricultural activity.

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

As-built drawings - Those maintained by the Contractor as he constructs the project and upon which he documents the actual locations of the building components and changes to the original contract documents. These, or a copy of same, are turned over to the Engineer at the completion of the project

Applicant - A person who has filed an application for approval to engage in any Regulated Activities as defined in Section 105 of this Ordinance.

Bankfull – The channel at the top-of-bank or point where water begins to overflow onto a floodplain.

Base Flow – Portion of stream discharge derived from groundwater; the sustained discharge that does not result from direct runoff or from water diversions, reservoir releases, piped discharges, or other human activities.

Bioretention – A stormwater retention area which utilizes woody and herbaceous plants and soils to remove pollutants before infiltration occurs.

BMP (Best Management Practice) – Methods, measures or practices to prevent or reduce surface runoff and/or water pollution, including but not limited to, structural and non-structural stormwater management practices and operation and maintenance procedures. See also Non-structured Best Management Practice (BMP).

Buffer – The area of land immediately adjacent to any stream, measured perpendicular to and horizontally from the top-of-bank on both sides of a stream. (See Top of Bank)

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

Channel Erosion - The widening, deepening, and headward cutting of small channels and waterways, caused by stormwater runoff or bankfull flows.

Cistern - An underground reservoir or tank for storing rainwater.

Conservation District - The Schuylkill County Conservation District.

Culvert - A structure with appurtenant works, which carries water under or through an embankment or fill.

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

Department – The Pennsylvania Department of Environmental Protection.

Designee - The agent of the Schuylkill County Planning Commission, Schuylkill County Conservation District and/or agent of the governing body involved with the administration, review or enforcement of any provisions of this ordinance by contract or memorandum of understanding.

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

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

Designated Watershed (ACT 167) – A Watershed which is listed under the Pennsylvania Department of Environmental Protection's "Index of Designated Watersheds (Stormwater Management)" pursuant to the Stormwater Management Act P.L. 864, No. 167, October 4, 1978, and published in the Pennsylvania Bulletin on May 31, 1980 and August 9, 1980, as amended on November 19, 1991, April 21, 1992, June 21, 1994, April 16, 1996, April 15, 1997 and December 16, 1997).

Detention Basin - An impoundment designed to collect and retard stormwater runoff by temporarily storing the runoff and releasing it at a predetermined rate. Detention basins are designed to drain completely shortly after any given rainfall event and are dry until the next rainfall event.

Developer – A person that seeks to undertake any Regulated Activities at a project site in South Manheim Township.

Development – Any human-induced change to improved or unimproved real estate, whether public or private, including but not limited to land development, construction, installation, or expansion of a building or other structure, land division, street construction, drilling, and site alteration such as embankments, dredging, grubbing, grading, paving, parking or storage facilities, excavation, filling, stockpiling, or clearing. As used in this ordinance, development encompasses both new development and redevelopment.

Development Site - The specific tract of land where any Regulated Activities in South Manheim Township are planned, conducted or maintained.

Diffused Drainage Discharge – Drainage discharge not confined to a single point location or channel, such as sheet flow or shallow concentrated flow.

Discharge – 1. (verb) To release water from a project, site, aquifer, drainage basin or other point of interest 2. (noun) The rate and volume of flow of water such as in a stream, generally expressed in cubic feet per second (volume per unit of time). See also Peak Discharge.

Discharge Point – The point of discharge for a stormwater facility.

Disturbed Areas – Unstabilized land area where an earth disturbance activity is occurring or has occurred.

Ditch – An artificial waterway for irrigation or stormwater conveyance.

Downslope Property Line - That portion of the property line of the lot, tract, or parcels of land being developed located such that overland or pipe flow from the site would be directed towards it.

Drainage Conveyance Facility - A Stormwater Management Facility designed to transmit stormwater runoff and shall include channels, swales, pipes, conduits, culverts, storm sewers, etc.

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

Drainage Permit - A permit issued by the Municipal governing body after the drainage plan has been approved.

Drainage Plan - The documentation of the stormwater management system, if any, to be used for a given development site, the contents of which are established in Section 403.

Earth Disturbance Activity – A construction or other human activity which disturbs the surface of land, including, but not limited to, clearing and grubbing, grading, excavations, embankments, land development, agricultural plowing or tilling, timber harvesting activities, road maintenance activities, mineral extraction, and the moving, depositing, stockpiling, or storing of soil, rock or earth materials.

Emergency Spillway – A conveyance area that is used to pass peak discharge greater than the maximum design storm controlled by the stormwater facility.

Encroachment – A structure or activity that changes, expands or diminishes the course, current or cross section of a watercourse, floodway or body of water.

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

Erosion and Sediment Control Plan - A plan for a project site which identifies BMPs to minimize accelerated erosion and sedimentation.

Exceptional Value Waters – Surface waters of high quality which satisfy Pennsylvania Code Title 25 Environmental Protection, Chapter 93, Water Quality Standards, §93.4b(b) (relating to anti-degradation).

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

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

Floodplain - Any land area susceptible to inundation by water from any natural source or delineated by applicable Department of Housing and Urban Development, Federal Insurance Administration Flood Hazard Boundary - Mapped as being a special flood hazard area.

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

Fluvial Geomorphology - The study of landforms associated with river channels and the processes that form them.

Forest Management/Timber Operations - Planning and activities necessary for the management of forest land with no change of land use proposed. These include timber inventory and preparation of forest management plans, silvicultural treatment, cutting budgets, logging road design and construction, timber harvesting and reforestation.

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

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

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

Groundwater - Water beneath the earth's surface, often between saturated soil and rock that supplies wells and springs.

Groundwater Recharge - Replenishment of existing natural underground water supplies without degrading groundwater quality.

HEC-HMS - The U.S. Army Corps of Engineers, Hydrologic Engineering Center (HEC) Hydrologic Modeling System (HMS). This model was used to model the Schuylkill River watershed during the ACT 167 Plan development and was the basis for the Standards and Criteria of this Ordinance.

High Quality Waters – Surface waters having quality which exceeds levels necessary to support propagation of fish, shellfish, and wildlife and recreation in and on the water by satisfying Pennsylvania Code Title 25 Environmental Protection, Chapter 93 Water Quality Standards, § 93.4b(a).

Hotspots - Areas where land use or activities generate highly contaminated runoff, with concentrations of pollutants in excess of those typically found in stormwater.

Hydrograph – A graph of discharge versus time for a selected point in the drainage system.

Hydrologic Regime (natural) – The hydrologic cycle or balance that sustains quality and quantity of stormwater, baseflow, storage, and groundwater supplies under natural conditions.

Hydrologic Soil Group, - A classification of soils by the Natural Resources Conservation Service, formerly the Soil Conservation Service, into four runoff potential groups. The groups range from A soils, which are very permeable and produce little runoff, to D soils, which are not very permeable and produce much more runoff.

Impervious Surface - A surface that prevents the infiltration of water into the ground. Impervious surface includes, but is not limited to, any roof, parking or driveway areas, and any new streets and sidewalks.

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

Infill – Development that occurs on smaller parcels that remain undeveloped but are within or very close proximity to urban areas. The development relies on existing infrastructure and does not require an extension of water, sewer or other public utilities.

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

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

Inlet - The upstream end of any structure through which water may flow.

Intermittent Stream - A stream that flows only part of the time. Flow generally occurs for several weeks or months in response to seasonal precipitation, due to groundwater discharge.

Land Development – Any of the following activities:

(i) The improvement of one lot or two or more contiguous lots, tracts, or parcels of land for any purpose involving:
   a. A group of two or more residential or nonresidential buildings, whether proposed initially or cumulatively, or a single nonresidential building on a lot or lots regardless of the number of occupants or tenure, or
   b. The division or allocation of land or space, whether initially or cumulatively, between or among two or more existing or prospective occupants by means of, or for the purpose of streets, common areas, leaseholds, condominiums, building groups, or other features;

(ii) A subdivision of land;

(iii) Development in accordance with Section 503(1.1) of the PA Municipalities Planning Code.

Limiting zone—A soil horizon or condition in the soil profile or underlying strata which includes one of the following:

(i) A seasonal high water table, whether perched or regional, determined by direct observation of the water table or indicated by soil mottling.

(ii) A rock with open joints, fracture or solution channels, or masses of loose rock fragments, including gravel, with insufficient fine soil to fill the voids between the fragments.

(iii) A rock formation, other stratum or soil condition which is so slowly permeable that it effectively limits downward passage of water.

Lot – A designated parcel, tract or area of land established by a plat or otherwise as permitted by law and to be used, developed or built upon as a unit.

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

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

Minor Subdivision – For the purposes of this ordinance, the division of a single tract or parcel of land into three or fewer tracts or parcels of land for the purpose, whether immediate or future, of transfer of ownership or of building development, provided that the proposed tracts or parcels of land thereby created have frontage on an improved public street or streets, and provided further

that there is not created by the subdivision any new street or streets or the need for required improvements, easement of access or the need for the same.

Municipal Engineer – A professional engineer licensed as such in the Commonwealth of Pennsylvania, duly appointed as the engineer for a municipality, planning agency or joint planning commission.

Municipality – South Manheim Township, Schuylkill County, Pennsylvania.

Natural Condition – Existing conditions

Natural Hydrologic Regime (see hydrologic regime)

Natural Recharge Area – Undisturbed surface area or depression where stormwater collects, and a portion of which infiltrates and replenishes the underground and groundwater.

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

Non-stormwater Discharges - Water flowing in stormwater collection facilities, such as pipes or swales, which is not the result of a rainfall event or snowmelt.

Nonstructural Best Management Practice (BMPs) – Methods of controlling stormwater runoff quantity and quality, such as innovative site planning, impervious area and grading reduction, protection of natural depression areas, temporary ponding on site and other techniques.

NPDES - National Pollutant Discharge Elimination System, the federal government's system for issuance of permits under the Clean Water Act, which is delegated to DEP in Pennsylvania.

NRCS - Natural Resource Conservation Service (previously SCS).

Outfall - "Point source" as described in 40 CFR § 122.2 at the point where South Manheim Township's storm sewer system discharges to surface waters of the Commonwealth.

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

Parent Tract – The parcel of land from which a land development or subdivision originates, determined from the date of municipal adoption of this ordinance.

Parking Lot Storage - Involves the use of parking areas as temporary impoundments with controlled release rates during rainstorms.

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

Penn State Runoff Model - The computer-based hydrologic model developed at the Pennsylvania State University.

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

Planning Commission - The planning commission of South Manheim Township.

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.

Post Construction – Period after construction where disturbed areas are stabilized, stormwater controls are in place and functioning and all proposed improvements in the approved land development plan are completed.

Pretreatment – Techniques employed in stormwater BMPs to provide storage or filtering to trap coarse materials and other pollutants before they enter the system, but not necessarily meet the water quality volume requirements of Section 306.

Project Site - The specific area of land where any Regulated Earth Disturbance activities in South Manheim Township are planned, conducted or maintained.

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

Recharge – The replenishment of groundwater through the infiltration of rainfall, other surface waters, or land application of water or treated wastewater.

Reconstruction – Demolition of, and subsequent rebuilding of impervious surface.

Record Drawings - Original documents revised to suit the as-built conditions and subsequently provided by the Engineer to the Client. The Engineer takes the Contractor's as-builts, reviews them in detail with his/her own records for completeness, then either turns these over to the Client or transfers the information to a set of reproducibles, in both cases for the Client's permanent records."

Redevelopment – The demolition, construction, reconstruction, alteration, or improvement exceeding 2,000 square feet of land disturbance performed on sites where existing land use is commercial, industrial, institutional, or multifamily residential. Maintenance activities such as top-layer grinding and re-paving are not considered to be redevelopment. Interior remodeling projects and tenant improvements are also not considered to be redevelopment. Utility trenches in streets are not considered redevelopment unless more than 50% of the street width is removed and re-paved.

Regulated Activities - Any actions or proposed actions that involve the alteration or development of land in a manner that may affect stormwater runoff.

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

Release Rate - The percentage of existing conditions peak rate of runoff from a site or subarea to which the proposed conditions peak rate of runoff must be reduced to protect downstream areas.

Repaving – Replacement of the impervious surface that does not involve reconstruction of an existing paved (impervious) surface.

Replacement Paving – Reconstruction of and full replacement of an existing paved (impervious) surface.

Retention Basin - A structure in which stormwater is stored and not released during the storm event. Retention basins do not typically have an outlet to other down stream conveyance features such as channels, storm sewer, or other surface waters. Generally, these features empty via recharge and must infiltrate stored water in no more than 4 days. These features may have an emergency spillway or other overflow device for large events.

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

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

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.

Roof Drains - A drainage conduit or pipe that collects water runoff from a roof and leads it away from the structure.

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

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

SALDO – Subdivision and Land Development Ordinance.

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

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

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

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

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.

Shallow Concentrated Flow - Stormwater runoff flowing in shallow, defined ruts prior to entering a defined channel or waterway.

Sheet Flow – A flow process associated with broad, shallow water movement on sloping ground surfaces that is not channelized or concentrated.

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

Source Water Protection Areas (SWPA) – The zone through which contaminants, if present, are likely to migrate and reach a drinking water well or surface water intake.

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.

Special Protection Subwatersheds - Watersheds for which the receiving waters are exceptional value (EV) or high quality (HQ) waters.

Spillway – A conveyance that is used to pass the peak discharge of the maximum design storm controlled by the stormwater facility.

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

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

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

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

Stormwater - The surface runoff generated by precipitation reaching the ground surface.

Stormwater Management District - Those subareas in which some type of detention is required to meet the plan requirements and the goals of Act 167.

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

Stormwater Management Plan - The plan for managing those land use activities that will influence stormwater runoff quality and quantity, as required by the Act of October 4, 1978, P.L. 864, (Act 167), and also known as an Act 167 Stormwater Management Plan.

Stormwater Management Site Plan - The plan prepared by the Applicant or his representative indicating how stormwater runoff will be managed at the particular site of interest according to this Ordinance.

Stream – A natural watercourse.

Stream Buffer – The land area adjacent to each side of a stream, essential to maintaining water quality. (See Buffer)

Stream Enclosure - A bridge, culvert or other structure in excess of 100 feet in length upstream to downstream which encloses a regulated water of this Commonwealth.

Subarea (Subwatershed)- The smallest drainage unit of a watershed for which stormwater management criteria have been established in the Stormwater Management Plan.

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

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

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

Timber Operations - See Forest Management.

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

Top-of-Bank – Highest point of elevation in a stream channel cross section at which a rising water level just begins to flow out of the channel and over the floodplain.

Vernal Pond – Seasonal depressional wetlands that are covered by shallow water for variable periods from winter to spring, but may be completely dry for most of the summer and fall.

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

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

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

Wellhead – 1. a structure built over a well, 2. the source of water for a well.

Wellhead Protection Area - The surface and subsurface area surrounding a water supply well, well field, spring or infiltration gallery supplying a public water system, through which contaminants are reasonably likely to move toward and reach the water source.

Wet Basin - Pond for urban runoff management that is designed to detain urban runoff and always contains water.

Wetland - Those 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, fens, and similar areas.

ARTICLE III-STORMWATER MANAGEMENT

Section 301. General Requirements

A. Applicants proposing regulated activities in South Manheim Township which do not fall under the exemption criteria shown in Section 402 shall submit a drainage plan to South Manheim Township for review. These criteria shall apply to the total proposed development even if development is to take place in stages

B. The Applicant is required to evaluate practicable alternatives to the surface discharge of stormwater, the creation of impervious surfaces and the degradation of waters of the Commonwealth, and must maintain as much as possible the natural hydrologic regime.

C. The Drainage Plan must be designed consistent with the sequencing provisions of Section 304 to ensure maintenance of the natural hydrologic regime and to promote groundwater recharge and protect groundwater and surface water quality and quantity. The Drainage Plan designer must proceed sequentially in accordance with Article III of this ordinance.

D. The existing points of concentrated drainage that discharge onto adjacent property shall not be altered in any manner which could cause property damage without permission of the affected property owner(s) and shall be subject to any applicable discharge criteria specified in this Ordinance.

E. Areas of existing diffused drainage discharge shall be subject to any applicable discharge criteria in the general direction of existing discharge, whether proposed to be concentrated or maintained as diffused drainage areas, except as otherwise provided by this ordinance. If diffused drainage discharge is proposed to be concentrated and discharged onto adjacent property, the Applicant must document that adequate downstream conveyance facilities exist to safely transport the concentrated discharge, or otherwise prove that no erosion, sedimentation, flooding or other impacts will result from the concentrated discharge.

F. Where a development site is traversed by existing watercourses, drainage easements shall be provided conforming to the line of such watercourses. The terms of the easement shall conform to the stream buffer requirements contained in Section 306.F of this Ordinance.

G. Any stormwater management facilities regulated by this Ordinance that would be located in or adjacent to waters of the Commonwealth or wetlands shall be subject to approval by PaDEP. When there is a question whether wetlands may be involved, it is the responsibility of the Applicant or his agent to show that the land in question cannot be classified as wetlands, otherwise approval to work in the area must be obtained from PaDEP.

H. Any alteration that affects stormwater flow directly or indirectly toward a PennDOT facility shall be subject to PennDOT regulations.

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

J. Roof drains shall not be connected to streets, sanitary or storm sewers or roadside ditches in order to promote overland flow and infiltration/ percolation of stormwater where advantageous to do so. When it is more advantageous to connect directly to streets or storm sewers, then it shall be permitted on a case by case basis by South Manheim Township.

K. All stormwater runoff shall be treated for water quality improvements.

L. Transference of runoff from one DEP designated Act 167 watershed to another shall be prohibited.

Section 302. Permit Requirements by Other Government Entities

Permits must comply with any and all applicable local, county, state and federal regulations.

Section 303. Erosion and Sediment Control during Regulated Earth Disturbance Activities

A. No Regulated Earth Disturbance activities within South Manheim Township shall commence until South Manheim Township receives an approval from the Conservation District of an Erosion and Sediment Control Plan for construction activities.

B. DEP has regulations that require an Erosion and Sediment Control Plan for any earth disturbance activity of 5,000 square feet or more, under 25 Pa. Code § 102.4(b).

C. In addition, under 25 Pa. Code Chapter 92, a DEP "NPDES Construction Activities" permit is required for Regulated Earth Disturbance activities.

Evidence of any necessary permit(s) for Regulated Earth Disturbance activities from the appropriate DEP regional office or Schuylkill County Conservation District must be provided to South Manheim Township. The issuance of an NPDES Construction Permit or permit coverage under the statewide General Permit (PAG-2) satisfies the requirements subsection 303.A.

D. A copy of the Erosion and Sediment Control plan and any required permit, as required by DEP regulations, shall be available at the project site at all times.

E. Additional erosion and sediment control design standards and criteria are recommended to be applied where infiltration BMPs are proposed, and shall include the following:

1. Areas proposed for infiltration BMPs shall be protected from sedimentation and compaction during the construction phase to maintain maximum infiltration capacity.

2. Infiltration BMPs shall not be constructed nor receive runoff until the entire contributory drainage area to the infiltration BMP has achieved final stabilization

Section 304. Nonstructural Project Design (Sequencing to Minimize Stormwater Impacts)

A. For projects disturbing one (1) acre or more, the design of all Regulated Activities shall include evaluation of practicable alternatives to the surface discharge of stormwater, the creation of impervious surfaces, and the degradation of waters of the Commonwealth, and must maintain as much as possible the natural hydrologic regime of the site.

1. An alternative is practicable if it is available and capable of being done after taking into consideration cost, existing technology and logistics in light of overall project purposes, and other municipal requirements.

2. All practicable alternatives to the discharge of stormwater are presumed to have less adverse impact on quantity and quality of waters of the Commonwealth unless otherwise demonstrated.

B. The Applicant shall demonstrate that they designed the Regulated Activities that disturb one (1) acre or more included consideration of the following issues:

1. Prepare an Existing Resource and Site Analysis Map (ERSAM), showing environmentally sensitive areas including, but not limited to, steep slopes, ponds, lakes, streams, wetlands, hydric soils, vernal pools, flood plains, stream buffer zones, hydrologic soil groups A and B (areas conducive to infiltration), special geologic features, any existing recharge areas and any other requirements outlined in the municipal Subdivision and Land Development ordinance.

2. Establish appropriate buffers for each of the delineated environmentally sensitive areas per the municipal zoning ordinance (See Section 306.F. for stream buffers and Section 310.K. for special geologic feature buffers).

3. Prepare a draft project layout avoiding sensitive areas identified in Section 304.B.1.

4. Identify site specific existing conditions drainage areas, discharge points, recharge areas and hydrologic soil groups A and B.

5. Evaluate Nonstructural Stormwater Management Alternatives
   a. Minimize earth disturbance
   b. Minimize impervious surfaces
   c. Break up large impervious surfaces.

6. Satisfy infiltration objective (Section 305) and provide for stormwater pretreatment prior to infiltration. Pretreatment may not be necessary for rooftop runoff which enters the infiltration facility directly from a roof leader.

7. Satisfy water quality (Section 306) and streambank erosion protection objective (Section 307).

8. Determine what Management District the site falls into (Appendix D) and conduct an existing conditions runoff analysis.

9. Prepare final project design to maintain existing conditions drainage areas and discharge points, to minimize earth disturbance and impervious surfaces, and to the maximum extent possible, to ensure the remaining site development has no surface or point discharge.

10. Conduct a proposed conditions runoff analysis based on the final design and to meet the release rate and in turn the overbank flow and extreme event requirements (Section 308).

11. Manage any remaining runoff through treatment prior to discharge, as part of detention, bioretention, direct discharge or other structural control.

Section 305. Ground Water Recharge (Infiltration/Recharge/Bioretention)

Maximizing the ground water recharge capacity of the area being developed is required. Design of the infiltration stormwater management facilities shall give consideration to providing ground water recharge to compensate for the reduction in the percolation that occurs when the ground surface is disturbed or impervious surface is created. It is recommended that roof runoff be directed to infiltration BMPs which can be over-designed to compensate for the infiltration losses due to parking areas. These measures are required to be consistent with Section 103, and take advantage of utilizing any existing recharge areas.

Infiltration may not be feasible on every site due to site-specific limitations such as soil type. If it cannot be physically accomplished, due to seasonal high water table, soil permeability rate, soil depth or setback distances from special geologic features, then the design professional shall be responsible to show that this cannot be physically accomplished. If it can be physically accomplished, then the volume of runoff to be infiltrated shall be determined from Sections 305.A.3 depending on demonstrated site conditions and shall be the greater of the two volumes.

A. Infiltration BMPs shall meet the following minimum requirements:

1. Infiltration Requirements:

a. Regulated activities will be required to infiltrate, where site conditions permit, a portion of the runoff created by the development as part of an overall Drainage Plan designed for the site. The volume of runoff to be infiltrated shall be determined from Sections 305.A.3.a. or 305.A.3.b, depending upon demonstrated site conditions.

2. Infiltration BMPs intended to receive runoff from developed areas shall be selected based on suitability of soils and site conditions and shall be constructed on soils that have the following characteristics:

a. A minimum depth of 24 inches between the bottom of the BMP and the limiting zone.

b. An infiltration and/or percolation rate sufficient to accept the additional stormwater load and drain completely as determined by field tests conducted by the Applicant's design professional.

c. The infiltration facility shall be capable of completely infiltrating the required retention (infiltration) volume within 4 days (96 hours).

d. Pretreatment shall be provided prior to infiltration.

3. The size of the infiltration facility shall be based upon the following volume criteria:

a. NRCS Curve Number equation.

The NRCS runoff equation shall be utilized to calculate infiltration requirements (I) in inches.

$$I \text{ (Infiltration requirement, in inches)} = (200 / CN) - 2 \qquad \text{Eqn: 305.1}$$

Where:

CN = SCS (NRCS) curve number of existing conditions contributing to the infiltration facility.

This equation is displayed graphically in, and the infiltration requirement can be determined from Figure 305.1.

It has been determined that infiltrating 0.46 inches of runoff from the impervious areas will aid in maintaining the hydrologic regime of the watershed. However, the rounded number 0.5 inches will be used.

