Chapter 296

STORMWATER MANAGEMENT

[HISTORY: Adopted by the Board of Commissioners of the Township of South Whitehall 1-3-2001 by Ord. No. 724. Amendments noted where applicable.]

General References

Code enforcement — See Ch. 144.
Floodplain management — See Ch. 181.
Subdivision and land development — See Ch. 312.
Zoning — See Ch. 350.

ARTICLE I
General Provisions

§ 296-1. Title. [Amended 7-17-2002 by Ord. No. 756; 3-16-2005 by Ord. No. 811]

This chapter shall be known as the "South Whitehall Township Stormwater Management Plan for portions of the Little Lehigh Creek Watershed, Coplay Creek Watershed and Jordan Creek Watershed located within South Whitehall Township."

§ 296-2. Statement of findings. [Amended 3-16-2005 by Ord. No. 811]

The Township Commissioners find that:

A. Inadequate management of accelerated runoff of stormwater resulting from development throughout the watersheds of the Township increases flood flows and velocities, contributes to erosion and sedimentation, changes the natural hydrologic patterns, destroys aquatic habitat, elevates aquatic pollutant concentrations and loadings, overtaxes the carrying capacity of streams and storm sewers, greatly increases the cost of public facilities to carry and control stormwater, undermines floodplain management and flood control efforts in downstream communities, reduces groundwater recharge and threatens public health and safety. **[Amended 4-18-2007 by Ord. No. 855]**

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

C. Stormwater can be an important resource by providing groundwater recharge for water supplies and baseflow of streams, which also protects and maintains surface water quality. **[Amended 6-15-2005 by Ord. No. 813]**

D. Public education on the control of pollution from stormwater is an essential component in successfully addressing stormwater. **[Amended 6-15-2005 by Ord. No. 813]**

E. Federal and state regulations require certain municipalities to implement a program of stormwater controls. These municipalities are required to obtain a permit for stormwater discharges from their separate storm sewer systems under the National Pollutant Discharge Elimination System (NPDES). **[Amended 6-15-2005 by Ord. No. 813]**

F. Nonstormwater discharges to Township separate storm sewer systems can contribute to pollution of waters of the Commonwealth by the Township. **[Amended 6-15-2005 by Ord. No. 813]**

§ 296-3. Purpose. [Amended 7-17-2002 by Ord. No. 756; 3-16-2005 by Ord. No. 811; 6-15-2005 by Ord. No. 813; 4-18-2007 by Ord. No. 855]

The purpose of this chapter is to promote the public health, safety and welfare within the Little Lehigh Creek, Coplay Creek and Jordan Creek Watersheds by minimizing the damages and maximizing the benefits described in § 296-2A above, by provisions designed to:

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

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

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

D. Maintain the existing flows and quality of streams and water courses in the Township and the Commonwealth.

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

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

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

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

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

J. Prevent scour and erosion of streambanks and streambeds.

K. Provide standards to meet the NPDES permit requirements.

§ 296-4. Statutory authority. [Amended 3-16-2005 by Ord. No. 811]

The Township of South Whitehall is empowered to regulate these activities by the authority of the Act of October 4, 1978, P.L. 864 (Act 167), 32 P.S. § 680.1 et seq., as amended, the Stormwater Management Act, the First Class Township Code, and the Township of South Whitehall, Chapter 312, Subdivision and Land Development, and Chapter 350, Zoning.

§ 296-5. Applicability. [Amended 7-17-2002 by Ord. No. 756; 3-16-2005 by Ord. No. 811]

A. Although generally applicable to all drainage areas in the Township, the provisions of this chapter, which make specific reference to the Little Lehigh Creek, Coplay Creek and Jordan Creek Watersheds or to the release rate maps contained in the plan, shall only apply to those areas of the Township which are located within the Little Lehigh Creek, Coplay Creek and Jordan Creek drainage basins as delineated on an official map available for inspection at the Township office. Maps of the Little Lehigh Creek, Coplay Creek and Jordan Creek Watersheds at a reduced scale are include in Appendix A of this chapter for general reference.[1]

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

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

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

(1) Land development.

(2) Subdivision.

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1. **Editor's Note: Appendix A is on file in the Township offices.**

(3) Construction of new or additional impervious surfaces (driveways, parking lots, etc.).

(4) Construction of new buildings or additions to existing buildings.

(5) Diversion or piping of any natural or man-made stream channel.

(6) Installation of stormwater systems or appurtenances thereto.