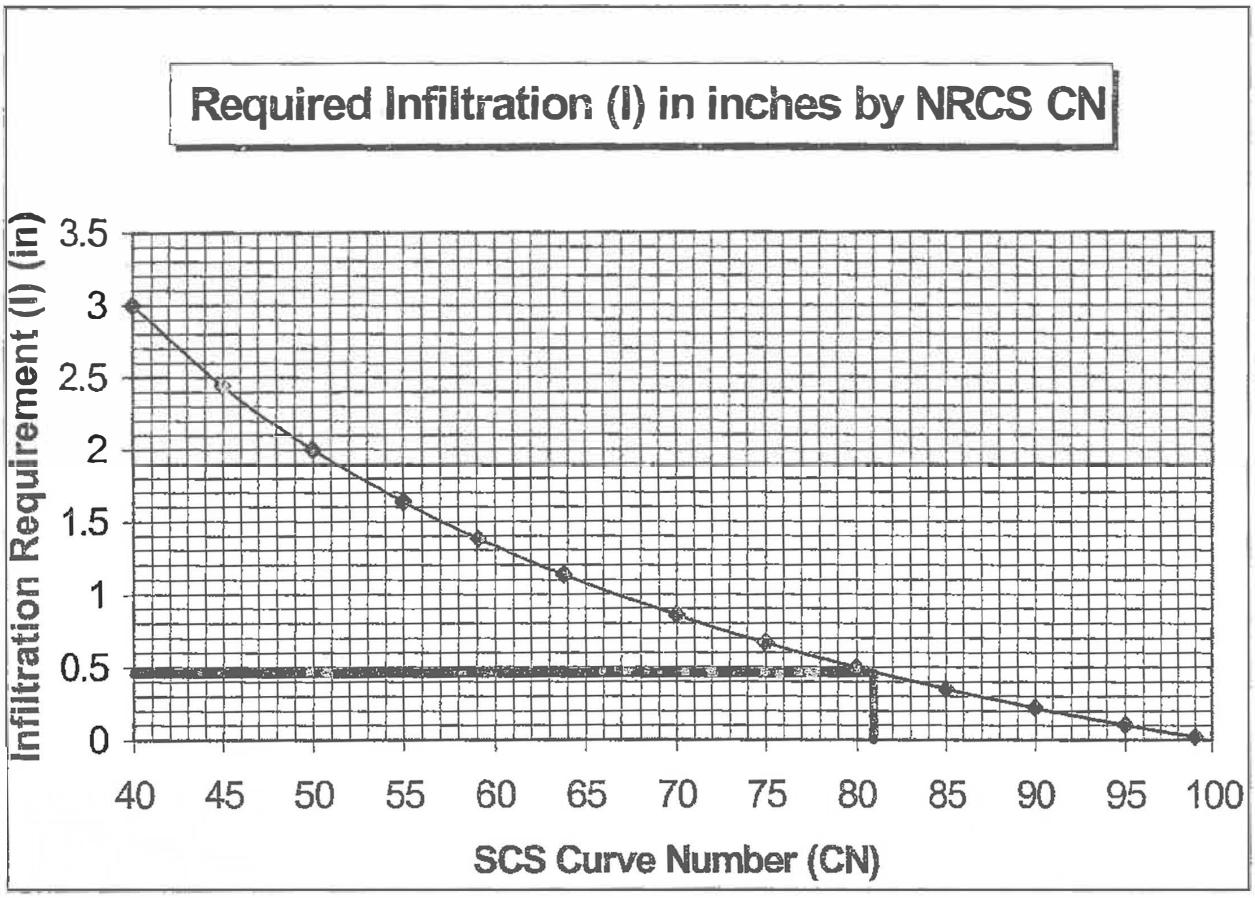


Figure 305.1. Infiltration requirement based upon NRCS Curve Number.

The retention (infiltration) volume (Re_v) required to meet the infiltration requirement would therefore be computed as:

Re_v = (0.5 or I, whichever is greater)* impervious area (square feet) / (12 in/ft) = Cubic Feet Eqn: 305.2

Where:

I = infiltration requirements (in inches.)

b. Annual Recharge – Water Budget Approach.

If the goals of Sections 305.A.3.a cannot be achieved, then 0.5 inches of rainfall shall be infiltrated from all impervious areas, up to a an existing site conditions curve number of 81. Above a curve number of 81, Equation 305.1 or the curve in Figure 305.1 should be used to determine the infiltration requirement.

The retention (infiltration) volume (Re_v) required again would therefore be computed as:

Re_v = (0.5 or I, whichever is greater) * impervious area (sq.ft.) / (12in/ft) = Cubic Feet.

B. Soils - A detailed soils evaluation of the project site shall be required where practicable to determine the suitability of infiltration facilities. The evaluation shall be performed by a qualified design professional, and at a minimum, address soil permeability, depth to bedrock and subgrade stability. The general process for designing the infiltration BMP shall be:

1. Analyze hydrologic soil groups as well as natural and man-made features within the site to determine general areas of suitability for infiltration practices. In areas where development on fill material is under consideration, conduct geotechnical investigations of sub-grade stability; infiltration is not permitted to be ruled out without conducting these tests.

2 Provide field tests such as double ring infiltrometer or hydraulic conductivity tests (at the level of the proposed infiltration surface) to determine the appropriate hydraulic conductivity rate. Percolation tests are not recommended for design purposes.

3. Design the infiltration structure for the required retention (Re_v) volume based on field determined capacity at the level of the proposed infiltration surface.

4. If on-lot infiltration structures are proposed by the Applicant's design professional, it must be demonstrated to South Manheim Township that the soils are conducive to infiltrate on the lots identified.

C. Carbonate Areas – The Applicant is required to investigate the ability of all areas on the site which are not underlain by carbonate rock to meet the infiltration requirements of Section 305.A. If this investigation proves infeasible, infiltration can occur on areas underlain by carbonate rock by following the recommended procedure below in conjunction with Figure B-2 in Ordinance Appendix B. *However, the Applicant is not required to use infiltration in carbonate areas even if the site falls into the "Recommended" range on Figure B-2 in Ordinance Appendix B.* If infiltration is not proposed, the calculated infiltration volume (Section 305.A) shall be treated by an acceptable BMP.

Infiltration BMP loading rate percentages in Figure B-2 in Ordinance Appendix B shall be calculated as follows:

$$\left(\frac{\text{Area tributary to the infiltration BMP}}{\text{Base Area of the infiltration BMP}}\right)*100\%$$

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

Area Description	Weighting
All disturbed area to be made impervious	100%
All disturbed areas to be made pervious	50%
All undisturbed impervious areas	100%
All undisturbed pervious areas	0%

Soil thickness is to be measured from the bottom of any proposed infiltration BMP. The effective soil thickness in Figure B-2 in Ordinance Appendix B is the measured soil thickness multiplied by the thickness factor based on soil permeability, as follows:

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

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

D. Stormwater Hotspots – Following is a list of examples of designated hotspots. If a site is designated as a hotspot, it has important implications for how stormwater is managed. First and foremost, untreated stormwater runoff from hotspots shall not be allowed to recharge into groundwater where it may contaminate water supplies. Therefore, the Rev requirement shall NOT applied to development sites that fit into the hotspot category (the entire WQv must still be treated). Second, a greater level of stormwater treatment shall be considered at hotspot sites to prevent pollutant washoff after construction. EPA's NPDES stormwater program requires some industrial sites to prepare and implement a stormwater pollution prevention plan.

Examples of Hotspots:

- Vehicle salvage yards and recycling facilities
- Vehicle fueling stations
- Vehicle service and maintenance facilities
- Vehicle and equipment cleaning facilities
- Fleet storage areas (bus, truck, etc.)
- Industrial sites (based on Standard Industrial Codes)
- Marinas (service and maintenance)
- Outdoor liquid container storage
- Outdoor loading/unloading facilities
- Public works storage areas
- Facilities that generate or store hazardous materials
- Commercial container nursery

• Other land uses and activities as designated by an appropriate review authority

The following land uses and activities are not normally considered hotspots:

• Residential streets and rural highways
• Residential development
• Institutional development
• Office developments
• Non-industrial rooftops
• Pervious areas, except golf courses and nurseries (which may need an Integrated Pest Management (IPM) Plan).

While large highways (average daily traffic volume (ADT) greater than 30,000) are not designated as a stormwater hotspot; it is important to ensure that highway Drainage Plans adequately protect groundwater.

E. Caution shall be exercised where infiltration is proposed in Source Water Protection Areas as defined by the local Municipality or Water Authority.

F. Infiltration facilities shall be used in conjunction with other innovative or traditional stormwater control facilities that are found within the PADEP State BMP Manual

G. Caution shall be exercised where salt or chloride (municipal salt storage) would be a pollutant since soils do little to filter this pollutant and it may contaminate the groundwater. The qualified design professional shall evaluate the possibility of groundwater contamination from the proposed infiltration facility and perform a hydrogeologic justification study if necessary.

H. The infiltration requirement in High Quality or Exceptional Value waters shall be subject to the Department's Chapter 93 Antidegradation Regulations.

I. Dependant upon certain landuse or hotspots an impermeable liner will be required in detention basins where the possibility of groundwater contamination exists. A detailed hydrogeologic investigation may be required by South Manheim Township.

J. South Manheim Township shall require the Applicant to provide safeguards against groundwater contamination for land uses that may cause groundwater contamination should there be a mishap or spill.

K. For projects that disturb one (1) acre or more, unless otherwise specified in the zoning ordinance, the following setbacks for infiltration facilities shall apply:

i. 100 feet from water supply wells
ii. 10 feet downslope or 100 feet upslope from building foundations
iii. 50 feet from septic system drainfields

iv. 50 feet from a geologic contact with carbonate bedrock, unless a preliminary site investigation is done in the carbonate bedrock to show the absence of special geologic features within 50 feet of the proposed infiltration area;

v. 100 feet from the property line unless documentation is provided to show all setbacks from wells, foundations and drainfields on the neighboring property will be met.

Section 306. Water Quality Requirements

The applicant shall comply with the following water quality requirements of this Article.

No regulated earth disturbance activities within South Manheim Township shall commence until approval by South Manheim Township of a plan which demonstrates compliance with State Water Quality Requirements post-construction is complete.

A. Developed areas shall provide adequate storage and treatment facilities necessary to capture and treat stormwater runoff. The infiltration volume computed under Section 305 may be a component of the water quality volume if the Applicant chooses to manage both components in a single facility. If the infiltration volume is less than the water quality volume, the remaining water quality volume may be captured and treated by methods other than infiltration BMPs. The required water quality volume (WQv) is the storage capacity needed to capture and treat a portion of stormwater runoff from the developed areas of the site.

To achieve this goal, the following criterion is established:

The following calculation formula is to be used to determine the water quality storage volume, (WQv), in acre-feet of storage for the Schuylkill River watershed:

$$WQ_v=[(P)(R_v)(A)]/12 \qquad \text{Eqn: 306.1}$$

WQ_v = Water Quality Volume (acre-feet)
P = 1 inch
A = Total contributing drainage area to the water quality BMP (acres)
R_v = 0.05 + 0.009(I) where I is the percent of the area that is impervious surface ((impervious area/A)*100)

This volume requirement can be accomplished by the permanent volume of a wet basin or the detained volume from other BMPs.

Release of water can begin at the start of the storm (i.e., the invert of the water quality orifice is at the invert of the facility). The design of the facility shall provide for protection from clogging and unwanted sedimentation.

B. For areas within defined Special Protection subwatersheds which include Exceptional Value (EV) and High Quality (HQ) waters, Cold Water Fishery (CWF) the temperature and quality of water and streams shall be maintained.

C. To accomplish the above, the Applicant shall use innovative or traditional stormwater control facilities that are found within the PADEP State BMP Manual.

D. If a perennial or intermittent stream passes through the site, the applicant shall create a stream buffer extending a minimum of fifty (50) feet to either side of the top-of-bank of the channel. The buffer area shall be maintained with appropriate native vegetation (Reference to Appendix H of Pennsylvania Handbook of Best Management Practices for Developing Area for plant lists). If the applicable rear or side yard setback is less than fifty (50) feet, the buffer width may be reduced to twenty-five (25) percent of the setback to a minimum of ten (10) feet. If an existing buffer is legally prescribed (i.e. deed, covenant, easement, etc.) and it exceeds the requirements of this Ordinance, the existing buffer shall be maintained.

E. Evidence of any necessary permit(s) for regulated earth disturbance activities from the appropriate DEP regional office must be provided to South Manheim Township. The issuance of an NPDES Construction Permit or permit coverage under the statewide General Permit (PAG-2) satisfies the requirements of subsection 306.A.

Section 307. Streambank Erosion Requirements

In addition to control of the water quality volume, in order to minimize the impact of stormwater runoff on downstream streambank erosion, the primary requirement is to design a BMP to detain the proposed conditions 2-year, 24-hour design storm to the existing conditions 1-year peak flow using the SCS Type II distribution. Additionally, provisions shall be made (such as adding a small orifice at the bottom of the outlet structure) so that the proposed conditions 1-year storm takes a minimum of 24 hours to drain from the facility from a point where the maximum volume of water from the 1-year storm is captured. (i.e., the maximum water surface elevation is achieved in the facility). Release of water can begin at the start of the storm (i.e., the invert of the water quality orifice is at the invert of the facility).

The minimum orifice size in the outlet structure to the BMP shall be a three (3) inch diameter orifice and a trash rack shall be installed to prevent clogging. On sites with small contributing drainage areas to this BMP that do not provide enough runoff volume to allow a 24-hour attenuation with the 3 inch orifice, the calculations shall be submitted showing this condition. Orifice sizes less than 3 inches can be utilized provided that the design will prevent clogging of the intake.

Section 308. Stormwater Management Districts

A. Unless amended or revised, all areas of South Manheim Township shall be presumed to exist within a single Stormwater Management District, District "A".

In addition to the requirements specified in Table 308.1 below, the groundwater recharge (Section 305), water quality (Section 306), and streambank erosion control (Section 307), requirements shall be implemented.

TABLE 308.1 – Water Quantity Requirements

Management District	Proposed Condition Design Storm		Existing Condition Design Storm	Equivalent Release Rate
A	2 - year	Reduce To	1 - year	-
	5 - year		5 - year	100 %
	10 - year		10 - year	100 %
	25 - year		25 - year	100 %
	50 - year		50 - year	100 %
	100 - year		100 - year	100 %

B. General - Post-development rates of runoff from any regulated activity shall not exceed the peak release rates of runoff prior to development for the design storms specified in Table 308.1.

C. Off-Site Areas - Off-site areas that drain through a proposed development site are not subject to release rate criteria when determining allowable peak runoff rates. However, on-site drainage facilities shall be designed to safely convey off-site flows through the development site.

D. Site Areas - Where the site area to be impacted by a proposed development activity differs significantly from the total site area, only the proposed impact area utilizing stormwater management measures shall be subject to the Management District Criteria. In other words, unimpacted areas bypassing the stormwater management facilities would not be subject to the Management District Criteria.

Section 309. Design Criteria for Stormwater Management and Conveyance BMPs

A. Applicants may select a combination of runoff control techniques that are most suitable to control stormwater runoff from the site. All controls shall be subject to approval of South Manheim Township. The municipal engineer may request specific information on design and/or operating features of the proposed stormwater controls in order to determine their suitability and adequacy in terms of the standards of this Section.

B. The Applicant shall consider the effect of the proposed stormwater management techniques on any special soil conditions or geological hazards that may exist on the development site. In the event such conditions are identified on the site, the municipal engineer may require in-depth studies by a Geotechnical Engineer.

C. Basins and Impoundments: Any BMP that is a dam, as defined in 25 Pa. Code Chapter 105, shall be designed according to the requirements in those regulations. Any stormwater BMP that does not constitute a dam under 25 Pa. Code Chapter 105, but is designed to

store runoff and requires a berm or earthen embankment (i.e. detention basin), shall be designed to comply with the following:

1. Basins with earthen embankments shall be designed with an emergency spillway that has capacity and stability to accommodate the 100-year post-development hydrograph, in a manner that will not damage the integrity of the facility and will not create a downstream hazard. Emergency spillway design shall assume that all other basin outlets are non-functional. Where practical, the emergency spillway shall be constructed in undisturbed ground, and locations in fill should be avoided. Regardless of location, appropriate stabilization measures shall be provided.

2. The height of the embankment shall be designed to provide a minimum 1.0 foot of freeboard above the maximum elevation computed when the 100-year peak post-development flow passes through the emergency spillway. Embankment heights shall not exceed 15 feet, unless approved by South Manheim Township.

3. The minimum top width of earthen embankments shall be equal to three-fourths (3/4) of the embankment height, but in no case shall the top width be less than eight feet (8').

4. Interior and exterior embankment side slopes shall not be greater than three (3) horizontal to one (1) vertical.

5. All pipes, conduits, etc. passing through basin embankments shall have properly spaced concrete anti-seep collars. Minimum collar projection beyond the pipe shall be two feet (2'), and maximum collar spacing is 14 times the projection. The joint between collar and pipe shall be watertight.

6. A key trench of relatively impervious material shall be provided within all basin embankments. The key trench shall be at least two feet (2') deep, or extend down to stable subgrade, whichever is deeper. Minimum bottom width for key trench shall be four feet (4'). Maximum side slopes for the key trench shall be one (1) horizontal to one (1) vertical. A compacted impervious core at least three feet (3') wide at the top, having maximum side slopes of one (1) horizontal to one (1) vertical shall extend for the full length of the embankment, and the top elevation shall be set at the 10-year design water surface elevation.

7. All basins shall be structurally sound and shall be constructed of durable materials. The completed structure and the foundation of all basins shall be stable under all probable conditions of operation. Embankments shall be placed in maximum eight-inch (8") lifts to a minimum of 95 percent of maximum dry density, as established by ASTM D-1557. Compaction test results shall be provided to South Manheim Township upon request. Embankments shall be constructed six inches (6") above design elevations to allow for settlement.

8. All basins not including groundwater recharge and/or water quality storage shall include an outlet structure to permit draining the basin to a completely dry condition within twenty-four (24) hours following the end of the design rainfall.

9. All discharge control devices with appurtenances (except discharge pipes) shall be made of reinforced concrete and stainless or hot dip galvanized steel. Bolts/fasteners and any orifice plates are to be stainless or galvanized steel. Outlet barrels/pipes shall have a minimum diameter of fifteen (15) inches and shall be made of reinforced concrete pipe with watertight joints, or approved equivalent. Where installation conditions merit, structural calculations that address the actual design requirements will be required.

10. All basins employing small orifices (i.e., less than six inches diameter or equivalent area), shall be provided with an apron of concrete or similar durable material which abuts the orifice invert and extends a minimum of 18 inches in all directions from the orifice, to prevent potential blockage by vegetative growth or debris, and to allow for easy cleaning of the area approaching the orifice. Appropriate trash racks are required for all orifice openings.

11. Low flow channels shall be provided from each water carrying facility to the outlet structure for all basins that do not include Groundwater Recharge and/or Water Quality storage. Low flow channels shall be one (1) percent minimum slope and shall be designed to enable ease of maintenance. All basins that do include Groundwater Recharge and/or Water Quality storage shall not be required to have a low flow channel.

12. Minimum slope within a basin that does not include Groundwater Recharge and/or Water Quality storage shall be two (2) percent positive grade to the low flow channel.

13. Design storms for the computation of retention basin volumes shall be based upon a 24-hour storm with 100 year return period (SCS Type II storm).

14. The effect on downstream areas if the basin embankment fails shall be considered in the design of all basins. The basin shall be designed to minimize the potential damage caused by such failure of the embankment.

15. All structures (detention basins, cisterns, etc.), other than those used for Groundwater Recharge Volume and Water Quality Volume, must completely drain within 24 hours after the end of the design storm.

16. Soils used for the construction of basins shall have low erodibility factors ("K" factors).

17. Minimum floor elevations for all structures that would be affected by a basin, other temporary impoundments, or open conveyance systems where ponding may occur shall be two (2) feet above the 100-year water surface. If basement or underground facilities are proposed, detailed calculations addressing the effects of stormwater ponding on the structure and water-proofing and/or flood-proofing design information shall be submitted for approval.

D. Stormwater Collection and Conveyance Systems: Gutters, inlets, pipes, conduits, swales, ditches and any other means for collecting and/or conveying stormwater shall be designed to comply with the following:

1. All storm sewer pipes, culverts and bridges (excluding detention and retention basin outfall structures), gutters and swales conveying water originating only from within the boundaries of the development site shall be designed for a twenty-five (25) year storm event. All storm sewer pipes, culverts and bridges (excluding detention and retention basin outfall structures) conveying water originating from off-site shall be designed for a fifty (50) year storm event. Facilities that convey runoff to stormwater management facilities (e.g., detention basins, etc.) shall be designed for the 100-year storm event, unless adequate alternate means for conveying 100-year flow to the facilities are provided. Drainage easements having widths no less than 20 feet shall be provided to contain and convey the 100-year frequency flood throughout the development site. Easements shall begin at the furthest upstream property line of the proposed development site in a watershed.

2. Water obstructions shall convey runoff from the 25-year design storm with a minimum of 2.0 feet of freeboard measured below the lowest point along the top of the roadway, without damage to the drainage structure or the roadway, unless more restrictive local, state and/or federal regulations apply. A concentrated discharge of stormwater to an adjacent property shall be within an existing watercourse or otherwise an easement and appropriate agreements shall be required.

3. Storm sewer pipes other than those used as roof drains, detention basin underdrains, and street subbase underdrains, shall have a minimum diameter of fifteen (15) inches and be either Class III reinforced concrete pipe (RCP) or smooth-lined corrugated high-density polyethylene pipe (HDPE). Corrugated metal pipe is not permitted. HDPE pipe joints shall be silt-tight at a minimum (e.g., ADS N-12 ST/IB, or equal), and RCP joints shall have pre-lubed O-ring gaskets. Water-tight specification is required in areas of carbonate geology and elsewhere as may be specified by South Manheim Township. Where installation conditions merit (e.g., deep fills), structural calculations that address the actual design requirements will be required.

4. Storm sewer pipes and culverts shall be installed on sufficient slopes to provide a minimum velocity of three (3) feet per second when flowing full.

5. Storm sewers shall be placed within in the cartway of curbed streets and parallel to the road shoulders of streets without curbs. At curbed street intersections, inlets shall be placed on the tangent and not on the curved portion of the curbing. Storm sewer crossings of streets shall be perpendicular to the street centerline to the maximum extent practicable.

6. Storm facilities not located within a public right-of-way shall be contained in and centered within an easement not less than 20 feet wide. Easements shall follow property boundaries where possible.

7. Manning "n" values used for design of pipes and culverts shall be in accordance with generally accepted engineering practice. Adequate documentation shall be provided in support of the chosen values.

8. All storm sewer pipe and culverts shall have a minimum cover of 18 inches. Embedment for all storm sewer pipe and culverts shall consist of AASHTO No. 8 (1B) aggregate from a minimum of six (6) inches of bedding beneath the pipe, to a minimum of 12 inches over the pipe. Aggregate requirements for street construction shall take precedence over the 1B specification, but in no case shall total aggregate cover over the pipe be less than 12 inches. Compaction shall be in conformance with manufacturer's specifications. Select backfill shall complete the trench to pavement subgrade or topsoil layer in grassed areas.

9. Curves, tees, elbows and wyes are not permitted in pipes other than those used as roof drains, detention basin underdrains, and street subbase underdrains. Manholes or inlets are required to facilitate such configurations.

10. Manholes and inlets shall not be spaced more than 400 feet apart for pipes with diameters of 24 inches and less, and not more than 500 feet apart for pipes of greater diameter. Ladder rungs shall be placed in manholes and inlets with depths exceeding five feet (5').

11. When there is a change in the pipe size in a manhole or inlet, the elevations of the top of the pipes shall be the same, or the smaller pipe(s) higher. A minimum drop of one-tenth foot (0.1') shall be provided from the inlet invert elevation(s) to the outlet invert elevation.

12. Manholes, inlets, headwalls, endwalls and end sections proposed for dedication or located along streets or subject to vehicular traffic, shall conform to the requirements of PennDOT, or to specifications as otherwise modified by South Manheim Township. Manhole covers shall have the word "STORM" cast clearly on the lid.

13. Inlets along curbed streets shall be spaced to limit depth along the curb to a maximum of three inches (3") during a 10-year storm. Inlet capacities and by-pass calculations shall be determined by PennDOT design techniques.

14. Pipe underdrains and/or pavement base drains shall be provided in areas known or otherwise documented to have a seasonal high water table, and as directed by South Manheim Township Engineer.

15. Appropriate headwalls, endwalls or end sections shall be used where stormwater runoff enters or leaves the storm sewer horizontally from a natural or manmade channel. Such facilities shall conform to the requirements of PennDOT, or to specifications as otherwise modified by South Manheim Township.

16. Adequate erosion and sediment control protection shall be provided along all open channels, and at all points of discharge.

17. Stormwater roof drains, sump pumps, and pipes shall not directly discharge water into a street right-of-way or discharge into a sanitary sewer or storm sewer.

18. All existing and natural watercourses, channels, drainage systems, wetlands and areas of surface water concentration shall be maintained in their existing condition unless an alteration is approved by South Manheim Township and any other necessary approving body.

19. Flow velocities from any storm sewer may not result in erosion of the receiving channel.

20. Energy dissipaters shall be placed at the outlets of all storm sewer pipes, culverts, and bridges where flow velocities exceed maximum permitted channel velocities as specified in the PADEP Erosion and Sediment Pollution Control Manual, as amended.

21. The following conditions shall be met for all swales:

    a. Capacities and velocities shall be computed using the Manning equation. Stabilization (i.e., linings, etc.) shall be as specified in the PADEP Erosion and Sediment Pollution Control Manual, as amended.

    b. All vegetated swales shall have a minimum slope of one (1) percent unless approved by South Manheim Township.

    c. "n" factors shall be based upon accepted engineering design practices as approved by South Manheim Township.

    d. All swales shall be designed to concentrate low flows to minimize siltation and meandering.

Section 310. Calculation Methodology

A. Stormwater runoff from all development sites with a drainage area of greater than 200 acres shall be calculated using a generally accepted calculation technique that is based on the NRCS soil cover complex method. Table 310-1 summarizes acceptable computation methods and the method selected by the design professional shall be based on the individual limitations and suitability of each method for a particular site. South Manheim Township may allow the use of the Rational Method to estimate peak discharges from drainage areas that contain less than 200 acres. The Soil Cover Complex Method shall be used for drainage areas greater than 200 acres.

TABLE 310-1
Acceptable Computation Methodologies For Drainage Plans

METHOD	METHOD DEVELOPED BY	APPLICABILITY
TR-20 (or commercial computer package based on TR-20)	USDA NRCS	Applicable where use of full hydrology computer model is desirable or necessary.
TR-55 (or commercial computer package based on TR-55)	USDA NRCS	Applicable for land development plans within limitations described in TR-55.
HEC-1 / HEC-HMS	US Army Corps of Engineers	Applicable where use of full hydrologic computer model is desirable or necessary.
PSRM	Penn State University	Applicable where use of a hydrologic computer model is desirable or necessary; simpler than TR-20 or HEC-1.
Rational Method or commercial computer package based on Rational Method)	Emil Kuichling(1889)	For sites less than 200 acres and with time of concentration less than 60 minutes (tc< 60 min), or as approved by South Manheim Township.
Other Methods	Varies	Other computation methodologies approved by South Manheim Township.

**Note: Successors to the above methods are also acceptable. These successors include WinTR55 for TR-55 and WinTR20 for TR-20*

B. All calculations consistent with this Ordinance using the soil cover complex method shall use the appropriate design rainfall depths for the various return period storms according to the region in which they are located. If a hydrologic computer model such as TR-55, PSRM or HEC-1 / HEC-HMS is used for stormwater runoff calculations, then the duration of rainfall shall be 24 hours. Rainfall depths for SCS Type II 24-hour durations are as follows:

TABLE 310-2
24-Hour Rainfall Depths

Storm Event	Inches of Rainfall
1 year	2.77
2 years	3.05
5 years	4.04
10 years	4.79
25 years	5.90
50 years	6.88
100 years	8.01

C. For the purposes of pre-development conditions flow rate determination, undeveloped land shall be considered as "meadow" in good condition, unless the natural ground cover generates a lower curve number (CN) or Rational "C" value (i.e., forest), as listed in Table B-2 or B-3 in Appendix B of this Ordinance.

D. All calculations using the Rational Method shall use rainfall intensities consistent with appropriate times of concentration for overland flow and return periods from the Design Storm Curves from PA Department of Transportation Design Rainfall Curves (1986) (Appendix B, Table B-1).

E. Times of concentration shall be based on the following design parameters:

1. Sheet/Overland flow: The maximum length for each reach of sheet or overland flow before shallow concentrated or open channel flow develops is one hundred fifty (150) feet. Flow lengths greater than one hundred (100) feet shall be justifiable based on the actual conditions at each development site. Sheet flow shall be determined using the Manning's kinematic solution described in Chapter 3 of TR-55, Urban Hydrology for Small Watersheds.

2. Shallow concentrated flow: Travel time for shallow concentrated flow shall be determined using Figure 3-1 from TR-55, Urban Hydrology for Small Watersheds.

3. Open channel flows: At points where sheet and shallow concentrated flows concentrate in field depressions, swales, gutters, curbs, or pipe collection systems, the travel times and downstream end of the development site between these design points shall be based upon Manning's Equation and/or acceptable engineering design standards acceptable to the municipal engineer.

F. Runoff Curve Numbers (CN) for both existing and proposed conditions to be used in the soil cover complex method shall be obtained from Table B-2 in Appendix B of this Ordinance.

G. Runoff coefficients (C) for both existing and proposed conditions for use in the Rational method shall be obtained from Table B-3 in Appendix B of this Ordinance.

H. Where uniform flow is anticipated, the Manning equation shall be used for hydraulic computations, and to determine the capacity of open channels, pipes, and storm sewers. Values for Manning's roughness coefficient (n) shall be consistent with Table B-4 in Appendix B of the Ordinance.

J. The design of any stormwater detention facilities intended to meet the performance standards of this Ordinance shall be verified by routing the design storm hydrograph through these facilities using the Storage-Indication Method. For drainage areas greater than 200 acres in size, the design storm hydrograph shall be computed using a calculation method that produces a full hydrograph (i.e. TR-20, TR-55, HEC-1, PSRM). South Manheim Township may approve the use of any generally accepted full hydrograph approximation technique that shall use a total runoff volume that is consistent with the volume from a method that produces a full hydrograph.

K. South Manheim Township may require that computed existing runoff rates be reconciled with field observations and conditions. If the design professional can substantiate through actual physical calibration that more appropriate runoff and time-of-concentration values should be utilized at a particular site, then appropriate variations may be made upon review and recommendations of the municipal engineer. Calibration shall require detailed gauge and rainfall data for the particular site in question.

Section 311. Other Requirements

A. All wet basin designs shall incorporate biologic minimization controls consistent with the West Nile Guidance found in Appendix F.

B. Any facilities that constitute water obstructions (e.g., culverts, bridges, outfalls, or stream enclosures), water encroachments, and any work involving wetlands governed by PaDEP Chapter 105 regulations (as amended or replaced from time to time by PaDEP), are subject to PaDEP Chapter 105 regulations.

C. Any proposed roadway drainage facilities shall be designed according to PennDOT design Manual Part II.

D. Adequate erosion protection shall be provided along all open channels, and at all points of discharge (DEP erosion and Erosion, Sediment and Pollution Control Manual).

E. South Manheim Township reserves the right to disapprove any design that would result in the construction in or continuation of a stormwater problem area.

F No stormwater detention facility shall be placed within fifty (50) feet of a special geologic feature. No stormwater conveyance facility shall be constructed within fifty (50) feet of a special geologic feature, unless it is constructed of durable pipe utilizing watertight joints.

ARTICLE IV-DRAINAGE PLAN REQUIREMENTS

Section 401. General Requirements

For any of the activities regulated by this Ordinance, the preliminary or final approval of subdivision and/or land development plans, the issuance of any building or occupancy permit, or the commencement of any earth disturbance activity may not proceed until the Property Owner or Applicant or his/her agent has received written approval of a Drainage Plan from South Manheim Township unless the project qualifies for an exemption from the requirements to submit a Drainage Plan.

Section 402. Exemptions

A. General Exemptions

The following land use activities are exempt from the application requirements of this ordinance.

1. Use of land for gardening for home consumption.

2. Agricultural plowing and tilling are exempt from the application requirements of this ordinance provided the activities are performed according to the requirements of 25 PA Code, Chapter 102.

3. Forest Management and timber operations are exempt from the application requirements of this ordinance provided the activities are performed according to the requirements of 25 PA Code, Chapter 102.

4. Land disturbance activities of less than 5,000 square feet, which do not include any impervious surface area additions, subject to subsection C.4. below. For the purpose of this subsection, "impervious" shall include compacted gravel and compacted earth or stone.

B. Impervious Area Exemptions

1. Any Regulated Activity that results in less than 1,000 square feet of new impervious area shall be exempt from the application requirements of this ordinance. The limitations of this exemption shall apply to the total development even if development is to take place in phases. The date of the municipal ordinance adoption shall be the starting point from which to consider tracts as "parent tracts" in which future subdivisions and respective impervious area computations shall be cumulatively considered. Impervious areas existing on the "parent tract" prior to adoption of this

Ordinance shall not be considered in cumulative impervious area calculations for exemption purposes.

2. Submissions for projects that meet the impervious area exemption criteria in Table 402-1 shall reference Ordinance Appendix G to meet the requirements of groundwater recharge, water quality, and streambank erosion controls of this Ordinance. The limitations of this exemption shall apply to the total development even if development is to take place in phases. The date of the municipal ordinance adoption shall be the starting point from which to consider tracts as "parent tracts" in which future subdivisions and respective impervious area computations shall be cumulatively considered. Impervious areas existing on the "parent tract" prior to adoption of this Ordinance shall not be considered in cumulative impervious area calculations for exemption purposes. Drainage plans in accordance with Sections 403 A.2, 403 B.7, 8, 11, 15, and 22 and 403.D.2. must be submitted.

TABLE 402-1
Impervious Area Exemption Criteria

Total Parcel Size	Impervious Area Exemption (sq.ft.)
0 to <0.125 ac	1,000 sq. ft.
0.125 to <0.5 ac	2,500 sq. ft.
0.5 to <1 ac	5,000 sq. ft.
1 to <2 ac	7,500 sq. ft.
2 to <3 ac	10,000 sq. ft.
3 to <4 ac	12,500 sq. ft.
> 4 ac	15,000 sq. ft.

C. Additional Exemption Requirements:

1. An exemption does not relieve the Applicant from the responsibility to secure required permits or approvals for activities regulated by any other applicable code, rule, act, or ordinance. Nor does exemption relieve the Applicant from meeting the water quality requirements of this Ordinance.

2. Exemption responsibilities – An exemption shall not relieve the Applicant from implementing such measures as are necessary to protect the public health, safety, and property. An exemption shall not relieve the Applicant from providing adequate stormwater management for Regulated Activities to meet the purpose of this Ordinance; however, drainage plans will not have to be submitted to South Manheim Township.

3. HQ and EV streams - An exemption shall not relieve the Applicant from meeting the special requirements for watersheds draining to high quality (HQ) or exceptional value (EV) waters, identified and Source Water Protection Areas (SWPA) and requirements for nonstructural project design sequencing (Section 304), groundwater recharge (Section 305), water quality (Section 306), and streambank erosion (Section 307). The volume

and rate of the net increase in stormwater runoff from Regulated Activities must be managed to prevent the physical degradation of receiving waters from such effects as scour and streambank destabilization, to satisfy State Water Quality Requirements;

All regulated activities occurring in drainage areas tributary to waters designated HQ/EV pursuant to 25 PA Code, Chapter 93, shall not change any biological, chemical, or physical characteristics, including volume, rate, velocity, course, current, cross section, or temperature of the waters, unless the activity is specifically permitted in accordance with the environmental laws of the Commonwealth.

4. Drainage Problems - If a drainage problem is documented or known to exist downstream of, or expected from the proposed activity, then South Manheim Township may require a drainage plan submittal.

5. Minor Subdivision Plans are exempt from the requirement to submit a Drainage Plan at the time of the subdivision; however, development of the individual lots created by the subdivision is subject to all other provisions of this Ordinance.

6. Any exemption must first be approved by South Manheim Township.

Section 403. Drainage Plan Contents

The Drainage Plan shall consist of a general description of the project including sequencing items described in Section 304, calculations, maps and plans. A note on the maps shall refer to the associated computations and erosion and sediment control plan by title and date. The cover sheet of the computations and erosion and sediment control plan shall refer to the associated maps by title and date. All Drainage Plan materials shall be submitted to South Manheim Township in a format that is clear, concise, legible, neat, and well organized; otherwise, the Drainage Plan shall not be accepted for review and shall be returned to the Applicant.

The following items shall be included in the Drainage Plan:

A. General

1. General description of the project including those areas described in Section 304.

2. General description of permanent stormwater management techniques, including construction specifications of the materials to be used for stormwater management facilities.

3. Complete hydrologic, hydraulic, and structural computations for all stormwater management facilities.

4. An Erosion and Sediment Control Plan, including all reviews and approvals by the Conservation District.

5. A general description of nonpoint source pollution controls.

B. Maps

Map(s) of the project area shall be submitted on 24-inch x 36-inch sheets and/or shall be prepared in a form that meets the requirements for recording at the offices of the Recorder of Deeds of Schuylkill County. If the Subdivision and Land Development Ordinance (SALDO) has more stringent criteria then the more stringent criteria shall apply. The contents of the map(s) shall include, but not be limited to:

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

2. Existing contours at intervals of two feet. In areas of steep slopes (greater than 15 percent), five-foot contour intervals may be used.

3. Existing streams, lakes, ponds or other Waters of the Commonwealth within the project area..

4. Other physical features including flood hazard boundaries, stream buffers, existing drainage courses, areas of natural vegetation to be preserved, and the total extent of the upstream area draining through the site.

5. The locations of all existing and proposed utilities, sanitary sewers, and water lines within fifty (50) feet of property lines.

6. An overlay showing soil names and boundaries.

7. Limits of earth disturbance, including the type and amount of impervious area that would be added.

8. Proposed structures, roads, paved areas, and buildings.

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

10. The name of the development, the name and address of the owner of the property, and the name of the individual or firm preparing the plan.

11. The date of submission.

12. A graphic and written scale of one (1) inch equals no more than fifty (50) feet; for tracts of twenty (20) acres or more, the scale shall be one (1) inch equals no more than one hundred (100) feet.

13. A north arrow.

14. The total tract boundary and size with distances marked to the nearest foot and bearings to the nearest degree.

15. Existing and proposed land use(s).

16. A key map showing all off site existing man-made features which may be affected by stormwater runoff or stormwater management controls for the project.

17. Location of all open channels.

18. Overland drainage patterns and swales.

19. A fifteen foot wide access easement around all stormwater management facilities that would provide ingress to and egress from a public right-of-way.

20. The location of all erosion and sediment control facilities.

21. A note on the plan indicating the location and responsibility for maintenance of stormwater management facilities that would be located on/off-site. All on/off-site facilities shall meet the performance standards and design criteria specified in this Ordinance.

22. A statement, signed by the landowner, acknowledging that any revision to the approved Drainage Plan must be approved by South Manheim Township and the Conservation District.

23. The following signature block for the Design Engineer:

    I, (Design Engineer), on this date (date of signature), hereby certify that the Drainage Plan meets all design standards and criteria of the South Manheim Stormwater Management Ordinance."

C. Supplemental Information

1. A written description of the following information shall be submitted.

    a. The overall stormwater management concept for the project designed in accordance with Section 304.
    b. Stormwater runoff computations as specified in this Ordinance.
    c. Stormwater management techniques to be applied both during and after development.
    d. Expected project time schedule.
    e. Development stages (project phases) if so proposed.
    f. An operation and maintenance plan in accordance with Section 702 of this Ordinance.

2. An erosion and sediment control plan.

3. The effect of the project (in terms of runoff volumes and peak flows) on adjacent properties and on any existing municipal stormwater collection system that may receive runoff from the project site.

D. Stormwater Management Facilities

1. All stormwater management facilities must be located on a plan and described in detail.

2. When infiltration facilities such as seepage pits, beds or trenches are used, the locations of existing and proposed septic tank infiltration areas and wells must be shown.

3. All calculations, assumptions, and criteria used in the design of the stormwater management facilities must be shown.

E. Responsibilities for Operations and Maintenance of Stormwater Controls and BMPs

1. No Regulated Earth Disturbance activities within South Manheim Township shall commence until approval by South Manheim Township of a Stormwater Control and BMP Operations and Maintenance plan which describes how the permanent (e.g., post-construction) stormwater controls and BMPs will be properly operated and maintained.

2. The following items shall be included in the Stormwater Control and BMP Operations and Maintenance Plan:

a. Map(s) of the project area, in a form that meets the requirements for recording at the offices of the Recorder of Deeds of Berks County, and shall be submitted on 24-inch x 36-inch sheets. The contents of the maps(s) shall include, but not be limited to:

1). Clear identification of the location and nature of permanent stormwater controls and BMPs,
2). The location of the project site relative to highways, municipal boundaries or other identifiable landmarks,
3). Existing and final contours at intervals of two feet, or others as appropriate,
4). Existing streams, lakes, ponds, or other bodies of water within the project site area,
5). Other physical features including flood hazard boundaries, sinkholes, streams, existing drainage courses, and areas of natural vegetation to be preserved,

6). The locations of all existing and proposed utilities, sanitary sewers, and water lines within fifty (50) feet of property lines of the project site,
7). Proposed final changes to the land surface and vegetative cover, including the type and amount of impervious area that would be added,
8). Proposed final structures, roads, paved areas, and buildings, and
9). A twenty (20) foot wide access easement around all stormwater controls and BMPs that would provide ingress to and egress from a public right-of-way.

b. A description of how each permanent stormwater control and BMP will be operated and maintained, and the identity of the person(s) responsible for operations and maintenance,

c. The name of the project site, the name and address of the owner of the property, and the name of the individual or firm preparing the plan, and

d. A statement, signed by the landowner, acknowledging that the stormwater controls and BMPs are fixtures that can be altered or removed only after approval by South Manheim Township.

3. The Stormwater Control and BMP Operations and Maintenance Plan for the project site shall establish responsibilities for the continuing operation and maintenance of all permanent stormwater controls and BMPs.

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

F. Municipality Review of Stormwater Control and BMP Operations and Maintenance Plan

1. South Manheim Township shall review the Stormwater Control and BMP Operations and Maintenance Plan for consistency with the purposes and requirements of this ordinance, and any permits issued by DEP.

2. South Manheim Township shall notify the Applicant in writing whether the Stormwater Control and BMP Operations and Maintenance Plan is approved.

3. South Manheim Township may require a "Record Drawing" of all stormwater controls and BMPs, and an explanation of any discrepancies with the Operations and Maintenance Plan.

Section 404. Plan Submission

South Manheim Township shall require receipt of a complete plan, as specified in this Ordinance.

For any activities that require an NPDES Permit for Stormwater Discharges from Construction Activities, a PaDEP Joint Permit Application, a PennDOT Highway Occupancy Permit, or any other permit under applicable state or federal regulations or are regulated under Chapter 105 (Dam Safety and Waterway Management) or Chapter 106 (Floodplain Management) of PaDEP's Rules and Regulations, the proof of application for said permit(s) or approvals shall be part of the plan. The plan shall be coordinated with the state and federal permit process and the municipal SALDO review process.

A. For projects which require SALDO approval, the Drainage Plan shall be submitted by the Applicant as part of the Preliminary Plan submission where applicable for the Regulated Activity.

B. For these regulated activities that do not require SALDO approval, See Section 401, General Requirements.

C. Six (6) copies of the Drainage Plan shall be submitted and distributed as follows:

1. Two (2) copies to South Manheim Township accompanied by the requisite Municipal Review Fee, in accordance with this Ordinance.

2. Two (2) copies to the Conservation District.

3. One (1) copy to the Municipal Engineer.

4. One (1) copy to the County Planning Commission/Department.

Section 405. Drainage Plan Review

A. South Manheim Township shall review the Drainage Plan with the standards set forth in this Ordinance. Plans found to be incomplete shall not be accepted for review and shall be returned to the Applicant.

B. For activities regulated by this Ordinance, South Manheim Township shall notify the Applicant in writing, within 90 calendar days, whether the Drainage Plan is consistent with the Stormwater Management Ordinance.

1. Should the Drainage Plan be determined to be consistent with the Stormwater Management Ordinance, the Municipal Engineer shall forward an approval letter to the Municipal Secretary who will then forward a copy to the Applicant.

2. Should the Drainage Plan be determined to be inconsistent with the Stormwater Management Ordinance, the Municipal Engineer shall forward a disapproval letter to the Municipal Secretary who will then forward a copy to the Applicant. The disapproval letter shall cite the reason(s) and specific Ordinance sections for the disapproval. Disapproval may be due to inadequate information to make a

reasonable judgment as to compliance with the Stormwater Management Ordinance. Any disapproved Drainage Plans may be revised by the Applicant and resubmitted consistent with this Ordinance.

C. For Regulated Activities specified in Section 104 of this Ordinance, which require a building permit, the Municipal Engineer shall notify the Municipal Building Permit Officer in writing, within a time frame consistent with the Municipal Building Code and/or Municipal Subdivision Ordinance, whether the Drainage Plan is consistent with the Stormwater Management Ordinance and forward a copy of the approval/disapproval letter to the Applicant. Any disapproved drainage plan may be revised by the Applicant and resubmitted consistent with this Ordinance.

D. For regulated activities under this ordinance that require an NPDES Permit Application, the Applicant shall forward a copy of the Municipal Engineer's letter stating that the Drainage Plan is consistent with the Stormwater Management Ordinance to the Conservation District. PaDEP and the Conservation District may consider the Municipal Engineer's review comments in determining whether to issue a permit.

E. South Manheim Township shall not grant approval or grant preliminary approval to any subdivision or land development for Regulated Activities specified in Section 105 of this Ordinance if the Drainage Plan has been found to be inconsistent with the Stormwater Management Ordinance, as determined by South Manheim Township. All required permits from PaDEP must be obtained prior to approval of any subdivision or land development.

F. The Applicant shall be responsible for completing record drawings of all stormwater management facilities included in the approved Drainage Plan. The record drawings and an explanation of any discrepancies with the design plans shall be submitted to South Manheim Township for final approval. South Manheim Township may withhold approval of the record drawings until South Manheim Township receives a copy of an approved Highway Occupancy Permit from the PennDOT District Office, NPDES Permit, and any other applicable permits or approvals, from PaDEP or the Conservation District. The above permits and approvals must be based on the record drawings.

G. South Manheim Township's approval of a Drainage Plan shall be valid for a period not to exceed five (5) years, commencing on the date that South Manheim Township signs the approved Drainage Plan. If stormwater management facilities included in the approved Drainage plan have not been constructed, or if constructed, and record drawings of these facilities have not been approved within this five (5) year time period, then South Manheim Township may consider the Drainage plan disapproved and may revoke any and all permits. Drainage Plans that are considered disapproved by South Manheim Township shall be resubmitted in accordance with Section 407 of this Ordinance.

Section 406. Modification of Plans

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

B. A modification to an already approved or disapproved Drainage Plan shall be submitted to South Manheim Township, accompanied by the applicable Municipal Review and Inspection Fee. A modification to a Drainage Plan for which a formal action has not been taken by South Manheim Township shall be submitted to South Manheim Township, accompanied by the applicable Municipal Review and Inspection Fee.

Section 407. Resubmission of Disapproved Drainage Plans

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

ARTICLE V-INSPECTIONS

Section 501. Schedule of Inspections

A. The Municipal Engineer or his municipal designee shall inspect all phases of the installation of the permanent stormwater management facilities as deemed appropriate by South Manheim Township.

B. During any stage of the work, if the Municipal Engineer or his municipal designee determines that the permanent stormwater management facilities are not being installed in accordance with the approved Drainage Plan, South Manheim Township shall revoke any existing building permits and issue a cease and desist order until a revised Drainage Plan is submitted and approved, as specified in this Ordinance.

C. A final inspection of all stormwater management facilities shall be conducted by the Municipal Engineer or his municipal designee as deemed appropriate by South Manheim Township to confirm compliance with the approved Drainage Plan prior to the issuance of any Occupancy Permit.

ARTICLE VI-FEES AND EXPENSES

Section 601. Drainage Plan Review and Inspection Fee

Fees shall be established by South Manheim Township to defray plan review and construction inspection costs incurred by South Manheim Township. All fees shall be paid by the Applicant at the time of Drainage Plan submission. Review and Inspection Fee Schedule shall be established by resolution of the Board of Supervisors based on the size of the Regulated Activity and based on South Manheim Township's costs for reviewing Drainage Plans and conducting inspections pursuant to Section 501. South Manheim Township shall periodically update the Review and Inspection Fee Schedule to ensure that review costs are adequately reimbursed.

Section 602. Expenses Covered by Fees

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

A. Administrative costs.

B. The review of the Drainage Plan by South Manheim Township and the Municipal Engineer.

C. The site inspections.

D. The inspection of stormwater management facilities and drainage improvements during construction.

E. The final inspection upon completion of the stormwater management facilities and drainage improvements presented in the Drainage Plan.

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

ARTICLE VII-MAINTENANCE RESPONSIBILITIES

Section 701. Performance Guarantee

A. For subdivisions and land developments, the Applicant shall provide a financial guarantee to South Manheim Township for the timely installation and proper construction of all stormwater management controls. This will typically be part of the financial guarantee and improvements cost estimate prepared for other improvements associated with the subdivision or land development and is required regardless of whether there are other improvements requiring security or not. Financial security shall be equal to or greater than the full construction cost of the required controls, unless otherwise provided

for in the Subdivision and Land Development Ordinance, in which case the amount and method of payment shall be as provided therein.

B. South Manheim Township may require a financial guarantee from the Applicant for other regulated activities, including but not limited to maintenance performance, inspections, etc.

C. At the completion of the project, and as a prerequisite for the release of the performance guarantee, the Applicant or his representatives shall:

1. Provide a certification of completion from an engineer, architect, surveyor or other qualified person verifying that all permanent facilities have been constructed according to the plans and specifications and approved revisions thereto.

2. Provide a set of record drawings.

D. After South Manheim Township receives the certification, a final inspection shall be conducted by the municipal engineer or designee to certify compliance with this ordinance.

Section 702. Adherence to Approved Stormwater Control and BMP Operations and Maintenance Plan

It shall be unlawful to alter or remove any permanent stormwater control and BMP required by an approved Stormwater Control and BMP Operations and Maintenance Plan, or to allow the property to remain in a condition which does not conform to an approved Stormwater Control and BMP Operations and Maintenance Plan.

Section 703. Operations and Maintenance Agreement for Privately Owned Stormwater Controls and BMPs

A. The property owner shall sign an operations and maintenance agreement with South Manheim Township covering all stormwater controls and BMPs that are to be privately owned. The agreement shall be substantially the same as the agreement in Appendix A of this Ordinance.

B. Other items may be included in the agreement where determined necessary to guarantee the satisfactory operation and maintenance of all permanent stormwater controls and BMPs. The agreement shall be subject to the review and approval of South Manheim Township.

Section 704. Stormwater Management Easements

A. Stormwater management easements are required for all areas used for off-site stormwater control, unless a waiver is granted by South Manheim Township.