(7) Regulated earth disturbance activities. **[Amended 6-15-2005 by Ord. No. 813]**

E. Any proposed regulated activity, except those defined in Subsection D(5) and (6), above, which would create 10,000 square feet or less of additional impervious cover would be exempt from meeting the provisions of this chapter. Development plans qualifying for this waiver would still be required to manage the quantity, velocity and direction of resulting storm runoff as is reasonably necessary to prevent injury to health, safety or other property.

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

G. Additional impervious cover shall include, but not be limited to, any roof, parking or driveway areas and any new streets and sidewalks constructed as part of or for the proposed regulated activity. Any areas which may be designed to initially be semipervious (e.g., gravel, crushed stone, porous pavement, etc.) shall be considered impervious areas for the purpose of the waiver provisions of § 296-17, hereof. **[Amended 6-15-2005 by Ord. No. 813]**

H. The hardship waiver provisions found in § 296-22 shall not be available for regulated activities as defined in Subsection D(5) and (6), above. **[Amended 6-15-2005 by Ord. No. 813]**

§ 296-6. Compatibility with other requirements. [Amended 3-16-2005 by Ord. No. 811]

Approvals issued pursuant to this chapter do not relieve the applicant of the responsibility to secure required permits or approvals for activities regulated by any other applicable code, rule, act or ordinance.

§ 296-7. Duty of persons engaged in the development of land. [Amended 3-16-2005 by Ord. No. 811]

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

ARTICLE II
Definitions

§ 296-8. Definitions of terms and phrases. [Amended 7-17-2002 by Ord. No. 756; 3-16-2005 by Ord. No. 811]

A. The following words and phrases shall have the meanings hereinafter indicated, unless the text clearly states an alternative or different meaning. 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. 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. The words "shall" and "must" are mandatory; the words "may" and "should" are permissive. **[Amended 6-15-2005 by Ord. No. 813]**

ACCELERATED EROSION — The removal of the surface of the land through the combined action of human activities and natural processes, at a rate greater than would occur because of the natural process alone. **[Amended 6-15-2005 by Ord. No. 813]**

APPLICANT — See "developer." **[Amended 6-15-2005 by Ord. No. 813]**

BEST MANAGEMENT PRACTICE (BMP) — Activities, facilities, measures or procedures used to manage stormwater quantity and quality impacts from the regulated activities listed in § 296-5 to meet State Water Quality Requirements, to promote groundwater recharge and to otherwise meet the purposes of this chapter. **[Amended 6-15-2005 by Ord. No. 813]**

BEST MANAGEMENT PRACTICE OPERATIONS AND MAINTENANCE PLAN — Documentation, included as part of a drainage plan, detailing the proposed BMPs, how they will be operated and maintained and who will be responsible. **[Amended 6-15-2005 by Ord. No. 813]**

BIORETENTION — Densely vegetated, depressed features that store stormwater and filter it through vegetation, mulch, planting soil, etc. Ultimately stormwater is evapotranspirated, infiltrated or discharged. Optimal bioretention areas mimic natural forest ecosystems in terms of species diversity, density, distribution, use of native plants, etc. **[Amended 6-15-2005 by Ord. No. 813]**

BUFFER —

(1) Streamside buffer. A zone of variable width located along a stream that is vegetated and is designed to filer pollutants from runoff.

(2) Special geologic feature buffer. A required isolation distance from a special geologic feature to a proposed BMP needed to reduce the risk of sinkhole formation due to stormwater management activities. **[Amended 6-15-2005 by Ord. No. 813]**

CAPTURE/REUSE — Stormwater management techniques, such as cisterns and rain barrels which direct runoff into storage devices, surface or subsurface for later reuse, such as irrigation of gardens and other planted areas. Because this stormwater is utilized

an no pollutant discharge results, water quality performance is superior to other noninfiltration BMPs. **[Amended 6-15-2005 by Ord. No. 813]**

CARBONATE BEDROCK — Rock consisting chiefly of carbonate minerals, such as limestone and dolomite; specifically a sedimentary rock composed of more than 50% by weight of carbonate minerals that underlies soil or other unconsolidated superficial material. **[Amended 6-15-2005 by Ord. No. 813]**

CISTERN — An underground reservoir or tank for storing rainwater.

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

CONSERVATION DISTRICT — The Lehigh County Conservation District.

CONSTRUCTED WETLANDS — Constructed wetlands are similar to wet ponds (see below) and consist of a basin which provides for necessary stormwater storage as well as a permanent pool or water level, planted with wetland vegetation. To be successful, constructed wetlands must have adequate natural hydrology (both runoff inputs as well as soils and water table which allow for maintenance of a permanent pool of water). In these cases, the permanent pool must be designed carefully, usually with shallow edge benches, so that water levels are appropriate to support carefully selected wetland vegetation. **[Amended 6-15-2005 by Ord. No. 813]**

CULVERT — A pipe, conduit or similar structure including appurtenant works which carries surface water.