B. Stormwater management easements shall be provided by the property owner if necessary for (1) access for inspections and maintenance, or (2) preservation of stormwater runoff conveyance, infiltration, and detention areas and other stormwater controls and BMPs, by persons other than the property owner. The purpose of the easement shall be specified in any agreement under Section 703.

Section 705. Recording of Approved Stormwater Control and BMP Operations and Maintenance Plan and Related Agreements

A. The owner of any land upon which permanent stormwater controls and BMPs will be placed, constructed or implemented, as described in the Stormwater Control and BMP Operations and Maintenance Plan, shall record the following documents in the Office of the Recorder of Deeds for Schuylkill County, within 15 days of approval of the Stormwater Control and BMP Operations Plan by South Manheim Township:

1. The Operations and Maintenance Plan, or a summary thereof,

2. Operations and Maintenance Agreements under Section 705, and

3. Easements under Section 704.

B. South Manheim 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.

ARTICLE VIII- PROHIBITIONS

Section 801. Prohibited Discharges and Connections

A. Any drain or conveyance, whether on the surface or subsurface, which allows any non-stormwater discharge including sewage, process wastewater, and wash water to enter the waters of this Commonwealth is prohibited.

B. No person shall allow, or cause to allow, discharges into surface waters of this Commonwealth which are not composed entirely of stormwater, except (1) as provided in subsection C below, and (2) discharges allowed under a state or federal permit.

C. The following discharges are authorized unless they are determined to be significant contributors to pollution to the waters of this Commonwealth:

- Discharges from fire fighting activities	- Flows from riparian habitats and wetlands
- Potable water sources including water line flushing	- Uncontaminated water from foundations or from footing drains
- Irrigation drainage	- Lawn watering

- Air conditioning condensate	- Dechlorinated swimming pool discharges
- Springs	- Uncontaminated groundwater
- Water from crawl space pumps	- Water from individual residential car washing
- Pavement wash waters where spills or leaks of toxic or hazardous materials have not occurred (unless all spill material has been removed) and where detergents are not used	- Routine external building wash down (which does not use detergents or other compounds)

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

Section 802. Roof Drains

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

Section 803. Alteration of SWM BMPs

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

ARTICLE IX-ENFORCEMENT AND PENALTIES

Section 901. Right-of-Entry

A. Upon presentation of proper credentials, duly authorized representatives of South Manheim Township may enter at reasonable times upon any property within South Manheim Township to inspect the implementation, condition, or operation and maintenance of the stormwater controls or BMPs in regard to any aspect governed by this Ordinance.

B. Stormwater control and BMP owners and operators shall allow persons working on behalf of South Manheim Township ready access to all parts of the premises for the purposes of determining compliance with this Ordinance.

C. Persons working on behalf of South Manheim Township shall have the right to temporarily locate on any stormwater control or BMP in South Manheim Township such devices as are necessary to conduct monitoring and/or sampling of the discharges from such stormwater control or BMP.

D. Unreasonable delays (greater than 24 hours) in allowing South Manheim Township access to a stormwater control or BMP is a violation of this Article.

Section 902. Public Nuisance

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

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

Section 903. Enforcement Generally

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

1. The performance of monitoring, analyses, and reporting;
2. The elimination of prohibited connections or discharges;
3. Cessation of any violating discharges, practices, or operations;
4. The abatement or remediation of stormwater pollution or contamination hazards and the restoration of any affected property;
5. Payment of a fine to cover administrative and remediation costs;
6. The implementation of stormwater controls and BMPs; and
7. Operation and maintenance of stormwater controls and BMPs.

B. Such notification shall set forth the nature of the violation(s) and establish a time limit for correction of these violations(s). Said notice may further advise that, if applicable, should the violator fail to take the required action within the established deadline, the work will be done by South Manheim Township or designee and the expense thereof shall be charged to the violator.

C. Failure to comply within 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 South Manheim Township from pursuing any and all other remedies available in law or equity.

Section 904. Suspension and Revocation of Permits and Approvals

A. Any building, land development or other permit or approval issued by South Manheim Township may be suspended or revoked, in whole or in part, by South Manheim Township for:

1. Non-compliance with or failure to implement any provision of the permit;

2. A violation of any provision of this Ordinance; or

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

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

1. The Municipal Engineer or designee has inspected and approved the corrections to the stormwater controls and BMPs, or the elimination of the hazard or nuisance, and/or;

2. South Manheim Township is satisfied that the violation of the Ordinance, law, or rule and regulation has been corrected.

C. A permit or approval which has been revoked by South Manheim Township cannot be reinstated. The applicant may apply for a new permit under the procedures outlined in this Ordinance.

Section 905. Penalties

A. Any violation of the provisions of this Ordinance shall be enforced by action brought before a District Justice in the same manner provided for the enforcement of summary offenses under the Pennsylvania Rules of Criminal Procedure. The Municipal Solicitor may assume charge of the prosecution without the consent of the District Attorney as required by Pa. R.Crim.P. No. 454 (relating to trial in summary cases). Upon conviction, the person shall be subject to a fine of not more than One Thousand Dollars ($1,000.00) for each violation, recoverable with costs, or imprisonment to the extent allowed by law for the punishment of summary offenses, or both. Each day that the violation continues shall be a separate offense.

B. In addition, South Manheim Township, through its Solicitor, may institute injunctive, mandamus or any other appropriate action or proceeding at law or in equity for the enforcement of this Ordinance. Any court of competent jurisdiction shall have the right to issue restraining orders, temporary or permanent injunctions, mandamus or other appropriate forms of remedy or relief. The imposition of a fine or penalty for any violation of, or non-compliance with, this Ordinance shall not excuse the violation or non-compliance, or permit it to continue, and all such persons shall be required to correct or remedy such violations and non-compliances.

Section 906. Notification

In the event that a person fails to comply with the requirements of this Ordinance, or fails to conform to the requirements of any permit issued hereunder, South Manheim Township will provide notification of the violation. After notice is provided, failure to correct violations in a timely manner may result in additional violations.

Section 907. Enforcement

The South Manheim Township Board of Supervisors is hereby authorized and directed to enforce all of the provisions of this ordinance. All inspections regarding compliance with the drainage plan shall be the responsibility of the municipal engineer or other qualified persons designated by South Manheim Township.

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

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

C. It shall be unlawful for a person to undertake any Regulated Activity except as provided in an approved SWM Site Plan, unless specifically exempted from the requirement to submit a SWM Site Plan by this Ordinance.

D. The Developer shall be responsible for providing as-built plan of all SWM BMPs included in the approved SWM Site Plan. The as-built plans and an explanation of any discrepancies with the construction plans shall be submitted by the Developer to South Manheim Township.

E. The as-built submission shall include a certification of completion signed by a Qualified Professional verifying that all permanent SWM BMPs have been constructed according to the approved plans and specifications. If any licensed Qualified Professionals contributed to the construction plans, then a licensed Qualified Professional must sign the completion certificate.

F. After receipt of the completion certificate, South Manheim Township may conduct a final inspection.

G. Inspections regarding compliance with the SWM Site Plan are a responsibility of South Manheim Township.

H. South Manheim Township may withhold an occupancy permit until a certificate of completion has been provided by the Developer.

Section 908. Appeals

A. Any person aggrieved by any action of South Manheim Township or its designee may appeal to the Board of Supervisors within thirty (30) days of that action.

B. Any person aggrieved by any decision of the Board of Supervisors may appeal to the County Court of Common Pleas in the County where the activity has taken place within thirty (30) days of the municipal decision.

ENACTED and ORDAINED at a regular meeting of the South Manheim Board of Supervisors on the 1st of December, 2008. This Ordinance shall take effect immediately.

[Name]

Supervisor
[Title]

[Name]

Supervisor
[Title]

[Name]

Supervisor
[Title]

[Name]

[Title]

[Name]

[Title]

ATTEST:

Kelly Handley
Secretary

I hereby certify that the foregoing Ordinance was advertised in the The Call Newspaper on Nov. 13, 2008, a newspaper of general circulation in South Manheim Township and was duly enacted and approved as set forth at a regular meeting of the South Manheim Township Board of Supervisors held on Dec. 1, 2008.

Kelly Handley
Secretary

ORDINANCE APPENDIX A

STORMWATER CONTROLS AND BEST MANAGEMENT PRACTICES
OPERATIONS AND MAINTENANCE AGREEMENT

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

WITNESSETH

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

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

WHEREAS, the Stormwater Controls and BMP Operations and Maintenance Plan approved by South Manheim 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 South Manheim Township, provides for management of stormwater within the confines of the Property through the use of Best Management Practices (BMPs); and

WHEREAS, South Manheim Township, and the Landowner, his successors and assigns, agree that the health, safety, and welfare of the residents of South Manheim 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, South Manheim 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 South Manheim Township and in accordance with the specific maintenance requirements noted on the Plan.

3. The Landowner hereby grants permission to South Manheim 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, South Manheim 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 South Manheim Township, South Manheim 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 South Manheim Township to erect any permanent structure on the land of the Landowner. It is expressly understood and agreed that South Manheim 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 South Manheim Township.

5. In the event South Manheim 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 South Manheim Township for all expenses (direct and indirect) incurred within 10 days of receipt of invoice from South Manheim Township.

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, shall release South Manheim 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 Municipality. In the event that a claim is asserted against South Manheim Township, its designated representatives or employees, South Manheim 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 South Manheim Township's employees or designated representatives shall be allowed, the Landowner shall pay all costs and expenses regarding said judgment or claim.

8. South Manheim Township shall inspect the BMP(s) upon complaint and/or at the discretion of the Board of Supervisors, to ensure the continued functioning.

This Agreement shall be recorded at the Office of the Recorder of Deeds of Schuylkill County, Pennsylvania, and shall constitute a covenant running with the Property and/or equitable servitude,

and shall be binding on the Landowner, his administrators, executors, assigns, heirs and any other successors in interests, in perpetuity.

ATTEST:

WITNESS the following signatures and seals:

(SEAL) For South Manheim Township:

(SEAL) For the Landowner:

ATTEST:

_____ (City, Borough, Township)

County of _____, Pennsylvania

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

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

NOTARY PUBLIC **(SEAL)**

ORDINANCE APPENDIX B
STORMWATER MANAGEMENT DESIGN CRITERIA

TABLE B-1
REGION 5 - DESIGN STORM RAINFALL INTENSITIES
Source: "Field Manual of Pennsylvania Department of Transportation"
STORM INTENSITY-DURATION-FREQUENCY CHARTS
P D T - I D F May 1986.

FIGURE B-1
PENNDOT DELINEATED REGIONS
Source: "Field Manual of Pennsylvania Department of Transportation"
STORM INTENSITY-DURATION-FREQUENCY CHARTS
P D T - I D F May 1986.

TABLE B-2
RUNOFF CURVE NUMBERS
Source: NRCS (SCS) TR-55

TABLE B-3
RATIONAL RUNOFF COEFFICIENTS

TABLE B-4
MANNING ROUGHNESS COEFFICIENTS

FIGURE B-2
RECOMMENDATION CHART FOR INFILTRATION STORMWATER MANAGEMENT BMPS IN CARBONATE AREAS

TABLE B-1
DESIGN STORM RAINFALL INTENSITIES (INCHES/HOUR)

The following tables are derived from PennDOT's Intensity-Duration-Frequency charts, for Pennsylvania Region 5 (see Figure B-1).

PA REGION 5 1-YEAR STORM															
Tc	INT	Tc	INT	Tc	INT	Tc	INT	Tc	INT	Tc	INT	Tc	INT	Tc	INT
5.0	4.000	11.9	2.848	18.8	2.269	25.7	1.907	32.6	1.653	39.5	1.463	46.4	1.315	53.3	1.196
5.1	3.975	12.0	2.837	18.9	2.263	25.8	1.902	32.7	1.650	39.6	1.461	46.5	1.313	53.4	1.194
5.2	3.949	12.1	2.826	19.0	2.257	25.9	1.898	32.8	1.646	39.7	1.458	46.6	1.311	53.5	1.193
5.3	3.925	12.2	2.815	19.1	2.250	26.0	1.894	32.9	1.643	39.8	1.456	46.7	1.309	53.6	1.191
5.4	3.900	12.3	2.805	19.2	2.244	26.1	1.889	33.0	1.640	39.9	1.453	46.8	1.307	53.7	1.189
5.5	3.876	12.4	2.794	19.3	2.238	26.2	1.885	33.1	1.637	40.0	1.451	46.9	1.305	53.8	1.188
5.6	3.853	12.5	2.784	19.4	2.232	26.3	1.881	33.2	1.634	40.1	1.449	47.0	1.304	53.9	1.186
5.7	3.829	12.6	2.773	19.5	2.225	26.4	1.877	33.3	1.631	40.2	1.446	47.1	1.302	54.0	1.185
5.8	3.806	12.7	2.763	19.6	2.219	26.5	1.873	33.4	1.628	40.3	1.444	47.2	1.300	54.1	1.183
5.9	3.784	12.8	2.753	19.7	2.213	26.6	1.869	33.5	1.625	40.4	1.442	47.3	1.298	54.2	1.182
6.0	3.761	12.9	2.743	19.8	2.207	26.7	1.864	33.6	1.622	40.5	1.439	47.4	1.296	54.3	1.180
6.1	3.740	13.0	2.733	19.9	2.201	26.8	1.860	33.7	1.619	40.6	1.437	47.5	1.294	54.4	1.179
6.2	3.718	13.1	2.723	20.0	2.195	26.9	1.856	33.8	1.616	40.7	1.435	47.6	1.292	54.5	1.177
6.3	3.697	13.2	2.713	20.1	2.189	27.0	1.852	33.9	1.613	40.8	1.432	47.7	1.291	54.6	1.176
6.4	3.676	13.3	2.703	20.2	2.183	27.1	1.848	34.0	1.610	40.9	1.430	47.8	1.289	54.7	1.174
6.5	3.655	13.4	2.693	20.3	2.177	27.2	1.844	34.1	1.607	41.0	1.428	47.9	1.287	54.8	1.173
6.6	3.635	13.5	2.684	20.4	2.172	27.3	1.840	34.2	1.604	41.1	1.426	48.0	1.285	54.9	1.171
6.7	3.615	13.6	2.674	20.5	2.166	27.4	1.836	34.3	1.601	41.2	1.423	48.1	1.283	55.0	1.170
6.8	3.595	13.7	2.665	20.6	2.160	27.5	1.832	34.4	1.598	41.3	1.421	48.2	1.281	55.1	1.168
6.9	3.575	13.8	2.656	20.7	2.154	27.6	1.828	34.5	1.595	41.4	1.419	48.3	1.280	55.2	1.167
7.0	3.556	13.9	2.646	20.8	2.149	27.7	1.824	34.6	1.592	41.5	1.417	48.4	1.278	55.3	1.165
7.1	3.537	14.0	2.637	20.9	2.143	27.8	1.820	34.7	1.589	41.6	1.414	48.5	1.276	55.4	1.164
7.2	3.518	14.1	2.628	21.0	2.137	27.9	1.817	34.8	1.587	41.7	1.412	48.6	1.274	55.5	1.162
7.3	3.500	14.2	2.619	21.1	2.132	28.0	1.813	34.9	1.584	41.8	1.410	48.7	1.272	55.6	1.161
7.4	3.482	14.3	2.610	21.2	2.126	28.1	1.809	35.0	1.581	41.9	1.408	48.8	1.271	55.7	1.159
7.5	3.463	14.4	2.601	21.3	2.121	28.2	1.805	35.1	1.578	42.0	1.405	48.9	1.269	55.8	1.158
7.6	3.446	14.5	2.592	21.4	2.115	28.3	1.801	35.2	1.575	42.1	1.403	49.0	1.267	55.9	1.156
7.7	3.428	14.6	2.583	21.5	2.110	28.4	1.797	35.3	1.572	42.2	1.401	49.1	1.265	56.0	1.155
7.8	3.411	14.7	2.575	21.6	2.104	28.5	1.794	35.4	1.570	42.3	1.399	49.2	1.264	56.1	1.153
7.9	3.394	14.8	2.566	21.7	2.099	28.6	1.790	35.5	1.567	42.4	1.397	49.3	1.262	56.2	1.152
8.0	3.377	14.9	2.558	21.8	2.094	28.7	1.786	35.6	1.564	42.5	1.394	49.4	1.260	56.3	1.151
8.1	3.360	15.0	2.549	21.9	2.088	28.8	1.782	35.7	1.561	42.6	1.392	49.5	1.258	56.4	1.149
8.2	3.344	15.1	2.541	22.0	2.083	28.9	1.779	35.8	1.558	42.7	1.390	49.6	1.257	56.5	1.148
8.3	3.327	15.2	2.532	22.1	2.078	29.0	1.775	35.9	1.556	42.8	1.388	49.7	1.255	56.6	1.146
8.4	3.311	15.3	2.524	22.2	2.073	29.1	1.771	36.0	1.553	42.9	1.386	49.8	1.253	56.7	1.145
8.5	3.295	15.4	2.516	22.3	2.067	29.2	1.768	36.1	1.550	43.0	1.384	49.9	1.251	56.8	1.143
8.6	3.280	15.5	2.508	22.4	2.062	29.3	1.764	36.2	1.547	43.1	1.382	50.0	1.250	56.9	1.142
8.7	3.264	15.6	2.500	22.5	2.057	29.4	1.760	36.3	1.545	43.2	1.379	50.1	1.248	57.0	1.141
8.8	3.249	15.7	2.492	22.6	2.052	29.5	1.757	36.4	1.542	43.3	1.377	50.2	1.246	57.1	1.139
8.9	3.234	15.8	2.484	22.7	2.047	29.6	1.753	36.5	1.539	43.4	1.375	50.3	1.245	57.2	1.138
9.0	3.219	15.9	2.476	22.8	2.042	29.7	1.750	36.6	1.537	43.5	1.373	50.4	1.243	57.3	1.136
9.1	3.204	16.0	2.468	22.9	2.037	29.8	1.746	36.7	1.534	43.6	1.371	50.5	1.241	57.4	1.135
9.2	3.189	16.1	2.460	23.0	2.032	29.9	1.743	36.8	1.531	43.7	1.369	50.6	1.239	57.5	1.134
9.3	3.175	16.2	2.452	23.1	2.027	30.0	1.739	36.9	1.529	43.8	1.367	50.7	1.238	57.6	1.132
9.4	3.161	16.3	2.445	23.2	2.022	30.1	1.736	37.0	1.526	43.9	1.365	50.8	1.236	57.7	1.131
9.5	3.146	16.4	2.437	23.3	2.017	30.2	1.732	37.1	1.523	44.0	1.363	50.9	1.234	57.8	1.129
9.6	3.132	16.5	2.429	23.4	2.012	30.3	1.729	37.2	1.521	44.1	1.361	51.0	1.233	57.9	1.128
9.7	3.119	16.6	2.422	23.5	2.007	30.4	1.725	37.3	1.518	44.2	1.359	51.1	1.231	58.0	1.127
9.8	3.105	16.7	2.415	23.6	2.002	30.5	1.722	37.4	1.516	44.3	1.357	51.2	1.229	58.1	1.125
9.9	3.091	16.8	2.407	23.7	1.998	30.6	1.718	37.5	1.513	44.4	1.354	51.3	1.228	58.2	1.124
10.0	3.078	16.9	2.400	23.8	1.993	30.7	1.715	37.6	1.510	44.5	1.352	51.4	1.226	58.3	1.122
10.1	3.065	17.0	2.392	23.9	1.988	30.8	1.711	37.7	1.508	44.6	1.350	51.5	1.225	58.4	1.121
10.2	3.052	17.1	2.385	24.0	1.983	30.9	1.708	37.8	1.505	44.7	1.348	51.6	1.223	58.5	1.120
10.3	3.039	17.2	2.378	24.1	1.979	31.0	1.705	37.9	1.503	44.8	1.346	51.7	1.221	58.6	1.118
10.4	3.026	17.3	2.371	24.2	1.974	31.1	1.701	38.0	1.500	44.9	1.344	51.8	1.220	58.7	1.117
10.5	3.013	17.4	2.364	24.3	1.969	31.2	1.698	38.1	1.498	45.0	1.342	51.9	1.218	58.8	1.116
10.6	3.001	17.5	2.357	24.4	1.965	31.3	1.695	38.2	1.495	45.1	1.340	52.0	1.216	58.9	1.114
10.7	2.988	17.6	2.350	24.5	1.960	31.4	1.691	38.3	1.493	45.2	1.338	52.1	1.215	59.0	1.113
10.8	2.976	17.7	2.343	24.6	1.955	31.5	1.688	38.4	1.490	45.3	1.336	52.2	1.213	59.1	1.112
10.9	2.964	17.8	2.336	24.7	1.951	31.6	1.685	38.5	1.488	45.4	1.334	52.3	1.211	59.2	1.110
11.0	2.951	17.9	2.329	24.8	1.946	31.7	1.681	38.6	1.485	45.5	1.332	52.4	1.210	59.3	1.109
11.1	2.940	18.0	2.322	24.9	1.942	31.8	1.678	38.7	1.483	45.6	1.330	52.5	1.208	59.4	1.108
11.2	2.928	18.1	2.315	25.0	1.937	31.9	1.675	38.8	1.480	45.7	1.329	52.6	1.207	59.5	1.106
11.3	2.916	18.2	2.309	25.1	1.933	32.0	1.672	38.9	1.478	45.8	1.327	52.7	1.205	59.6	1.105
11.4	2.904	18.3	2.302	25.2	1.928	32.1	1.669	39.0	1.475	45.9	1.325	52.8	1.204	59.7	1.104
11.5	2.893	18.4	2.295	25.3	1.924	32.2	1.665	39.1	1.473	46.0	1.323	52.9	1.202	59.8	1.102
11.6	2.881	18.5	2.289	25.4	1.920	32.3	1.662	39.2	1.470	46.1	1.321	53.0	1.200	59.9	1.101
11.7	2.870	18.6	2.282	25.5	1.915	32.4	1.659	39.3	1.468	46.2	1.319	53.1	1.199	60.0	1.100
11.8	2.859	18.7	2.276	25.6	1.911	32.5	1.656	39.4	1.465	46.3	1.317	53.2	1.197		

PA REGION 5 2-YEAR STORM															
Tc	INT	Tc	INT	Tc	INT	Tc	INT	Tc	INT	Tc	INT	Tc	INT	Tc	INT
5.0	4.603	11.9	3.333	18.8	2.686	25.7	2.276	32.6	1.988	39.5	1.770	46.4	1.600	53.3	1.462
5.1	4.575	12.0	3.321	18.9	2.679	25.8	2.272	32.7	1.984	39.6	1.768	46.5	1.598	53.4	1.460
5.2	4.547	12.1	3.309	19.0	2.672	25.9	2.267	32.8	1.980	39.7	1.765	46.6	1.595	53.5	1.458
5.3	4.520	12.2	3.297	19.1	2.665	26.0	2.262	32.9	1.977	39.8	1.762	46.7	1.593	53.6	1.456
5.4	4.493	12.3	3.285	19.2	2.658	26.1	2.257	33.0	1.973	39.9	1.759	46.8	1.591	53.7	1.454
5.5	4.467	12.4	3.273	19.3	2.651	26.2	2.252	33.1	1.970	40.0	1.757	46.9	1.589	53.8	1.452
5.6	4.441	12.5	3.261	19.4	2.644	26.3	2.248	33.2	1.966	40.1	1.754	47.0	1.587	53.9	1.451
5.7	4.415	12.6	3.250	19.5	2.637	26.4	2.243	33.3	1.963	40.2	1.751	47.1	1.584	54.0	1.449
5.8	4.390	12.7	3.238	19.6	2.630	26.5	2.238	33.4	1.959	40.3	1.748	47.2	1.582	54.1	1.447
5.9	4.365	12.8	3.227	19.7	2.623	26.6	2.233	33.5	1.956	40.4	1.746	47.3	1.580	54.2	1.445
6.0	4.341	12.9	3.216	19.8	2.616	26.7	2.229	33.6	1.952	40.5	1.743	47.4	1.578	54.3	1.444
6.1	4.317	13.0	3.205	19.9	2.609	26.8	2.224	33.7	1.949	40.6	1.740	47.5	1.576	54.4	1.442
6.2	4.293	13.1	3.193	20.0	2.603	26.8	2.219	33.8	1.946	40.7	1.738	47.6	1.574	54.5	1.440
6.3	4.270	13.2	3.182	20.1	2.596	27.0	2.215	33.9	1.942	40.8	1.735	47.7	1.572	54.6	1.438
6.4	4.247	13.3	3.172	20.2	2.589	27.1	2.210	34.0	1.939	40.9	1.733	47.8	1.569	54.7	1.437
6.5	4.224	13.4	3.161	20.3	2.583	27.2	2.206	34.1	1.935	41.0	1.730	47.9	1.567	54.8	1.435
6.6	4.202	13.5	3.150	20.4	2.576	27.3	2.201	34.2	1.932	41.1	1.727	48.0	1.565	54.9	1.433
6.7	4.180	13.6	3.140	20.5	2.570	27.4	2.197	34.3	1.929	41.2	1.725	48.1	1.563	55.0	1.431
6.8	4.158	13.7	3.129	20.6	2.563	27.5	2.192	34.4	1.925	41.3	1.722	48.2	1.561	55.1	1.430
6.9	4.137	13.8	3.119	20.7	2.557	27.6	2.188	34.5	1.922	41.4	1.719	48.3	1.559	55.2	1.428
7.0	4.115	13.9	3.108	20.8	2.550	27.7	2.183	34.6	1.919	41.5	1.717	48.4	1.557	55.3	1.426
7.1	4.095	14.0	3.098	20.9	2.544	27.8	2.179	34.7	1.915	41.6	1.714	48.5	1.555	55.4	1.424
7.2	4.074	14.1	3.088	21.0	2.538	27.9	2.174	34.8	1.912	41.7	1.712	48.6	1.553	55.5	1.423
7.3	4.054	14.2	3.078	21.1	2.531	28.0	2.170	34.9	1.909	41.8	1.709	48.7	1.551	55.6	1.421
7.4	4.034	14.3	3.068	21.2	2.525	28.1	2.166	35.0	1.905	41.9	1.707	48.8	1.549	55.7	1.419
7.5	4.014	14.4	3.058	21.3	2.519	28.2	2.161	35.1	1.902	42.0	1.704	48.9	1.546	55.8	1.418
7.6	3.994	14.5	3.048	21.4	2.513	28.3	2.157	35.2	1.899	42.1	1.701	49.0	1.544	55.9	1.416
7.7	3.975	14.6	3.038	21.5	2.506	28.4	2.153	35.3	1.896	42.2	1.699	49.1	1.542	56.0	1.414
7.8	3.956	14.7	3.028	21.6	2.500	28.5	2.148	35.4	1.893	42.3	1.696	49.2	1.540	56.1	1.413
7.9	3.937	14.8	3.019	21.7	2.494	28.6	2.144	35.5	1.889	42.4	1.694	49.3	1.538	56.2	1.411
8.0	3.918	14.9	3.009	21.8	2.488	28.7	2.140	35.6	1.886	42.5	1.691	49.4	1.536	56.3	1.409
8.1	3.900	15.0	3.000	21.9	2.482	28.8	2.135	35.7	1.883	42.6	1.689	49.5	1.534	56.4	1.407
8.2	3.882	15.1	2.990	22.0	2.476	28.9	2.131	35.8	1.880	42.7	1.686	49.6	1.532	56.5	1.406
8.3	3.864	15.2	2.981	22.1	2.470	29.0	2.127	35.9	1.877	42.8	1.684	49.7	1.530	56.6	1.404
8.4	3.846	15.3	2.972	22.2	2.464	29.1	2.123	36.0	1.873	42.9	1.681	49.8	1.528	56.7	1.402
8.5	3.828	15.4	2.963	22.3	2.459	29.2	2.119	36.1	1.870	43.0	1.679	49.9	1.526	56.8	1.401
8.6	3.811	15.5	2.953	22.4	2.453	29.3	2.115	36.2	1.867	43.1	1.677	50.0	1.524	56.9	1.399
8.7	3.794	15.6	2.944	22.5	2.447	29.4	2.110	36.3	1.864	43.2	1.674	50.1	1.522	57.0	1.397
8.8	3.777	15.7	2.935	22.6	2.441	29.5	2.106	36.4	1.861	43.3	1.672	50.2	1.520	57.1	1.396
8.9	3.760	15.8	2.927	22.7	2.435	29.6	2.102	36.5	1.858	43.4	1.669	50.3	1.518	57.2	1.394
9.0	3.744	15.9	2.918	22.8	2.430	29.7	2.098	36.6	1.855	43.5	1.667	50.4	1.516	57.3	1.393
9.1	3.727	16.0	2.909	22.9	2.424	29.8	2.094	36.7	1.852	43.6	1.664	50.5	1.514	57.4	1.391
9.2	3.711	16.1	2.900	23.0	2.418	29.9	2.090	36.8	1.849	43.7	1.662	50.6	1.512	57.5	1.389
9.3	3.695	16.2	2.891	23.1	2.413	30.0	2.086	36.9	1.846	43.8	1.660	50.7	1.510	57.6	1.388
9.4	3.679	16.3	2.883	23.2	2.407	30.1	2.082	37.0	1.843	43.9	1.657	50.8	1.508	57.7	1.386
9.5	3.664	16.4	2.874	23.3	2.402	30.2	2.078	37.1	1.840	44.0	1.655	50.9	1.507	57.8	1.384
9.6	3.648	16.5	2.866	23.4	2.396	30.3	2.074	37.2	1.837	44.1	1.652	51.0	1.505	57.9	1.383
9.7	3.633	16.6	2.857	23.5	2.390	30.4	2.070	37.3	1.834	44.2	1.650	51.1	1.503	58.0	1.381
9.8	3.618	16.7	2.849	23.6	2.385	30.5	2.066	37.4	1.831	44.3	1.648	51.2	1.501	58.1	1.380
9.9	3.603	16.8	2.841	23.7	2.380	30.6	2.062	37.5	1.828	44.4	1.645	51.3	1.499	58.2	1.378
10.0	3.588	16.9	2.833	23.8	2.374	30.7	2.059	37.6	1.825	44.5	1.643	51.4	1.497	58.3	1.376
10.1	3.573	17.0	2.824	23.9	2.369	30.8	2.055	37.7	1.822	44.6	1.641	51.5	1.495	58.4	1.375
10.2	3.559	17.1	2.816	24.0	2.363	30.9	2.051	37.8	1.819	44.7	1.638	51.6	1.493	58.5	1.373
10.3	3.544	17.2	2.808	24.1	2.358	31.0	2.047	37.9	1.816	44.8	1.636	51.7	1.491	58.6	1.372
10.4	3.530	17.3	2.800	24.2	2.353	31.1	2.043	38.0	1.813	44.9	1.634	51.8	1.489	58.7	1.370
10.5	3.516	17.4	2.792	24.3	2.348	31.2	2.039	38.1	1.810	45.0	1.631	51.9	1.487	58.8	1.368
10.6	3.502	17.5	2.784	24.4	2.342	31.3	2.035	38.2	1.807	45.1	1.629	52.0	1.486	58.9	1.367
10.7	3.488	17.6	2.776	24.5	2.337	31.4	2.032	38.3	1.804	45.2	1.627	52.1	1.484	59.0	1.365
10.8	3.475	17.7	2.769	24.6	2.332	31.5	2.028	38.4	1.801	45.3	1.624	52.2	1.482	59.1	1.364
10.9	3.461	17.8	2.761	24.7	2.327	31.6	2.024	38.5	1.798	45.4	1.622	52.3	1.480	59.2	1.362
11.0	3.448	17.9	2.753	24.8	2.322	31.7	2.020	38.6	1.796	45.5	1.620	52.4	1.478	59.3	1.361
11.1	3.435	18.0	2.746	24.9	2.316	31.8	2.017	38.7	1.793	45.6	1.618	52.5	1.476	59.4	1.359
11.2	3.421	18.1	2.738	25.0	2.311	31.9	2.013	38.8	1.790	45.7	1.615	52.6	1.474	59.5	1.358
11.3	3.408	18.2	2.730	25.1	2.306	32.0	2.009	38.9	1.787	45.8	1.613	52.7	1.472	59.6	1.356
11.4	3.395	18.3	2.723	25.2	2.301	32.1	2.006	39.0	1.784	45.9	1.611	52.8	1.471	59.7	1.354
11.5	3.383	18.4	2.715	25.3	2.296	32.2	2.002	39.1	1.781	46.0	1.609	52.9	1.469	59.8	1.353
11.6	3.370	18.5	2.708	25.4	2.291	32.3	1.998	39.2	1.779	46.1	1.606	53.0	1.467	59.9	1.351
11.7	3.358	18.6	2.701	25.5	2.286	32.4	1.995	39.3	1.776	46.2	1.604	53.1	1.465	60.0	1.350
11.8	3.345	18.7	2.693	25.6	2.281	32.5	1.991	39.4	1.773	46.3	1.602	53.2	1.463		

PA REGION 5 5-YEAR STORM															
Tc	INT	Tc	INT	Tc	INT	Tc	INT	Tc	INT	Tc	INT	Tc	INT	Tc	INT
5.0	5.391	11.9	3.986	18.8	3.225	25.7	2.732	32.6	2.381	39.5	2.116	46.4	1.907	53.3	1.737
5.1	5.361	12.0	3.972	18.9	3.217	25.8	2.727	32.7	2.377	39.6	2.113	46.5	1.904	53.4	1.735
5.2	5.333	12.1	3.958	19.0	3.208	25.9	2.721	32.8	2.373	39.7	2.109	46.6	1.901	53.5	1.733
5.3	5.304	12.2	3.944	19.1	3.199	26.0	2.715	32.9	2.368	39.8	2.106	46.7	1.899	53.6	1.731
5.4	5.276	12.3	3.930	19.2	3.191	26.1	2.709	33.0	2.364	39.9	2.103	46.8	1.896	53.7	1.728
5.5	5.248	12.4	3.917	19.3	3.183	26.2	2.703	33.1	2.360	40.0	2.099	46.9	1.893	53.8	1.726
5.6	5.221	12.5	3.903	19.4	3.174	26.3	2.697	33.2	2.355	40.1	2.096	47.0	1.891	53.9	1.724
5.7	5.194	12.6	3.890	19.5	3.166	26.4	2.692	33.3	2.351	40.2	2.093	47.1	1.888	54.0	1.722
5.8	5.167	12.7	3.876	19.6	3.158	26.5	2.686	33.4	2.347	40.3	2.089	47.2	1.885	54.1	1.720
5.9	5.140	12.8	3.863	19.7	3.150	26.6	2.680	33.5	2.343	40.4	2.088	47.3	1.883	54.2	1.717
6.0	5.114	12.9	3.850	19.8	3.141	26.7	2.675	33.6	2.339	40.5	2.083	47.4	1.880	54.3	1.715
6.1	5.089	13.0	3.837	19.9	3.133	26.8	2.669	33.7	2.334	40.6	2.079	47.5	1.878	54.4	1.713
6.2	5.063	13.1	3.824	20.0	3.125	26.9	2.663	33.8	2.330	40.7	2.076	47.6	1.875	54.5	1.711
6.3	5.038	13.2	3.811	20.1	3.117	27.0	2.658	33.9	2.326	40.8	2.073	47.7	1.872	54.6	1.709
6.4	5.013	13.3	3.799	20.2	3.109	27.1	2.652	34.0	2.322	40.9	2.070	47.8	1.870	54.7	1.707
6.5	4.989	13.4	3.786	20.3	3.101	27.2	2.647	34.1	2.318	41.0	2.066	47.9	1.867	54.8	1.704
6.6	4.964	13.5	3.774	20.4	3.094	27.3	2.641	34.2	2.314	41.1	2.063	48.0	1.864	54.9	1.702
6.7	4.940	13.6	3.761	20.5	3.086	27.4	2.636	34.3	2.309	41.2	2.060	48.1	1.862	55.0	1.700
6.8	4.917	13.7	3.749	20.6	3.078	27.5	2.630	34.4	2.305	41.3	2.057	48.2	1.859	55.1	1.698
6.9	4.893	13.8	3.737	20.7	3.070	27.6	2.625	34.5	2.301	41.4	2.054	48.3	1.857	55.2	1.696
7.0	4.870	13.9	3.725	20.8	3.062	27.7	2.619	34.6	2.297	41.5	2.050	48.4	1.854	55.3	1.694
7.1	4.847	14.0	3.713	20.9	3.055	27.8	2.614	34.7	2.293	41.6	2.047	48.5	1.852	55.4	1.692
7.2	4.824	14.1	3.701	21.0	3.047	27.9	2.609	34.8	2.289	41.7	2.044	48.6	1.849	55.5	1.690
7.3	4.802	14.2	3.689	21.1	3.040	28.0	2.603	34.9	2.285	41.8	2.041	48.7	1.847	55.6	1.687
7.4	4.780	14.3	3.677	21.2	3.032	28.1	2.598	35.0	2.281	41.9	2.038	48.8	1.844	55.7	1.685
7.5	4.758	14.4	3.665	21.3	3.025	28.2	2.593	35.1	2.277	42.0	2.035	48.9	1.841	55.8	1.683
7.6	4.736	14.5	3.654	21.4	3.017	28.3	2.587	35.2	2.273	42.1	2.032	49.0	1.839	55.9	1.681
7.7	4.715	14.6	3.642	21.5	3.010	28.4	2.582	35.3	2.269	42.2	2.029	49.1	1.836	56.0	1.679
7.8	4.694	14.7	3.631	21.6	3.003	28.5	2.577	35.4	2.265	42.3	2.025	49.2	1.834	56.1	1.677
7.9	4.673	14.8	3.620	21.7	2.995	28.6	2.572	35.5	2.262	42.4	2.022	49.3	1.831	56.2	1.675
8.0	4.652	14.9	3.608	21.8	2.988	28.7	2.567	35.6	2.258	42.5	2.019	49.4	1.829	56.3	1.673
8.1	4.632	15.0	3.597	21.9	2.981	28.8	2.561	35.7	2.254	42.6	2.016	49.5	1.827	56.4	1.671
8.2	4.611	15.1	3.586	22.0	2.974	28.9	2.556	35.8	2.250	42.7	2.013	49.6	1.824	56.5	1.669
8.3	4.591	15.2	3.575	22.1	2.966	29.0	2.551	35.9	2.246	42.8	2.010	49.7	1.822	56.6	1.667
8.4	4.571	15.3	3.564	22.2	2.959	29.1	2.546	36.0	2.242	42.9	2.007	49.8	1.819	56.7	1.665
8.5	4.552	15.4	3.553	22.3	2.952	29.2	2.541	36.1	2.238	43.0	2.004	49.9	1.817	56.8	1.663
8.6	4.532	15.5	3.543	22.4	2.945	29.3	2.536	36.2	2.234	43.1	2.001	50.0	1.814	56.9	1.661
8.7	4.513	15.6	3.532	22.5	2.938	29.4	2.531	36.3	2.231	43.2	1.998	50.1	1.812	57.0	1.659
8.8	4.494	15.7	3.521	22.6	2.931	29.5	2.526	36.4	2.227	43.3	1.995	50.2	1.809	57.1	1.657
8.9	4.475	15.8	3.511	22.7	2.924	29.6	2.521	36.5	2.223	43.4	1.992	50.3	1.807	57.2	1.654
9.0	4.456	15.9	3.500	22.8	2.917	29.7	2.516	36.6	2.219	43.5	1.989	50.4	1.804	57.3	1.652
9.1	4.438	16.0	3.490	22.9	2.911	29.8	2.511	36.7	2.216	43.6	1.986	50.5	1.802	57.4	1.650
9.2	4.420	16.1	3.479	23.0	2.904	29.9	2.506	36.8	2.212	43.7	1.983	50.6	1.800	57.5	1.648
9.3	4.402	16.2	3.469	23.1	2.897	30.0	2.501	36.9	2.208	43.8	1.980	50.7	1.797	57.6	1.646
9.4	4.384	16.3	3.459	23.2	2.890	30.1	2.497	37.0	2.204	43.9	1.977	50.8	1.795	57.7	1.644
9.5	4.366	16.4	3.449	23.3	2.884	30.2	2.492	37.1	2.201	44.0	1.974	50.9	1.792	57.8	1.642
9.6	4.348	16.5	3.439	23.4	2.877	30.3	2.487	37.2	2.197	44.1	1.972	51.0	1.790	57.9	1.641
9.7	4.331	16.6	3.429	23.5	2.870	30.4	2.482	37.3	2.193	44.2	1.969	51.1	1.788	58.0	1.639
9.8	4.314	16.7	3.419	23.6	2.864	30.5	2.477	37.4	2.190	44.3	1.968	51.2	1.785	58.1	1.637
9.9	4.297	16.8	3.409	23.7	2.857	30.6	2.473	37.5	2.186	44.4	1.963	51.3	1.783	58.2	1.635
10.0	4.280	16.9	3.399	23.8	2.851	30.7	2.468	37.6	2.183	44.5	1.960	51.4	1.781	58.3	1.633
10.1	4.263	17.0	3.390	23.9	2.844	30.8	2.463	37.7	2.179	44.6	1.957	51.5	1.778	58.4	1.631
10.2	4.246	17.1	3.380	24.0	2.838	30.9	2.458	37.8	2.175	44.7	1.954	51.6	1.776	58.5	1.629
10.3	4.230	17.2	3.370	24.1	2.831	31.0	2.454	37.9	2.172	44.8	1.951	51.7	1.774	58.6	1.627
10.4	4.214	17.3	3.361	24.2	2.825	31.1	2.449	38.0	2.168	44.9	1.949	51.8	1.771	58.7	1.625
10.5	4.198	17.4	3.351	24.3	2.818	31.2	2.444	38.1	2.165	45.0	1.946	51.9	1.769	58.8	1.623
10.6	4.182	17.5	3.342	24.4	2.812	31.3	2.440	38.2	2.161	45.1	1.943	52.0	1.767	58.9	1.621
10.7	4.166	17.6	3.333	24.5	2.806	31.4	2.435	38.3	2.157	45.2	1.940	52.1	1.764	59.0	1.619
10.8	4.150	17.7	3.323	24.6	2.799	31.5	2.431	38.4	2.154	45.3	1.937	52.2	1.762	59.1	1.617
10.9	4.134	17.8	3.314	24.7	2.793	31.6	2.426	38.5	2.150	45.4	1.934	52.3	1.760	59.2	1.615
11.0	4.119	17.9	3.305	24.8	2.787	31.7	2.422	38.6	2.147	45.5	1.932	52.4	1.757	59.3	1.613
11.1	4.104	18.0	3.296	24.9	2.781	31.8	2.417	38.7	2.143	45.6	1.929	52.5	1.755	59.4	1.611
11.2	4.089	18.1	3.287	25.0	2.775	31.9	2.412	38.8	2.140	45.7	1.926	52.6	1.753	59.5	1.609
11.3	4.074	18.2	3.278	25.1	2.769	32.0	2.408	38.9	2.137	45.8	1.923	52.7	1.751	59.6	1.608
11.4	4.059	18.3	3.269	25.2	2.762	32.1	2.404	39.0	2.133	45.9	1.921	52.8	1.748	59.7	1.606
11.5	4.044	18.4	3.260	25.3	2.756	32.2	2.399	39.1	2.130	46.0	1.918	52.9	1.746	59.8	1.604
11.6	4.029	18.5	3.251	25.4	2.750	32.3	2.395	39.2	2.126	46.1	1.915	53.0	1.744	59.9	1.602
11.7	4.015	18.6	3.243	25.5	2.744	32.4	2.390	39.3	2.123	46.2	1.912	53.1	1.742	60.0	1.600
11.8	4.000	18.7	3.234	25.6	2.738	32.5	2.386	39.4	2.119	46.3	1.910	53.2	1.739		

PA REGION 5 10-YEAR STORM															
Tc	INT	Tc	INT	Tc	INT	Tc	INT	Tc	INT	Tc	INT	Tc	INT	Tc	INT
5.0	6.016	11.9	4.429	18.8	3.601	25.7	3.070	32.6	2.692	39.5	2.407	46.4	2.181	53.3	1.998
5.1	5.982	12.0	4.413	18.9	3.591	25.8	3.063	32.7	2.687	39.6	2.403	46.5	2.178	53.4	1.996
5.2	5.948	12.1	4.398	19.0	3.582	25.9	3.057	32.8	2.683	39.7	2.399	46.6	2.176	53.5	1.993
5.3	5.914	12.2	4.382	19.1	3.573	26.0	3.051	32.9	2.678	39.8	2.396	46.7	2.173	53.6	1.991
5.4	5.881	12.3	4.367	19.2	3.564	26.1	3.044	33.0	2.673	39.9	2.392	46.8	2.170	53.7	1.989
5.5	5.849	12.4	4.352	19.3	3.555	26.2	3.038	33.1	2.669	40.0	2.389	46.9	2.167	53.8	1.986
5.6	5.817	12.5	4.338	19.4	3.546	26.3	3.032	33.2	2.664	40.1	2.385	47.0	2.164	53.9	1.984
5.7	5.786	12.6	4.323	19.5	3.537	26.4	3.026	33.3	2.660	40.2	2.381	47.1	2.161	54.0	1.981
5.8	5.754	12.7	4.308	19.6	3.528	26.5	3.019	33.4	2.655	40.3	2.378	47.2	2.158	54.1	1.979
5.9	5.724	12.8	4.294	19.7	3.519	26.6	3.013	33.5	2.651	40.4	2.374	47.3	2.155	54.2	1.977
6.0	5.694	12.9	4.279	19.8	3.510	26.7	3.007	33.6	2.646	40.5	2.371	47.4	2.153	54.3	1.974
6.1	5.664	13.0	4.265	19.9	3.501	26.8	3.001	33.7	2.641	40.6	2.367	47.5	2.150	54.4	1.972
6.2	5.635	13.1	4.251	20.0	3.493	26.9	2.995	33.8	2.637	40.7	2.364	47.6	2.147	54.5	1.970
6.3	5.606	13.2	4.237	20.1	3.484	27.0	2.989	33.9	2.633	40.8	2.360	47.7	2.144	54.6	1.967
6.4	5.577	13.3	4.223	20.2	3.475	27.1	2.983	34.0	2.628	40.9	2.357	47.8	2.141	54.7	1.965
6.5	5.549	13.4	4.210	20.3	3.467	27.2	2.977	34.1	2.624	41.0	2.353	47.9	2.138	54.8	1.963
6.6	5.521	13.5	4.196	20.4	3.458	27.3	2.971	34.2	2.619	41.1	2.350	48.0	2.136	54.9	1.960
6.7	5.494	13.6	4.182	20.5	3.450	27.4	2.965	34.3	2.615	41.2	2.346	48.1	2.133	55.0	1.958
6.8	5.467	13.7	4.169	20.6	3.442	27.5	2.960	34.4	2.610	41.3	2.343	48.2	2.130	55.1	1.956
6.9	5.440	13.8	4.156	20.7	3.433	27.6	2.954	34.5	2.606	41.4	2.340	48.3	2.127	55.2	1.953
7.0	5.414	13.9	4.142	20.8	3.425	27.7	2.948	34.6	2.602	41.5	2.336	48.4	2.125	55.3	1.951
7.1	5.388	14.0	4.129	20.9	3.417	27.8	2.942	34.7	2.597	41.6	2.333	48.5	2.122	55.4	1.949
7.2	5.362	14.1	4.116	21.0	3.409	27.9	2.936	34.8	2.593	41.7	2.329	48.6	2.119	55.5	1.947
7.3	5.337	14.2	4.103	21.1	3.400	28.0	2.931	34.9	2.589	41.8	2.326	48.7	2.116	55.6	1.944
7.4	5.312	14.3	4.091	21.2	3.392	28.1	2.925	35.0	2.584	41.9	2.323	48.8	2.114	55.7	1.942
7.5	5.287	14.4	4.078	21.3	3.384	28.2	2.919	35.1	2.580	42.0	2.319	48.9	2.111	55.8	1.940
7.6	5.262	14.5	4.065	21.4	3.376	28.3	2.914	35.2	2.576	42.1	2.316	49.0	2.108	55.9	1.938
7.7	5.238	14.6	4.053	21.5	3.368	28.4	2.908	35.3	2.572	42.2	2.313	49.1	2.105	56.0	1.935
7.8	5.214	14.7	4.040	21.6	3.360	28.5	2.902	35.4	2.567	42.3	2.309	49.2	2.103	56.1	1.933
7.9	5.191	14.8	4.028	21.7	3.352	28.6	2.897	35.5	2.563	42.4	2.306	49.3	2.100	56.2	1.931
8.0	5.167	14.9	4.016	21.8	3.345	28.7	2.891	35.6	2.559	42.5	2.303	49.4	2.097	56.3	1.929
8.1	5.144	15.0	4.004	21.9	3.337	28.8	2.886	35.7	2.555	42.6	2.299	49.5	2.095	56.4	1.926
8.2	5.122	15.1	3.992	22.0	3.329	28.9	2.880	35.8	2.551	42.7	2.296	49.6	2.092	56.5	1.924
8.3	5.099	15.2	3.980	22.1	3.321	29.0	2.875	35.9	2.546	42.8	2.293	49.7	2.089	56.6	1.922
8.4	5.077	15.3	3.968	22.2	3.314	29.1	2.869	36.0	2.542	42.9	2.289	49.8	2.087	56.7	1.920
8.5	5.055	15.4	3.956	22.3	3.306	29.2	2.864	36.1	2.538	43.0	2.286	49.9	2.084	56.8	1.917
8.6	5.033	15.5	3.944	22.4	3.298	29.3	2.858	36.2	2.534	43.1	2.283	50.0	2.081	56.9	1.915
8.7	5.012	15.6	3.933	22.5	3.291	29.4	2.853	36.3	2.530	43.2	2.280	50.1	2.079	57.0	1.913
8.8	4.990	15.7	3.921	22.6	3.283	29.5	2.848	36.4	2.526	43.3	2.276	50.2	2.076	57.1	1.911
8.9	4.969	15.8	3.910	22.7	3.276	29.6	2.842	36.5	2.522	43.4	2.273	50.3	2.073	57.2	1.909
9.0	4.948	15.9	3.898	22.8	3.269	29.7	2.837	36.6	2.518	43.5	2.270	50.4	2.071	57.3	1.907
9.1	4.928	16.0	3.887	22.9	3.261	29.8	2.832	36.7	2.514	43.6	2.267	50.5	2.068	57.4	1.904
9.2	4.907	16.1	3.876	23.0	3.254	29.9	2.826	36.8	2.510	43.7	2.264	50.6	2.066	57.5	1.902
9.3	4.887	16.2	3.865	23.1	3.247	30.0	2.821	36.9	2.506	43.8	2.261	50.7	2.063	57.6	1.900
9.4	4.867	16.3	3.854	23.2	3.239	30.1	2.816	37.0	2.502	43.9	2.257	50.8	2.060	57.7	1.898
9.5	4.848	16.4	3.843	23.3	3.232	30.2	2.811	37.1	2.498	44.0	2.254	50.9	2.058	57.8	1.896
9.6	4.828	16.5	3.832	23.4	3.225	30.3	2.806	37.2	2.494	44.1	2.251	51.0	2.055	57.9	1.894
9.7	4.809	16.6	3.821	23.5	3.218	30.4	2.800	37.3	2.490	44.2	2.248	51.1	2.053	58.0	1.891
9.8	4.790	16.7	3.810	23.6	3.211	30.5	2.795	37.4	2.486	44.3	2.245	51.2	2.050	58.1	1.889
9.9	4.771	16.8	3.800	23.7	3.204	30.6	2.790	37.5	2.482	44.4	2.242	51.3	2.048	58.2	1.887
10.0	4.752	16.9	3.789	23.8	3.197	30.7	2.785	37.6	2.478	44.5	2.239	51.4	2.045	58.3	1.885
10.1	4.733	17.0	3.778	23.9	3.190	30.8	2.780	37.7	2.474	44.6	2.235	51.5	2.043	58.4	1.883
10.2	4.715	17.1	3.768	24.0	3.183	30.9	2.775	37.8	2.470	44.7	2.232	51.6	2.040	58.5	1.881
10.3	4.697	17.2	3.758	24.1	3.176	31.0	2.770	37.9	2.467	44.8	2.229	51.7	2.038	58.6	1.879
10.4	4.679	17.3	3.747	24.2	3.169	31.1	2.765	38.0	2.463	44.9	2.226	51.8	2.035	58.7	1.877
10.5	4.661	17.4	3.737	24.3	3.162	31.2	2.760	38.1	2.459	45.0	2.223	51.9	2.033	58.8	1.874
10.6	4.643	17.5	3.727	24.4	3.155	31.3	2.755	38.2	2.455	45.1	2.220	52.0	2.030	58.9	1.872
10.7	4.626	17.6	3.717	24.5	3.148	31.4	2.750	38.3	2.451	45.2	2.217	52.1	2.028	59.0	1.870
10.8	4.609	17.7	3.707	24.6	3.142	31.5	2.745	38.4	2.447	45.3	2.214	52.2	2.025	59.1	1.868
10.9	4.592	17.8	3.697	24.7	3.135	31.6	2.740	38.5	2.444	45.4	2.211	52.3	2.023	59.2	1.866
11.0	4.575	17.9	3.687	24.8	3.128	31.7	2.735	38.6	2.440	45.5	2.208	52.4	2.020	59.3	1.864
11.1	4.558	18.0	3.677	24.9	3.122	31.8	2.730	38.7	2.436	45.6	2.205	52.5	2.018	59.4	1.862
11.2	4.541	18.1	3.667	25.0	3.115	31.9	2.725	38.8	2.432	45.7	2.202	52.6	2.015	59.5	1.860
11.3	4.525	18.2	3.658	25.1	3.108	32.0	2.721	38.9	2.429	45.8	2.199	52.7	2.013	59.6	1.858
11.4	4.508	18.3	3.648	25.2	3.102	32.1	2.716	39.0	2.425	45.9	2.196	52.8	2.010	59.7	1.856
11.5	4.492	18.4	3.638	25.3	3.095	32.2	2.711	39.1	2.421	46.0	2.193	52.9	2.008	59.8	1.854
11.6	4.476	18.5	3.629	25.4	3.089	32.3	2.706	39.2	2.418	46.1	2.190	53.0	2.005	59.9	1.852
11.7	4.460	18.6	3.619	25.5	3.082	32.4	2.702	39.3	2.414	46.2	2.187	53.1	2.003	60.0	1.850
11.8	4.444	18.7	3.610	25.6	3.076	32.5	2.697	39.4	2.410	46.3	2.184	53.2	2.001		

PA REGION 5 25-YEAR STORM															
Tc	INT	Tc	INT	Tc	INT	Tc	INT	Tc	INT	Tc	INT	Tc	INT	Tc	INT
5.0	6.702	11.9	5.063	18.8	4.153	25.7	3.555	32.6	3.124	39.5	2.796	46.4	2.535	53.3	2.322
5.1	6.669	12.0	5.046	18.9	4.142	25.8	3.548	32.7	3.119	39.6	2.791	46.5	2.532	53.4	2.319
5.2	6.636	12.1	5.030	19.0	4.132	25.9	3.540	32.8	3.113	39.7	2.787	46.6	2.528	53.5	2.316
5.3	6.603	12.2	5.013	19.1	4.122	26.0	3.533	32.9	3.108	39.8	2.783	46.7	2.525	53.6	2.314
5.4	6.571	12.3	4.997	19.2	4.112	26.1	3.526	33.0	3.103	39.9	2.779	46.8	2.522	53.7	2.311
5.5	6.539	12.4	4.981	19.3	4.102	26.2	3.519	33.1	3.097	40.0	2.775	46.9	2.518	53.8	2.308
5.6	6.507	12.5	4.965	19.4	4.091	26.3	3.512	33.2	3.092	40.1	2.771	47.0	2.515	53.9	2.305
5.7	6.476	12.6	4.949	19.5	4.081	26.4	3.505	33.3	3.087	40.2	2.767	47.1	2.511	54.0	2.303
5.8	6.445	12.7	4.933	19.6	4.071	26.5	3.498	33.4	3.082	40.3	2.762	47.2	2.508	54.1	2.300
5.9	6.415	12.8	4.917	19.7	4.062	26.6	3.491	33.5	3.076	40.4	2.758	47.3	2.505	54.2	2.297
6.0	6.384	12.9	4.901	19.8	4.052	26.7	3.484	33.6	3.071	40.5	2.754	47.4	2.502	54.3	2.294
6.1	6.355	13.0	4.886	19.9	4.042	26.8	3.477	33.7	3.066	40.6	2.750	47.5	2.498	54.4	2.292
6.2	6.325	13.1	4.871	20.0	4.032	26.9	3.470	33.8	3.061	40.7	2.746	47.6	2.495	54.5	2.289
6.3	6.296	13.2	4.855	20.1	4.022	27.0	3.464	33.9	3.056	40.8	2.742	47.7	2.492	54.6	2.286
6.4	6.267	13.3	4.840	20.2	4.013	27.1	3.457	34.0	3.051	40.9	2.738	47.8	2.488	54.7	2.283
6.5	6.239	13.4	4.825	20.3	4.003	27.2	3.450	34.1	3.046	41.0	2.734	47.9	2.485	54.8	2.281
6.6	6.211	13.5	4.810	20.4	3.994	27.3	3.443	34.2	3.040	41.1	2.730	48.0	2.482	54.9	2.278
6.7	6.183	13.6	4.796	20.5	3.984	27.4	3.437	34.3	3.035	41.2	2.726	48.1	2.479	55.0	2.275
6.8	6.155	13.7	4.781	20.6	3.975	27.5	3.430	34.4	3.030	41.3	2.722	48.2	2.475	55.1	2.273
6.9	6.128	13.8	4.766	20.7	3.966	27.6	3.423	34.5	3.025	41.4	2.718	48.3	2.472	55.2	2.270
7.0	6.101	13.9	4.752	20.8	3.956	27.7	3.417	34.6	3.020	41.5	2.714	48.4	2.469	55.3	2.267
7.1	6.074	14.0	4.738	20.9	3.947	27.8	3.410	34.7	3.015	41.6	2.710	48.5	2.466	55.4	2.265
7.2	6.048	14.1	4.723	21.0	3.938	27.9	3.403	34.8	3.010	41.7	2.706	48.6	2.463	55.5	2.262
7.3	6.022	14.2	4.709	21.1	3.929	28.0	3.397	34.9	3.005	41.8	2.702	48.7	2.459	55.6	2.259
7.4	5.996	14.3	4.695	21.2	3.919	28.1	3.390	35.0	3.001	41.9	2.699	48.8	2.456	55.7	2.257
7.5	5.971	14.4	4.681	21.3	3.910	28.2	3.384	35.1	2.996	42.0	2.695	48.9	2.453	55.8	2.254
7.6	5.945	14.5	4.667	21.4	3.901	28.3	3.377	35.2	2.991	42.1	2.691	49.0	2.450	55.9	2.251
7.7	5.920	14.6	4.654	21.5	3.892	28.4	3.371	35.3	2.986	42.2	2.687	49.1	2.447	56.0	2.249
7.8	5.896	14.7	4.640	21.6	3.884	28.5	3.365	35.4	2.981	42.3	2.683	49.2	2.444	56.1	2.246
7.9	5.871	14.8	4.626	21.7	3.875	28.6	3.358	35.5	2.976	42.4	2.679	49.3	2.441	56.2	2.244
8.0	5.847	14.9	4.613	21.8	3.866	28.7	3.352	35.6	2.971	42.5	2.675	49.4	2.437	56.3	2.241
8.1	5.823	15.0	4.600	21.9	3.857	28.8	3.346	35.7	2.966	42.6	2.672	49.5	2.434	56.4	2.238
8.2	5.799	15.1	4.586	22.0	3.848	28.9	3.339	35.8	2.962	42.7	2.668	49.6	2.431	56.5	2.236
8.3	5.776	15.2	4.573	22.1	3.840	29.0	3.333	35.9	2.957	42.8	2.664	49.7	2.428	56.6	2.233
8.4	5.753	15.3	4.560	22.2	3.831	29.1	3.327	36.0	2.952	42.9	2.660	49.8	2.425	56.7	2.231
8.5	5.730	15.4	4.547	22.3	3.822	29.2	3.321	36.1	2.947	43.0	2.656	49.9	2.422	56.8	2.228
8.6	5.707	15.5	4.534	22.4	3.814	29.3	3.314	36.2	2.943	43.1	2.653	50.0	2.419	56.9	2.226
8.7	5.684	15.6	4.522	22.5	3.805	29.4	3.308	36.3	2.938	43.2	2.649	50.1	2.416	57.0	2.223
8.8	5.662	15.7	4.509	22.6	3.797	29.5	3.302	36.4	2.933	43.3	2.645	50.2	2.413	57.1	2.220
8.9	5.640	15.8	4.496	22.7	3.789	29.6	3.296	36.5	2.929	43.4	2.642	50.3	2.410	57.2	2.218
9.0	5.618	15.9	4.484	22.8	3.780	29.7	3.290	36.6	2.924	43.5	2.638	50.4	2.407	57.3	2.215
9.1	5.596	16.0	4.471	22.9	3.772	29.8	3.284	36.7	2.919	43.6	2.634	50.5	2.404	57.4	2.213
9.2	5.575	16.1	4.459	23.0	3.764	29.9	3.278	36.8	2.915	43.7	2.630	50.6	2.401	57.5	2.210
9.3	5.554	16.2	4.446	23.1	3.755	30.0	3.272	36.9	2.910	43.8	2.627	50.7	2.398	57.6	2.208
9.4	5.532	16.3	4.434	23.2	3.747	30.1	3.266	37.0	2.905	43.9	2.623	50.8	2.395	57.7	2.205
9.5	5.512	16.4	4.422	23.3	3.739	30.2	3.260	37.1	2.901	44.0	2.619	50.9	2.392	57.8	2.203
9.6	5.491	16.5	4.410	23.4	3.731	30.3	3.254	37.2	2.896	44.1	2.616	51.0	2.389	57.9	2.200
9.7	5.470	16.6	4.398	23.5	3.723	30.4	3.248	37.3	2.892	44.2	2.612	51.1	2.386	58.0	2.198
9.8	5.450	16.7	4.386	23.6	3.715	30.5	3.242	37.4	2.887	44.3	2.609	51.2	2.383	58.1	2.195
9.9	5.430	16.8	4.374	23.7	3.707	30.6	3.236	37.5	2.883	44.4	2.605	51.3	2.380	58.2	2.193
10.0	5.410	16.9	4.363	23.8	3.699	30.7	3.231	37.6	2.878	44.5	2.601	51.4	2.377	58.3	2.190
10.1	5.390	17.0	4.351	23.9	3.691	30.8	3.225	37.7	2.874	44.6	2.598	51.5	2.374	58.4	2.188
10.2	5.371	17.1	4.339	24.0	3.683	30.9	3.219	37.8	2.869	44.7	2.594	51.6	2.371	58.5	2.185
10.3	5.351	17.2	4.328	24.1	3.675	31.0	3.213	37.9	2.865	44.8	2.591	51.7	2.368	58.6	2.183
10.4	5.332	17.3	4.316	24.2	3.667	31.1	3.208	38.0	2.860	44.9	2.587	51.8	2.365	58.7	2.180
10.5	5.313	17.4	4.305	24.3	3.660	31.2	3.202	38.1	2.856	45.0	2.584	51.9	2.362	58.8	2.178
10.6	5.294	17.5	4.294	24.4	3.652	31.3	3.196	38.2	2.852	45.1	2.580	52.0	2.359	58.9	2.175
10.7	5.276	17.6	4.282	24.5	3.644	31.4	3.190	38.3	2.847	45.2	2.576	52.1	2.356	59.0	2.173
10.8	5.257	17.7	4.271	24.6	3.637	31.5	3.185	38.4	2.843	45.3	2.573	52.2	2.353	59.1	2.171
10.9	5.239	17.8	4.260	24.7	3.629	31.6	3.179	38.5	2.838	45.4	2.569	52.3	2.351	59.2	2.168
11.0	5.220	17.9	4.249	24.8	3.621	31.7	3.174	38.6	2.834	45.5	2.566	52.4	2.348	59.3	2.166
11.1	5.202	18.0	4.238	24.9	3.614	31.8	3.168	38.7	2.830	45.6	2.562	52.5	2.345	59.4	2.163
11.2	5.184	18.1	4.227	25.0	3.606	31.9	3.162	38.8	2.825	45.7	2.559	52.6	2.342	59.5	2.161
11.3	5.167	18.2	4.216	25.1	3.599	32.0	3.157	38.9	2.821	45.8	2.556	52.7	2.339	59.6	2.159
11.4	5.149	18.3	4.206	25.2	3.591	32.1	3.151	39.0	2.817	45.9	2.552	52.8	2.336	59.7	2.156
11.5	5.132	18.4	4.195	25.3	3.584	32.2	3.146	39.1	2.813	46.0	2.549	52.9	2.333	59.8	2.154
11.6	5.114	18.5	4.184	25.4	3.577	32.3	3.140	39.2	2.808	46.1	2.545	53.0	2.331	59.9	2.151
11.7	5.097	18.6	4.174	25.5	3.569	32.4	3.135	39.3	2.804	46.2	2.542	53.1	2.328	60.0	2.149
11.8	5.080	18.7	4.163	25.6	3.562	32.5	3.130	39.4	2.800	46.3	2.538	53.2	2.325		

PA REGION 5 50-YEAR STORM															
Tc	INT	Tc	INT	Tc	INT	Tc	INT	Tc	INT	Tc	INT	Tc	INT	Tc	INT
5.0	7.505	11.9	5.900	18.8	4.915	25.7	4.243	32.6	3.748	39.5	3.366	46.4	3.060	53.3	2.807
5.1	7.475	12.0	5.882	18.9	4.903	25.8	4.235	32.7	3.742	39.6	3.361	46.5	3.056	53.4	2.804
5.2	7.446	12.1	5.864	19.0	4.892	25.9	4.226	32.8	3.736	39.7	3.356	46.6	3.052	53.5	2.801
5.3	7.416	12.2	5.847	19.1	4.880	26.0	4.218	32.9	3.730	39.8	3.351	46.7	3.048	53.6	2.797
5.4	7.387	12.3	5.830	19.2	4.869	26.1	4.210	33.0	3.724	39.9	3.346	46.8	3.044	53.7	2.794
5.5	7.358	12.4	5.812	19.3	4.858	26.2	4.202	33.1	3.718	40.0	3.342	46.9	3.040	53.8	2.791
5.6	7.330	12.5	5.795	19.4	4.847	26.3	4.194	33.2	3.711	40.1	3.337	47.0	3.036	53.9	2.788
5.7	7.301	12.6	5.779	19.5	4.835	26.4	4.186	33.3	3.705	40.2	3.332	47.1	3.032	54.0	2.784
5.8	7.273	12.7	5.762	19.6	4.824	26.5	4.178	33.4	3.699	40.3	3.327	47.2	3.028	54.1	2.781
5.9	7.245	12.8	5.745	19.7	4.813	26.6	4.170	33.5	3.693	40.4	3.322	47.3	3.024	54.2	2.778
6.0	7.217	12.9	5.728	19.8	4.802	26.7	4.162	33.6	3.687	40.5	3.318	47.4	3.020	54.3	2.774
6.1	7.189	13.0	5.712	19.9	4.791	26.8	4.154	33.7	3.681	40.6	3.313	47.5	3.016	54.4	2.771
6.2	7.162	13.1	5.696	20.0	4.781	26.9	4.146	33.8	3.675	40.7	3.308	47.6	3.012	54.5	2.768
6.3	7.134	13.2	5.679	20.1	4.770	27.0	4.139	33.9	3.669	40.8	3.303	47.7	3.008	54.6	2.765
6.4	7.107	13.3	5.663	20.2	4.759	27.1	4.131	34.0	3.663	40.9	3.299	47.8	3.005	54.7	2.762
6.5	7.080	13.4	5.647	20.3	4.748	27.2	4.123	34.1	3.657	41.0	3.294	47.9	3.001	54.8	2.758
6.6	7.054	13.5	5.631	20.4	4.738	27.3	4.115	34.2	3.651	41.1	3.289	48.0	2.997	54.9	2.755
6.7	7.027	13.6	5.615	20.5	4.727	27.4	4.108	34.3	3.646	41.2	3.285	48.1	2.993	55.0	2.752
6.8	7.001	13.7	5.600	20.6	4.717	27.5	4.100	34.4	3.640	41.3	3.280	48.2	2.989	55.1	2.749
6.9	6.975	13.8	5.584	20.7	4.706	27.6	4.092	34.5	3.634	41.4	3.275	48.3	2.985	55.2	2.746
7.0	6.949	13.9	5.569	20.8	4.696	27.7	4.085	34.6	3.628	41.5	3.271	48.4	2.982	55.3	2.742
7.1	6.923	14.0	5.553	20.9	4.685	27.8	4.077	34.7	3.622	41.6	3.266	48.5	2.978	55.4	2.739
7.2	6.898	14.1	5.538	21.0	4.675	27.9	4.070	34.8	3.616	41.7	3.261	48.6	2.974	55.5	2.736
7.3	6.872	14.2	5.523	21.1	4.665	28.0	4.062	34.9	3.611	41.8	3.257	48.7	2.970	55.6	2.733
7.4	6.847	14.3	5.508	21.2	4.655	28.1	4.055	35.0	3.605	41.9	3.252	48.8	2.967	55.7	2.730
7.5	6.822	14.4	5.493	21.3	4.644	28.2	4.047	35.1	3.599	42.0	3.248	48.9	2.963	55.8	2.727
7.6	6.798	14.5	5.478	21.4	4.634	28.3	4.040	35.2	3.594	42.1	3.243	49.0	2.959	55.9	2.723
7.7	6.773	14.6	5.463	21.5	4.624	28.4	4.033	35.3	3.588	42.2	3.239	49.1	2.955	56.0	2.720
7.8	6.749	14.7	5.448	21.6	4.614	28.5	4.025	35.4	3.582	42.3	3.234	49.2	2.952	56.1	2.717
7.9	6.725	14.8	5.433	21.7	4.604	28.6	4.018	35.5	3.577	42.4	3.229	49.3	2.948	56.2	2.714
8.0	6.701	14.9	5.419	21.8	4.594	28.7	4.011	35.6	3.571	42.5	3.225	49.4	2.944	56.3	2.711
8.1	6.677	15.0	5.404	21.9	4.585	28.8	4.004	35.7	3.565	42.6	3.221	49.5	2.941	56.4	2.708
8.2	6.654	15.1	5.390	22.0	4.575	28.9	3.996	35.8	3.560	42.7	3.216	49.6	2.937	56.5	2.705
8.3	6.630	15.2	5.376	22.1	4.565	29.0	3.989	35.9	3.554	42.8	3.212	49.7	2.933	56.6	2.702
8.4	6.607	15.3	5.362	22.2	4.555	29.1	3.982	36.0	3.549	42.9	3.207	49.8	2.930	56.7	2.699
8.5	6.584	15.4	5.347	22.3	4.546	29.2	3.975	36.1	3.543	43.0	3.203	49.9	2.926	56.8	2.696
8.6	6.561	15.5	5.333	22.4	4.536	29.3	3.968	36.2	3.538	43.1	3.198	50.0	2.922	56.9	2.693
8.7	6.539	15.6	5.320	22.5	4.526	29.4	3.961	36.3	3.532	43.2	3.194	50.1	2.919	57.0	2.689
8.8	6.516	15.7	5.306	22.6	4.517	29.5	3.954	36.4	3.527	43.3	3.190	50.2	2.915	57.1	2.686
8.9	6.494	15.8	5.292	22.7	4.507	29.6	3.947	36.5	3.521	43.4	3.185	50.3	2.911	57.2	2.683
9.0	6.472	15.9	5.278	22.8	4.498	29.7	3.940	36.6	3.516	43.5	3.181	50.4	2.908	57.3	2.680
9.1	6.450	16.0	5.265	22.9	4.489	29.8	3.933	36.7	3.510	43.6	3.176	50.5	2.904	57.4	2.677
9.2	6.428	16.1	5.251	23.0	4.479	29.9	3.926	36.8	3.505	43.7	3.172	50.6	2.901	57.5	2.674
9.3	6.407	16.2	5.238	23.1	4.470	30.0	3.919	36.9	3.500	43.8	3.168	50.7	2.897	57.6	2.671
9.4	6.385	16.3	5.224	23.2	4.461	30.1	3.912	37.0	3.494	43.9	3.163	50.8	2.894	57.7	2.668
9.5	6.364	16.4	5.211	23.3	4.452	30.2	3.905	37.1	3.489	44.0	3.159	50.9	2.890	57.8	2.665
9.6	6.343	16.5	5.198	23.4	4.442	30.3	3.898	37.2	3.484	44.1	3.155	51.0	2.886	57.9	2.662
9.7	6.322	16.6	5.185	23.5	4.433	30.4	3.892	37.3	3.478	44.2	3.151	51.1	2.883	58.0	2.659
9.8	6.301	16.7	5.172	23.6	4.424	30.5	3.885	37.4	3.473	44.3	3.146	51.2	2.879	58.1	2.656
9.9	6.281	16.8	5.159	23.7	4.415	30.6	3.878	37.5	3.468	44.4	3.142	51.3	2.876	58.2	2.653
10.0	6.260	16.9	5.148	23.8	4.406	30.7	3.871	37.6	3.463	44.5	3.138	51.4	2.872	58.3	2.651
10.1	6.240	17.0	5.133	23.9	4.397	30.8	3.865	37.7	3.457	44.6	3.134	51.5	2.869	58.4	2.648
10.2	6.220	17.1	5.120	24.0	4.388	30.9	3.858	37.8	3.452	44.7	3.129	51.6	2.865	58.5	2.645
10.3	6.200	17.2	5.108	24.1	4.379	31.0	3.851	37.9	3.447	44.8	3.125	51.7	2.862	58.6	2.642
10.4	6.180	17.3	5.095	24.2	4.371	31.1	3.845	38.0	3.442	44.9	3.121	51.8	2.858	58.7	2.639
10.5	6.160	17.4	5.083	24.3	4.362	31.2	3.838	38.1	3.437	45.0	3.117	51.9	2.855	58.8	2.636
10.6	6.141	17.5	5.070	24.4	4.353	31.3	3.832	38.2	3.431	45.1	3.113	52.0	2.852	58.9	2.633
10.7	6.122	17.6	5.058	24.5	4.344	31.4	3.825	38.3	3.426	45.2	3.109	52.1	2.848	59.0	2.630
10.8	6.102	17.7	5.046	24.6	4.336	31.5	3.818	38.4	3.421	45.3	3.104	52.2	2.845	59.1	2.627
10.9	6.083	17.8	5.033	24.7	4.327	31.6	3.812	38.5	3.416	45.4	3.100	52.3	2.841	59.2	2.624
11.0	6.064	17.9	5.021	24.8	4.318	31.7	3.806	38.6	3.411	45.5	3.096	52.4	2.838	59.3	2.621
11.1	6.045	18.0	5.009	24.9	4.310	31.8	3.799	38.7	3.406	45.6	3.092	52.5	2.834	59.4	2.618
11.2	6.027	18.1	4.997	25.0	4.301	31.9	3.793	38.8	3.401	45.7	3.088	52.6	2.831	59.5	2.616
11.3	6.008	18.2	4.985	25.1	4.293	32.0	3.786	38.9	3.396	45.8	3.084	52.7	2.828	59.6	2.613
11.4	5.990	18.3	4.973	25.2	4.284	32.1	3.780	39.0	3.391	45.9	3.080	52.8	2.824	59.7	2.610
11.5	5.971	18.4	4.961	25.3	4.276	32.2	3.774	39.1	3.386	46.0	3.076	52.9	2.821	59.8	2.607
11.6	5.953	18.5	4.950	25.4	4.268	32.3	3.767	39.2	3.381	46.1	3.072	53.0	2.817	59.9	2.604
11.7	5.935	18.6	4.938	25.5	4.259	32.4	3.761	39.3	3.376	46.2	3.068	53.1	2.814	60.0	2.601
11.8	5.917	18.7	4.926	25.6	4.251	32.5	3.755	39.4	3.371	46.3	3.064	53.2	2.811		

PA REGION 5 100-YEAR STORM

Tc	INT	Tc	INT	Tc	INT	Tc	INT	Tc	INT	Tc	INT	Tc	INT	Tc	INT
5.0	8.190	11.9	6.521	18.8	5.479	25.7	4.761	32.6	4.229	39.5	3.815	46.4	3.482	53.3	3.206
5.1	8.160	12.0	6.503	18.9	5.467	25.8	4.752	32.7	4.222	39.6	3.810	46.5	3.477	53.4	3.203
5.2	8.130	12.1	6.484	19.0	5.455	25.9	4.743	32.8	4.216	39.7	3.804	46.6	3.473	53.5	3.199
5.3	8.100	12.2	6.466	19.1	5.442	26.0	4.735	32.9	4.209	39.8	3.799	46.7	3.469	53.6	3.195
5.4	8.070	12.3	6.448	19.2	5.430	26.1	4.726	33.0	4.202	39.9	3.794	46.8	3.464	53.7	3.192
5.5	8.040	12.4	6.430	19.3	5.418	26.2	4.717	33.1	4.196	40.0	3.789	46.9	3.460	53.8	3.188
5.6	8.011	12.5	6.412	19.4	5.406	26.3	4.709	33.2	4.189	40.1	3.783	47.0	3.456	53.9	3.185
5.7	7.981	12.6	6.394	19.5	5.395	26.4	4.700	33.3	4.182	40.2	3.778	47.1	3.451	54.0	3.181
5.8	7.952	12.7	6.376	19.6	5.383	26.5	4.692	33.4	4.176	40.3	3.773	47.2	3.447	54.1	3.177
5.9	7.923	12.8	6.358	19.7	5.371	26.6	4.683	33.5	4.169	40.4	3.768	47.3	3.443	54.2	3.174
6.0	7.894	12.9	6.341	19.8	5.359	26.7	4.675	33.6	4.163	40.5	3.762	47.4	3.439	54.3	3.170
6.1	7.866	13.0	6.324	19.9	5.348	26.8	4.666	33.7	4.156	40.6	3.757	47.5	3.434	54.4	3.167
6.2	7.837	13.1	6.306	20.0	5.336	26.9	4.658	33.8	4.150	40.7	3.752	47.6	3.430	54.5	3.163
6.3	7.809	13.2	6.289	20.1	5.325	27.0	4.649	33.9	4.143	40.8	3.747	47.7	3.426	54.6	3.160
6.4	7.781	13.3	6.272	20.2	5.313	27.1	4.641	34.0	4.137	40.9	3.742	47.8	3.422	54.7	3.156
6.5	7.753	13.4	6.255	20.3	5.302	27.2	4.633	34.1	4.131	41.0	3.737	47.9	3.418	54.8	3.153
6.6	7.726	13.5	6.238	20.4	5.290	27.3	4.624	34.2	4.124	41.1	3.732	48.0	3.413	54.9	3.149
6.7	7.698	13.6	6.222	20.5	5.279	27.4	4.616	34.3	4.118	41.2	3.727	48.1	3.409	55.0	3.145
6.8	7.671	13.7	6.205	20.6	5.268	27.5	4.608	34.4	4.112	41.3	3.722	48.2	3.405	55.1	3.142
6.9	7.644	13.8	6.189	20.7	5.257	27.6	4.600	34.5	4.105	41.4	3.716	48.3	3.401	55.2	3.138
7.0	7.617	13.9	6.172	20.8	5.246	27.7	4.592	34.6	4.099	41.5	3.711	48.4	3.397	55.3	3.135
7.1	7.591	14.0	6.156	20.9	5.235	27.8	4.583	34.7	4.093	41.6	3.706	48.5	3.393	55.4	3.132
7.2	7.564	14.1	6.140	21.0	5.224	27.9	4.575	34.8	4.086	41.7	3.701	48.6	3.388	55.5	3.128
7.3	7.538	14.2	6.124	21.1	5.213	28.0	4.567	34.9	4.080	41.8	3.696	48.7	3.384	55.6	3.125
7.4	7.512	14.3	6.108	21.2	5.202	28.1	4.559	35.0	4.074	41.9	3.691	48.8	3.380	55.7	3.121
7.5	7.486	14.4	6.092	21.3	5.191	28.2	4.551	35.1	4.068	42.0	3.686	48.9	3.376	55.8	3.118
7.6	7.460	14.5	6.076	21.4	5.180	28.3	4.543	35.2	4.062	42.1	3.682	49.0	3.372	55.9	3.114
7.7	7.435	14.6	6.060	21.5	5.169	28.4	4.535	35.3	4.056	42.2	3.677	49.1	3.368	56.0	3.111
7.8	7.410	14.7	6.045	21.6	5.159	28.5	4.528	35.4	4.049	42.3	3.672	49.2	3.364	56.1	3.107
7.9	7.385	14.8	6.029	21.7	5.148	28.6	4.520	35.5	4.043	42.4	3.667	49.3	3.360	56.2	3.104
8.0	7.360	14.9	6.014	21.8	5.138	28.7	4.512	35.6	4.037	42.5	3.662	49.4	3.356	56.3	3.101
8.1	7.335	15.0	5.999	21.9	5.127	28.8	4.504	35.7	4.031	42.6	3.657	49.5	3.352	56.4	3.097
8.2	7.311	15.1	5.984	22.0	5.117	28.9	4.496	35.8	4.025	42.7	3.652	49.6	3.348	56.5	3.094
8.3	7.286	15.2	5.968	22.1	5.106	29.0	4.489	35.9	4.019	42.8	3.647	49.7	3.344	56.6	3.090
8.4	7.262	15.3	5.953	22.2	5.096	29.1	4.481	36.0	4.013	42.9	3.642	49.8	3.340	56.7	3.087
8.5	7.238	15.4	5.939	22.3	5.085	29.2	4.473	36.1	4.007	43.0	3.638	49.9	3.336	56.8	3.084
8.6	7.214	15.5	5.924	22.4	5.075	29.3	4.466	36.2	4.001	43.1	3.633	50.0	3.332	56.9	3.080
8.7	7.191	15.6	5.909	22.5	5.065	29.4	4.458	36.3	3.995	43.2	3.628	50.1	3.328	57.0	3.077
8.8	7.167	15.7	5.894	22.6	5.055	29.5	4.450	36.4	3.989	43.3	3.623	50.2	3.324	57.1	3.074
8.9	7.144	15.8	5.880	22.7	5.045	29.6	4.443	36.5	3.983	43.4	3.619	50.3	3.320	57.2	3.070
9.0	7.121	15.9	5.865	22.8	5.035	29.7	4.435	36.6	3.978	43.5	3.614	50.4	3.316	57.3	3.067
9.1	7.098	16.0	5.851	22.9	5.024	29.8	4.428	36.7	3.972	43.6	3.609	50.5	3.312	57.4	3.064
9.2	7.076	16.1	5.836	23.0	5.014	29.9	4.420	36.8	3.966	43.7	3.604	50.6	3.308	57.5	3.060
9.3	7.053	16.2	5.822	23.1	5.005	30.0	4.413	36.9	3.960	43.8	3.600	50.7	3.304	57.6	3.057
9.4	7.031	16.3	5.808	23.2	4.995	30.1	4.406	37.0	3.954	43.9	3.595	50.8	3.300	57.7	3.054
9.5	7.008	16.4	5.794	23.3	4.985	30.2	4.398	37.1	3.948	44.0	3.590	50.9	3.297	57.8	3.051
9.6	6.986	16.5	5.780	23.4	4.975	30.3	4.391	37.2	3.943	44.1	3.586	51.0	3.293	57.9	3.047
9.7	6.965	16.6	5.766	23.5	4.965	30.4	4.383	37.3	3.937	44.2	3.581	51.1	3.289	58.0	3.044
9.8	6.943	16.7	5.752	23.6	4.955	30.5	4.376	37.4	3.931	44.3	3.576	51.2	3.285	58.1	3.041
9.9	6.921	16.8	5.739	23.7	4.946	30.6	4.369	37.5	3.926	44.4	3.572	51.3	3.281	58.2	3.038
10.0	6.900	16.9	5.725	23.8	4.936	30.7	4.362	37.6	3.920	44.5	3.567	51.4	3.277	58.3	3.034
10.1	6.879	17.0	5.711	23.9	4.927	30.8	4.354	37.7	3.914	44.6	3.562	51.5	3.273	58.4	3.031
10.2	6.858	17.1	5.698	24.0	4.917	30.9	4.347	37.8	3.909	44.7	3.558	51.6	3.270	58.5	3.028
10.3	6.837	17.2	5.684	24.1	4.908	31.0	4.340	37.9	3.903	44.8	3.553	51.7	3.266	58.6	3.025
10.4	6.816	17.3	5.671	24.2	4.898	31.1	4.333	38.0	3.897	44.9	3.549	51.8	3.262	58.7	3.021
10.5	6.795	17.4	5.658	24.3	4.889	31.2	4.326	38.1	3.892	45.0	3.544	51.9	3.258	58.8	3.018
10.6	6.775	17.5	5.644	24.4	4.879	31.3	4.319	38.2	3.886	45.1	3.540	52.0	3.255	58.9	3.015
10.7	6.754	17.6	5.631	24.5	4.870	31.4	4.312	38.3	3.881	45.2	3.535	52.1	3.251	59.0	3.012
10.8	6.734	17.7	5.618	24.6	4.861	31.5	4.305	38.4	3.875	45.3	3.531	52.2	3.247	59.1	3.009
10.9	6.714	17.8	5.605	24.7	4.851	31.6	4.298	38.5	3.869	45.4	3.526	52.3	3.243	59.2	3.005
11.0	6.694	17.9	5.592	24.8	4.842	31.7	4.291	38.6	3.864	45.5	3.522	52.4	3.240	59.3	3.002
11.1	6.674	18.0	5.579	24.9	4.833	31.8	4.284	38.7	3.858	45.6	3.517	52.5	3.236	59.4	2.999
11.2	6.655	18.1	5.567	25.0	4.824	31.9	4.277	38.8	3.853	45.7	3.513	52.6	3.232	59.5	2.996
11.3	6.635	18.2	5.554	25.1	4.815	32.0	4.270	38.9	3.848	45.8	3.508	52.7	3.228	59.6	2.993
11.4	6.616	18.3	5.541	25.2	4.806	32.1	4.263	39.0	3.842	45.9	3.504	52.8	3.225	59.7	2.990
11.5	6.597	18.4	5.529	25.3	4.797	32.2	4.256	39.1	3.837	46.0	3.499	52.9	3.221	59.8	2.986
11.6	6.578	18.5	5.516	25.4	4.788	32.3	4.249	39.2	3.831	46.1	3.495	53.0	3.217	59.9	2.983
11.7	6.559	18.6	5.504	25.5	4.779	32.4	4.243	39.3	3.826	46.2	3.491	53.1	3.214	60.0	2.980
11.8	6.540	18.7	5.491	25.6	4.770	32.5	4.236	39.4	3.820	46.3	3.486	53.2	3.210		

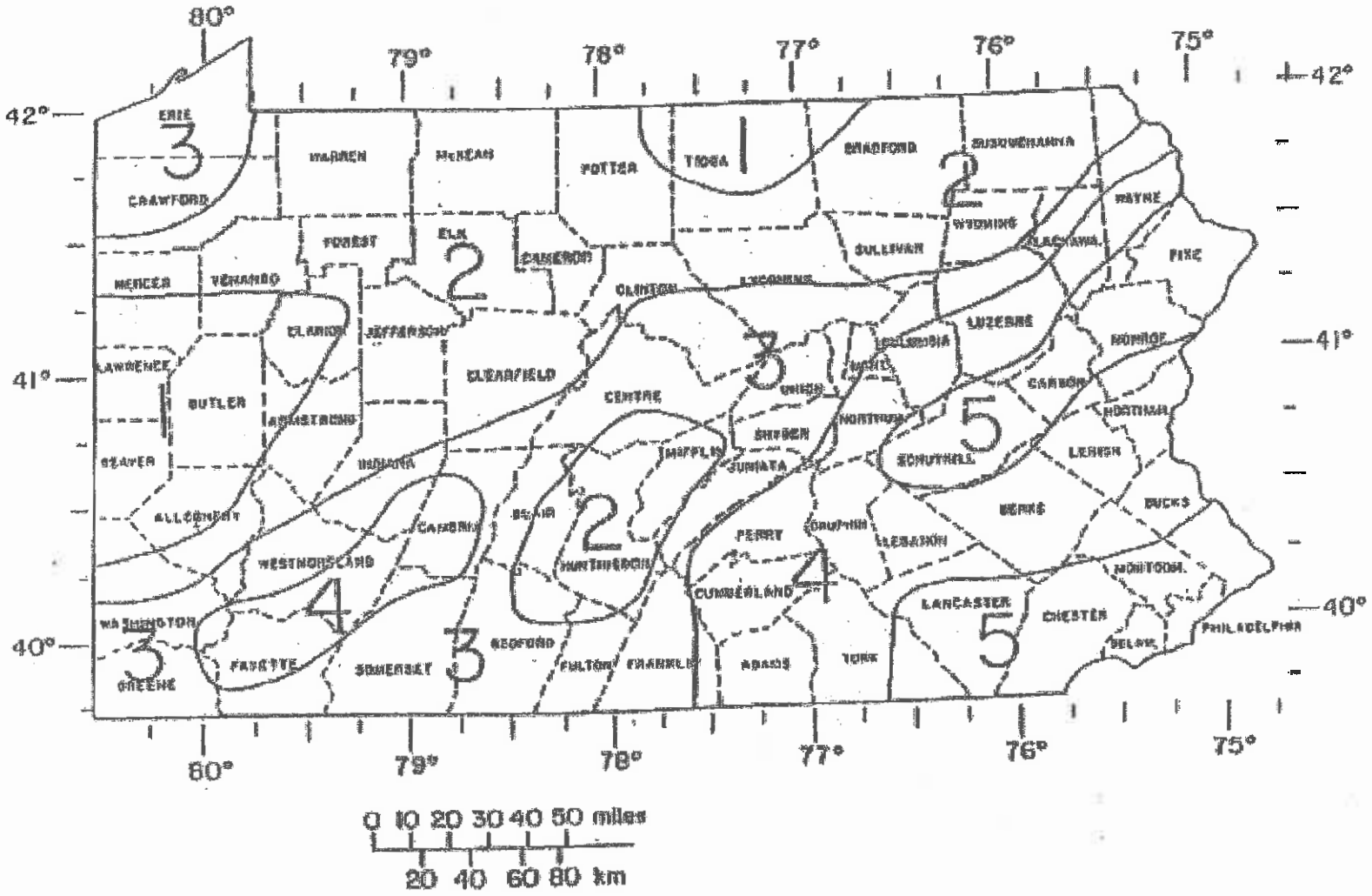


FIGURE B-1
PENNDOT DELINEATED REGIONS

TABLE B-2
Runoff Curve Numbers
(From NRCS (SCS) TR-55)

LAND USE DESCRIPTION		HYDROLOGIC SOIL GROUP A	B	C	D
Open Space		44	65	77	82
Meadow / Orchard		30	58	71	78
Agricultural		59	71	79	83
Forest		36	60	73	79
Commercial	(85% Impervious)	89	92	94	95
Industrial	(72% Impervious)	81	88	91	93
Institutional	(50% Impervious)	71	82	88	90
Residential					
Average Lot Size	% impervious				
1/8 acre or less*	65	77	85	90	92
1/8 - 1/3 acre	34	59	74	82	87
1/3 - 1 acre	23	53	69	80	85
1 - 4 acres	12	46	66	78	82
Farmstead		59	74	82	86
Smooth Surfaces (Concrete, Asphalt, Gravel or Bare Compacted Soil)		98	98	98	98
Water		98	98	98	98
Mining/Newly Graded Areas (Pervious Areas Only)		77	86	91	94

* Includes Multi-Family Housing unless justified lower density can be provided.

Note: Existing site conditions of bare earth or fallow ground shall be considered as meadow when choosing a CN value.

TABLE B-3
RATIONAL RUNOFF COEFFICIENTS
By Hydrologic Soils Group and Overland Slope (%)

Land Use	A			B			C			D		
	0-2%	2-6%	6%+	0-2%	2-6%	6%+	0-2%	2-6%	6%+	0-2%	2-6%	6%+
Cultivated Land	0.08[a]	0.13	0.16	0.11	0.15	0.21	0.14	0.19	0.26	0.18	0.23	0.31
	0.14[b]	0.18	0.22	0.16	0.21	0.28	0.20	0.25	0.34	0.24	0.29	0.41
Pasture	0.12	0.20	0.30	0.18	0.28	0.37	0.24	0.34	0.44	0.30	0.40	0.50
	0.15	0.25	0.37	0.23	0.34	0.45	0.30	0.42	0.52	0.37	0.50	0.62
Meadow	0.10	0.16	0.25	0.14	0.22	0.30	0.20	0.28	0.36	0.24	0.30	0.40
	0.14	0.22	0.30	0.20	0.28	0.37	0.26	0.35	0.44	0.30	0.40	0.50
Forest	0.05	0.08	0.11	0.08	0.11	0.14	0.10	0.13	0.16	0.12	0.16	0.20
	0.08	0.11	0.14	0.10	0.14	0.18	0.12	0.16	0.20	0.15	0.20	0.25
Residential												
Lot Size 1/8 Acre	0.25	0.28	0.31	0.27	0.30	0.25	0.30	0.33	0.38	0.33	0.36	0.42
	0.33	0.37	0.40	0.35	0.39	0.44	0.38	0.42	0.49	0.41	0.45	0.54
Lot Size 1/4 Acre	0.22	0.26	0.29	0.24	0.29	0.33	0.27	0.31	0.36	0.30	0.34	0.40
	0.30	0.34	0.37	0.33	0.37	0.42	0.36	0.40	0.47	0.38	0.42	0.52
Lot Size 1/3 Acre	0.19	0.23	0.26	0.22	0.26	0.30	0.25	0.29	0.34	0.28	0.32	0.39
	0.28	0.32	0.35	0.30	0.35	0.39	0.33	0.38	0.45	0.36	0.40	0.50
Lot Size 1/2 Acre	0.16	0.20	0.24	0.19	0.23	0.28	0.22	0.27	0.32	0.26	0.30	0.37
	0.25	0.29	0.32	0.28	0.32	0.36	0.31	0.35	0.42	0.34	0.38	0.48
Lot Size 1 Acre	0.14	0.19	0.22	0.17	0.21	0.26	0.20	0.25	0.31	0.24	0.29	0.35
	0.22	0.26	0.29	0.24	0.28	0.34	0.28	0.32	0.40	0.31	0.35	0.46
Industrial	0.67	0.68	0.68	0.68	0.68	0.69	0.68	0.69	0.69	0.69	0.69	0.70
	0.85	0.85	0.86	0.85	0.86	0.86	0.86	0.86	0.87	0.86	0.86	0.88
Commercial	0.71	0.71	0.72	0.71	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72
	0.88	0.88	0.89	0.89	0.89	0.89	0.89	0.89	0.90	0.89	0.89	0.90
Streets	0.70	0.71	0.71	0.71	0.72	0.74	0.72	0.73	0.76	0.73	0.75	0.78
	0.76	0.77	0.79	0.80	0.82	0.84	0.84	0.85	0.89	0.89	0.91	0.95
Open Space	0.05	0.10	0.14	0.08	0.13	0.19	0.12	0.17	0.24	0.16	0.21	0.28
	0.11	0.16	0.20	0.14	0.19	0.26	0.18	0.23	0.32	0.22	0.27	0.39
Parking	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

[a] Runoff coefficients for storm recurrence intervals less than 25 years.

[b] Runoff coefficients for storm recurrence intervals of 25 years or more.

Source : Rawls, W.J., S.L. Wong and R.H. McCuen, 1981, "Comparison of Urban Flood Frequency Procedures", Preliminary Draft, U.S. Department of Agriculture, Soil Conservation Service, Baltimore, MD.

TABLE B-4

Roughness Coefficients (Manning's "n") For Overland Flow (U.S. Army Corps Of Engineers, HEC-1 Users Manual)

Surface Description	n
Dense Growth	0.4 - 0.5
Pasture	0.3 - 0.4
Lawns	0.2 - 0.3
Bluegrass Sod	0.2 - 0.5
Short Grass Prairie	0.1 - 0.2
Sparse Vegetation	0.05 - 0.13
Bare Clay-Loam Soil (eroded)	0.01 - 0.03
Concrete/Asphalt - very shallow depths (less than 1/4 inch)	0.10 - 0.15
- small depths (1/4 inch to several inches)	0.05 - 0.10

Roughness Coefficients (Manning's "n") For Channel Flow

Reach Description	n
Natural stream, clean, straight, no rifts or pools	0.03
Natural stream, clean, winding, some pools or shoals	0.04
Natural stream, winding, pools, shoals, stony with some weeds	0.05
Natural stream, sluggish deep pools and weeds	0.07
Natural stream or swale, very weedy or with timber underbrush	0.10
Concrete pipe, culvert or channel	0.012
Corrugated metal pipe	0.012-0.027[1]
High Density Polyethylene (HDPE) Pipe	
Corrugated	0.021-0.029[2]
Smooth Lined	0.012-0.020[2]

(1) Depending upon type, coating and diameter

(2) Values recommended by the American Concrete Pipe Association, check Manufacturer's recommended value.

FIGURE B-2

Recommendation Chart for Infiltration Stormwater Management BMP's 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 ***									✓	✓					✓	✓		✓	✓							✓	✓		✓	✓	✓

✓ RECOMMENDED

NOT RECOMMENDED

* 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: Lower 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.

Source: Little Lehigh Creek Watershed ACT 167 – Stormwater Management Ordinance. May 2004

ORDINANCE APPENDIX C
DRAINAGE PLAN APPLICATION

(Use where Stormwater Management and Erosion and Sedimentation Control Plan are submitted independently of a "Subdivision Plan" or "Land Development Plan" review application)

Application is hereby made for review of the Stormwater Management and Erosion and Sedimentation Control Plan and related data as submitted herewith in accordance with the South Manheim Township Stormwater Management Ordinance.

IMPORTANT: Refer to *Stormwater Application Flowchart* that follows this application to determine whether your project is exempt from the Application requirements.

Date of Submission _____ Submission/Revision No._____

1. Name of development (if applicable) _____

2. Name of Applicant _____ Telephone No._____

   (if corporation, list the corporation's name and the names of two officers of the corporation)
   _____Officer 1
   _____Officer 2

   Address_____

   Applicant's interest in development_____
   (if other than property owner give owners name and address)

3. Name of property owner _____Telephone No._____

   Address_____

   Tax Parcel Number: _____

4. Name of engineer or surveyor _____Telephone No._____

   Address_____

5. Type development proposed:

   Residential Commercial Industrial
   Other (_____)

6. Areas
   a. Lot area _____(indicate square feet or acres)
   b. Area to be disturbed (indicate square feet or acres)
   c. Existing Impervious (to remain) S.F. _____% of Property
   d. Proposed Impervious (new) S.F. _____% of Property

7. Erosion and Sediment Pollution Control (E&S):

   a. Has or will the stormwater management and E&S plan, supporting documentation and narrative been submitted to the Schuylkill County Conservation District?_____
   (if "no", please explain_____)

8. Wetlands

   a. Are wetlands present within the project area?_____
   (if "no", skip remainder of this section)

   b. Have the wetlands been delineated by someone trained in wetland delineation?_____

   c. Have the wetland lines been verified by a state or federal permitting authority?_____

   d. Have the wetland lines been surveyed?_____

   e. Will the wetlands be disturbed?_____
   (if "yes", attach permit-related documentation)

9. Filing

   a. Has the required fee been submitted?_____

      Amount_____

SIGNATURE OF APPLICANT_____
(signature authorizes South Manheim Township or its agents to enter subject property for examination of site conditions, photography, etc., as may be necessary to complete review of this application).

//

(Following information to be completed by South Manheim Township)

Date complete application received _____Plan Number_____

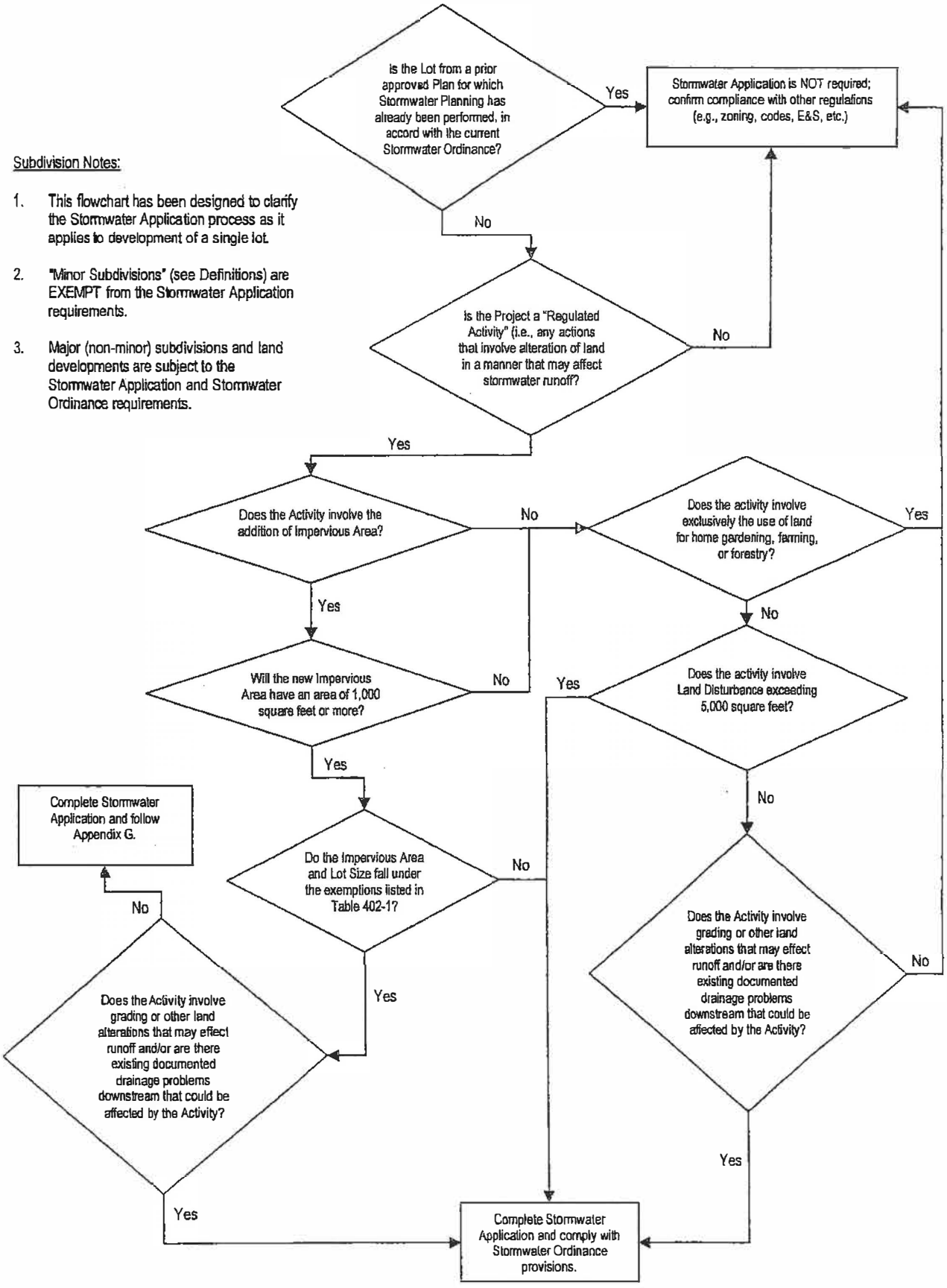
Fees _____ date fees paid _____ received by_____

Official submission receipt date _____

Received by_____

Municipality

SOUTH MANHEIM TOWNSHIP – STORMWATER APPLICATION FLOWCHART



Subdivision Notes:

1. This flowchart has been designed to clarify the Stormwater Application process as it applies to development of a single lot.
2. "Minor Subdivisions" (see Definitions) are EXEMPT from the Stormwater Application requirements.
3. Major (non-minor) subdivisions and land developments are subject to the Stormwater Application and Stormwater Ordinance requirements.

ORDINANCE APPENDIX D
LOW IMPACT DEVELOPMENT (LID) PRACTICES

ALTERNATIVE APPROACH FOR MANAGING STORMWATER RUNOFF

ALTERNATIVE APPROACH FOR MANAGING STORMWATER RUNOFF

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

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

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

- **Preserving Natural Drainage Features**. Protecting natural drainage features, particularly vegetated drainage swales and channels, is desirable because of their ability to infiltrate and attenuate flows and to filter pollutants. However, this objective is often not accomplished in land development. In fact, commonly held drainage philosophy encourages just the opposite pattern -- streets and adjacent storm sewers typically are located in the natural headwater valleys and swales, thereby replacing natural drainage functions with a completely impervious system. As a result, runoff and pollutants generated from impervious surfaces flow directly into storm sewers with no opportunity for attenuation, infiltration, or filtration. Developments designed to fit site topography also minimizes the amount of grading on site.

  Protecting Natural Depression Storage Areas. Depressional storage areas have no surface outlet, or drain very slowly following a storm event. They can be commonly seen as ponded areas in farm fields during the wet season or after large

runoff events. Traditional development practices eliminate these depressions by filling or draining, thereby obliterating their ability to reduce surface runoff volumes and trap pollutants. The volume and release-rate characteristics of depressions should be protected in the design of the development site. The depressions can be protected by simply avoiding the depression or by incorporating its storage as additional capacity in required detention facilities.

- **Avoiding introduction of impervious areas**. Careful site planning should consider reducing impervious coverage to the maximum extent possible. Building footprints, sidewalks, driveways and other features producing impervious surfaces should be evaluated to minimize impacts on runoff.

- **Reducing the Hydraulic Connectivity of Impervious Surfaces**. Impervious surfaces are significantly less of a problem if they are not directly connected to an impervious conveyance system (such as storm sewer). Two basic ways to reduce hydraulic connectivity are routing of roof runoff over lawns and reducing the use of storm sewers. Site grading should promote increasing travel time of 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.

In summary, a careful consideration of the existing topography and implementation of a combination of the above mentioned techniques may avoid construction of costly stormwater control measures. Other benefits include reduced potential of downstream flooding, water quality degradation of receiving streams/water bodies and enhancement of aesthetics and reduction of development costs. Beneficial results include more stable baseflows in receiving streams, improved groundwater recharge, reduced flood flows, reduced pollutant loads, and reduced costs for conveyance and storage.

ORDINANCE APPENDIX E
REFERENCES

BMP Manuals

California
California Stormwater BMP Handbook: New Development and Redevelopment (January 2003) – separate file available at http://www.cabmphandbooks.org/Development.asp

Georgia
Georgia Stormwater Management Manual Volume 2: Technical Handbook (August 2001) separate file (http://www.georgiastormwater.com/)

Maryland
2000 Maryland Stormwater Design Manual –
http://www.mde.state.md.us/Programs/Waterprograms/SedimentandStormwater/stormwater design/index.asp

Massachusetts
Stormwater Management, Volume Two: Stormwater Technical Handbook (Massachusetts, 1997) – separate file available at
http://www.state.ma.us/dep/brp/stormwtr/stormpub.htm

Minnesota
Minnesota Urban Small Sites BMP Manual: Stormwater Best Management Practices for Cold Climates (July 2001) –
http://www.metrocouncil.org/environment/Watershed/BMP/manual.htm

New Jersey
Revised Manual for New Jersey: Best Management Practices for Control of Non-point Source Pollution from Stormwater (Fifth Draft May 2000) –
http://www.state.nj.us/dep/watershedmgt/bmpmanual.htm

New York
New York State Stormwater Management Design Manual (2001) –
http://www.dec.state.ny.us/website/dow/swmanual/swmanual.html

Pennsylvania
Pennsylvania Association of Conservation Districts, Pennsylvania Handbook of Best Management Practices for Developing Areas, November 14, 1997.

Pennsylvania Department of Environmental Protection, Pennsylvania Stormwater Best Management Practices Manual, December 30, 2006 –
http://www.depweb.state.pa.us/watershedmgmt/cwp/view.asp?a=1437&Q=518682&PM=1

Washington
Stormwater Management Manual for Western Washington (August 2001) – http://www.ecy.wa.gov/programs/wq/stormwater/manual.html

Federal
Stormwater Best Management Practices in an Ultra-Urban Setting: Selection and Monitoring (FHWA) – http://www.fhwa.dot.gov/environment/ultraurb/3fs1.htm

USEPA Infiltration Trench Fact Sheet (September 1999) – http://cfpub.epa.gov/npdes/stormwater/menuofbmps/post.cfm

Precipitation Frequency Data Reference

Precipitation Frequency Data Server (NOAA Atlas 14), National Oceanic and Atmospheric Administration (NOAA), Hydrometeorological Design Studies Center – http://hdsc.nws.noaa.gov/hdsc/pfds/

Riparian Buffer References

Alliance for the Chesapeake Bay, Pennsylvania Department of Environmental Protection, September 2000. *Forest Buffer Toolkit*, Stream ReLeaf Program.

Penn State College of Agricultural Sciences, 1996. *Establishing Vegetative Buffer Strips Along Streams to Improve Water Quality.* Publication # AGRS-67.

Fike, Jean, June 1999. *Terrestrial & Palustrine Plant Communities of Pennsylvania,* Pennsylvania Natural Diversity Inventory, The Nature Conservancy, Western Pennsylvania Conservancy, and Pennsylvania Department of Conservation and Natural Resources.

Pennsylvania Association of Conservation Districts, Inc., Keystone Chapter, Soil and Water Conservation Society, Pennsylvania Department of Environmental Protection, Natural Resources Conservation Service, 1998. *Pennsylvania Handbook of Best Management Practices for Developing Areas.* Prepared by CH2MHill.

Palone, R. S. and A. H. Todd (eds), 1997. *Chesapeake Bay Riparian Handbook: A Guide for Establishing and Maintaining Riparian Forest Buffers.* Chesapeake Bay Program and Northeastern Area State and Private Forestry. Natural Resources Conservation Service Cooperative State Research Education and Extension Services.

The Federal Interagency Stream Restoration Working Group (FISRWG, 10/1998). Stream Corridor Restoration Principles, Processes, and Practices. GPO Item No. 0120-A; SuDocs No. A57.6/2:EN3/PT.653. ISBN-0-934213-59-3. Published October 1998. Revised August 2000.

ORDINANCE APPENDIX F
West Nile Virus Guidance

(This source is from the Monroe County, PA Conservation District who researched the potential of West Nile Virus problems from BMPs due to a number of calls they were receiving)

Monroe County Conservation District Guidance:
Stormwater Management and West Nile Virus
Source: Brodhead McMichaels Creeks Watershed Act 167 Stormwater Management Ordinance Final Draft 2/23/04

The Monroe County Conservation District recognizes the need to address the problem of non-point source pollution impacts caused by runoff from impervious surfaces. The new stormwater policy being integrated into Act 167 Stormwater Management regulations by the PA Department of Environmental Protection (DEP) will make non-point pollution controls an important component of all future plans and updates to existing plans. In addition, to meet post-construction anti-degradation standards under the state National Pollution Discharge Elimination System (NPDES) permitting program, applicants will be required to employ Best Management Practices (BMPs) to address non-point pollution concerns.

Studies conducted throughout the United States have shown that wet basins and in particular constructed wetlands are effective in traditional stormwater management areas such as channel stability and flood control, and are one of the most effective ways to remove stormwater pollutants (United States Environmental Protection Agency 1991, Center for Watershed Protection 2000). From Maryland to Oregon, studies have shown that as urbanization and impervious surface increase in a watershed, the streams in those watersheds become degraded (CWP 2000). Although there is debate over the threshold of impervious cover when degradation becomes apparent (some studies show as little as 6% while others show closer to 20%), there is agreement that impervious surfaces cause non-point pollution in urban and urbanizing watersheds, and that degradation is ensured if stormwater BMPs are not implemented.

Although constructed wetlands and ponds are desirable from a water quality perspective there may be concerns about the possibility of these stormwater management structures becoming breeding grounds for mosquitoes. The Conservation District feels that although it may be a valid concern, **municipalities should not adopt ordinance provisions prohibiting wet basins for stormwater management.**

Mosquitoes

The questions surrounding mosquito production in wetlands and ponds have intensified in recent years by the outbreak of the mosquito-borne West Nile Virus. As is the case with all vector-borne maladies, the life cycle of West Nile Virus is complicated, traveling from mosquito to bird, back to mosquito and then to other animals including humans. *Culex pipiens* was identified as the vector species in the first documented cases from New York in 1999. This species is still considered the primary transmitter of the disease across its range. Today there are some 60 species of mosquitoes that inhabit

Pennsylvania. Along with *C. pipiens*, three other species have been identified as vectors of West Nile Virus while four more have been identified as potential vectors.

The four known vectors in NE Pennsylvania are *Culex pipiens*, *C. restuans*, *C. salinarius* and *Ochlerotatus japonicus*. All four of these species prefer, and almost exclusively use, artificial containers (old tires, rain gutters, birdbaths, etc.) as larval habitats. In the case of *C. pipiens*, the most notorious of the vector mosquitoes, the dirtier the water the better they like it. The important factor is that these species do not thrive in functioning wetlands where competition for resources and predation by larger aquatic and terrestrial organisms is high.

The remaining four species, *Aedes vexans*, *Ochlerotatus Canadensis*, *O. triseriatus* and *O. trivittatus* are currently considered potential vectors due to laboratory tests (except the *O. trivittatus*, which did have one confirmed vector pool for West Nile Virus in PA during 2002). All four of these species prefer vernal habitats and ponded woodland areas following heavy summer rains. These species may be the greatest threat of disease transmission around stormwater basins that pond water for more than four days. This can be mitigated however by establishing ecologically functioning wetlands.

Stormwater Facilities

If a stormwater wetland or pond is constructed properly and a diverse ecological community develops, mosquitoes should not become a problem. Wet basins and wetlands constructed as stormwater management facilities, should be designed to attract a diverse wildlife community. If a wetland is planned, proper hydrologic soil conditions and the establishment of hydrophytic vegetation will promote the population of the wetland by amphibians and other mosquito predators. In natural wetlands, predatory insects and amphibians are effective at keeping mosquito populations in check during the larval stage of development while birds and bats prey on adult mosquitoes.

The design of a stormwater wetland must include the selection of hydrophytic plant species for their pollutant uptake capabilities and for not contributing to the potential for vector mosquito breeding. In particular, species of emergent vegetation with little submerged growth are preferable. By limiting the vegetation growing below the water surface, larvae lose protective cover and there is less chance of anaerobic conditions occurring in the water.

Stormwater ponds can be designed for multiple purposes. When incorporated into an open space design a pond can serve as a stormwater management facility and a community amenity. Aeration fountains and stocked fish should be added to keep larval mosquito populations in check.

Publications from the PA Department of Health and the Penn State Cooperative Extension concerning West Nile Virus identify aggressive public education about the risks posed by standing water in artificial containers (tires, trash cans, rain gutters, bird baths) as the most effective method to control vector mosquitoes.

Conclusion

The Conservation District understands the pressure faced by municipalities when dealing with multifaceted issues such as stormwater management and encourages the incorporation of water quality management techniques into stormwater designs. As Monroe County continues to grow, conservation design, groundwater recharge and

constructed wetlands and ponds should be among the preferred design options to reduce the impacts of increases in impervious surfaces. When designed and constructed appropriately, the runoff mitigation benefits to the community from these design options will far out weigh their potential to become breeding grounds for mosquitoes.

ORDINANCE APPENDIX G

Stormwater Management Practices for projects which are exempt under Section 402 of this Ordinance.

STORMWATER MANAGEMENT PROCEDURES
FOR PROJECTS MEETING THE LAND COVER EXEMPTION CRITERIA

What are the Act 167 Stormwater Management Requirements?

Pennsylvania Act 167 was authorized on October 4, 1978 (32 P.S., P.L. 864) and gave Pennsylvania Municipalities the power to regulate activities that affect stormwater runoff, surface and groundwater quantity and quality.

Who is affected by these requirements?

The South Manheim Township Stormwater Management Ordinance affects all NEW development in South Manheim Township. Individual home construction projects on single family lots which result are exempt under Section 402 of this Ordinance, are not required to submit formal drainage plans to South Manheim Township; however, they must still address Water Quality and Groundwater Recharge criteria specified in the Stormwater Management Ordinance (Ord. Sections 305 and 306).

Do I require professional services to meet these requirements?

This brochure has been developed to assist the individual homeowner in meeting the water quality and groundwater recharge goals of the South Manheim Township Stormwater Management Ordinance. If the guidelines presented in this brochure are followed, the individual homeowner will not require professional services to comply with these water quality and groundwater recharge.

What do I need to Send to South Manheim Township?

Even though a formal drainage plan is not required for many individual lot owners, a brief description of the proposed infiltration facilities, including types of material to be used, total impervious areas and volume calculations as shown above, and a simple sketch plan showing the following information shall be submitted to South Manheim Township prior to construction:

- Location of proposed structures, driveways or other paved areas with approximate size in square feet.
- Location of any existing or proposed on site septic system and/or potable water wells showing rough proximity to infiltration facilities.

Determination of Recharge Volume

The amount of recharge volume to be provided can be determined by following the simple steps below. Impervious area calculations should include all areas on the

individual lots that are covered by roof area or pavement which would prevent rain for naturally percolating into the ground, including sidewalks, driveways or parking areas. Sidewalks, driveways or patios that are constructed with gravel or turf pavers and will not be blacktopped in the future, need not be included in this calculation.

Example Recharge Volume:

STEP 1 – Determine Total Impervious Surfaces:

House Roof (Front)	12 ft x 48 ft	=	576 sq. ft
House Roof (Rear)	12 ft x 48 ft	=	576 sq. ft.
Driveway	12 ft x 50 ft	=	600 sq. ft.
Parking Pad	12 ft x 12 ft	=	144 sq. ft.
Walkway	6 ft x 20 ft	=	120 sq. ft.

			2,016 sq. ft.

STEP 2 – Determine Require Infiltration Volume (Rv) Using the Following Equation

$$Rv = \frac{0.46 \text{ inches} \times (\text{total impervious area in square feet})}{12} = \_\_\_\_\_ \text{ cubic feet of recharge}$$

$$Rv = \frac{0.46 \text{ in.} \times 2{,}016 \text{ sq. ft.}}{12} = 77.3 \text{ cu. ft.}$$

STEP 3 – Sizing of Select Infiltration Method

The following pages show several methods of infiltrating stormwater runoff from residential areas. Their appropriateness depends on the amount of infiltration volume required and the amount of land available. More than one method can be implemented on a site, depending on site constraints. Dry wells should be used only for receiving runoff from roof drains. Infiltration trenches are appropriate for receiving runoff from driveways, sidewalk or parking areas. Other methods may be appropriate, but these should be discussed with the municipal engineer prior to installation.

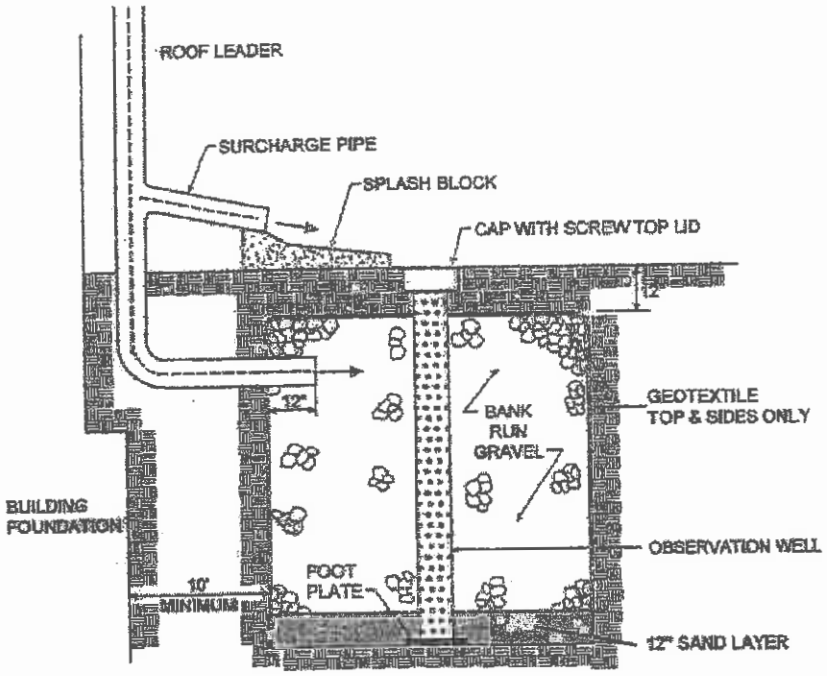
Dry Wells

Dry wells are effective methods of infiltrating runoff from roof leaders. These facilities should be located a minimum of 10 feet from the building foundation to avoid seepage problems. A dry well can be either a structural prefabricated chamber or an excavated pit filled with aggregate. Construction of a dry well should be performed after all other areas of the site are stabilized, to avoid clogging. During construction, compaction of the subgrade soil should be avoided and construction should be performed with only light machinery. Depth of dry wells in excess of 3 ½ feet should be avoided. Gravel fill

should be an average 1.5 – 3.0 inches in diameter. Dry wells should be inspected at least four times annually as well as after large storm events.

FIGURE G-1

TYPICAL DRY WELL CONFIGURATION



Source: Maryland Stormwater Design Manual, 2000

Example Sizing:

STEP 1 – Determine Total Impervious Surfaces

House Roof Area: 12 ft x 48 ft = 576 sq. feet

STEP 2 – Determine Require Infiltration Volume using Equation

$\frac{0.46 \text{ in.} \times 576 \text{ sq. ft.}}{12} = 22.1$ cu. ft.

$\frac{22.1 \text{ cu. ft.}}{0.4} = 55.3$ cu. ft. (* assume 40% void ratio in gravel bed)

STEP 3 – Sizing of Select Infiltration Method

Volume of facility = Depth x Width x Length

Set D = 3.5 ft; Set W = L for a square chamber

55.3 cu. ft. = 3.5 x L X L ; L = 4.0 ft

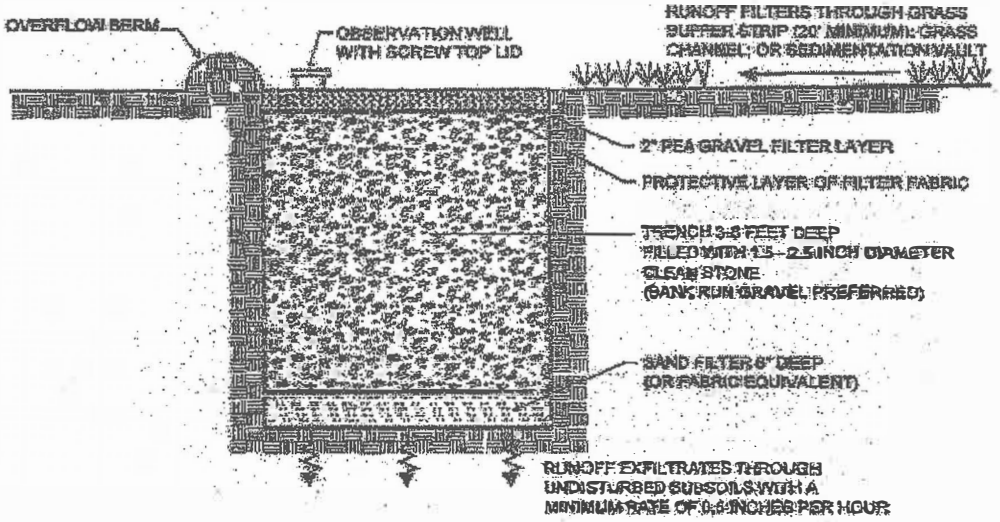
Final Facility Dimensions: 3.5 ft (D) x 4.0 ft (W) x 4.0 ft (L)

Infiltration Trenches

An infiltration trench is a long, narrow, rock-filled trench with no outlet that receives stormwater runoff. Runoff is stored in the void space between the stones and infiltrates through the bottom and into the soil matrix. Infiltration trenches perform well for removal of fine sediment and associated pollutants. Pretreatment using buffer strips, swales, or detention basins is important for limiting amounts of coarse sediment entering the trench which can clog and render the trench ineffective.

FIGURE G-2

TYPICAL INFILTRATION TRENCH CONFIGUATION



Source: Maryland Stormwater Design Manual, 2000

Example Sizing:

STEP 1 – Determine Total Impervious Surfaces

Driveway	12 ft x 50 ft	=	600 sq. ft.
Parking Pad	12 ft x 12 ft	=	144 sq. ft.
Walkway	6 ft x 20 ft	=	120 sq. ft.
			----------
			864 sq. ft.

STEP 2 – Determine Require Infiltration Volume using Equation

$$\frac{0.46 \text{ in.} \times 864 \text{ sq. ft.}}{12} = 33.1 \text{ cu. ft.}$$

$$\frac{33.1 \text{ cu. ft.}}{0.4} = 82.8 \text{ cu. ft.}$$ (* assume 40% void ratio in gravel bed)

STEP 3 – Sizing of Select Infiltration Method

Volume of facility = Depth x Width x Length

Set D = 3.0 ft; Determine Required Surface Area of Trench

82.8 cu. ft. / 3.0 ft. = 27.6 sq. ft.

The width of the trench should be greater than 2 times its depth (2 x D); therefore in this example a trench width of 6 feet is selected;

Determine trench length: L = 27.6 sq. ft. / 6 ft = 4.6 ft.

Final Trench Dimensions: 3.0 ft. (D) x 6 ft. (W) x 4.6 ft. (L)

FIGURE G-3

SAMPLE SITE SKETCH PLAN