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

DEP — The Pennsylvania Department of Environmental Protection (formerly the Pennsylvania Department of Environmental Resources).

DESIGN STORM — The depth and time distribution of precipitation from a storm event measured in probability of occurrence (e.g., fifty-year storm) and duration (e.g., 24 hours), and used in computing stormwater management control systems. **[Amended 6-15-2005 by Ord. No. 813]**

DETENTION BASIN — A basin designed to retard stormwater runoff by temporarily storing the runoff and releasing it at a predetermined rate.

DEVELOPER — A person, partnership, association, corporation or other entity, or any responsible person therein or agent thereof, that undertakes any regulated activity of this chapter.

DEVELOPMENT SITE — The specific tract of land for which a regulated activity is proposed.

DIFFUSED DRAINAGE — See "sheet flow." **[Amended 6-15-2005 by Ord. No. 813]**

DRAINAGE EASEMENT — A right granted by a land owner to a grantee, allowing the use of private land for stormwater management purposes.

DRAINAGE PLAN — The documentation of the proposed stormwater quantity and quality management controls, if any, to be used for a given development site, including a BMP operations and maintenance plan, the contents of which are established in § 296-18. **[Amended 6-15-2005 by Ord. No. 813]**

EARTH DISTURBANCE ACTIVITY — A construction or other human activity which disturbs the surface of the land including, but not limited to, clearing and grubbing, grading, excavations, embankments, road maintenance, building construction and the moving, depositing, stockpiling or storing of soil, rock or earth materials. **[Amended 6-15-2005 by Ord. No. 813]**

EROSION — The removal of soil particles by the action of water, wind, ice or other geological agents.

EXISTING USES — Those uses actual attained in the water body on or after November 28, 1975, whether or not they are included in the water quality standards. (25 Pa. Code Chapter 93.1) **[Amended 6-15-2005 by Ord. No. 813]**

FILL — Man-made deposits of natural soils or rock products and waste materials. **[Amended 6-15-2005 by Ord. No. 813]**

FILTER STRIPS — See "vegetated buffers." **[Amended 6-15-2005 by Ord. No. 813]**

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

GROUNDWATER RECHARGE — Replenishment of existing natural underground water supplies.

HARDSHIP WAIVER REQUEST — A written request for a waiver alleging that the provisions of this chapter inflict unnecessary hardship upon the applicant. Waivers from the water quality provisions of this chapter shall not be granted. **[Amended 6-15-2005 by Ord. No. 813]**

HOT SPOT LAND USES — A land use or activity that generates higher concentrations of hydrocarbons, trace metals or other toxic substances than typically found in stormwater runoff. These land uses are listed in § 296-12P. **[Amended 6-15-2005 by Ord. No. 813]**

HYDROLOGIC SOIL GROUP (HSG) — Soils are classified into four HSGs (A, B, C and D) to indicate the minimum infiltration rates, which are obtained for bare soil after prolonged wetting. The Natural Resources Conservation Service (NRCS) of the US Department of Agriculture defines the four groups and provides a list of most of the soils in the United States and their group classification. The soils in the area of the

development site may be identified from a soil survey report that can be obtained from local NRCS offices or conservation district offices. Soils become less permeable as the HSG varies from A to D. **[Added 4-18-2007 by Ord. No. 855]**

IMPERVIOUS SURFACE (IMPERVIOUS COVER) — A surface which prevents the percolation of water into the ground. **[Amended 4-18-2007 by Ord. No. 855]**

INFILTRATION PRACTICE — A practice designed to direct runoff into the ground, e.g., French drain, seepage pit, seepage trench or bioretention area. **[Amended 6-15-2005 by Ord. No. 813]**

INFILTRATION STRUCTURE — A structure designed to direct runoff into the ground, e.g., french drain, seepage pit or seepage trench.

KARST — A type of topography or landscape characterized by depressions, sinkholes, limestone towers and steep sided hills, underground drainage and caves. Karst is usually formed on carbonate rocks, such as limestones or dolomites and sometimes gypsum. **[Amended 6-15-2005 by Ord. No. 813]**

LAND DEVELOPMENT —

(1) 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.

(2) A subdivision of land.

LOADING RATE — The ratio of the land area draining to the system, as modified by the weighting factors in § 296-15B, compared to the base area of the infiltration system. **[Amended 6-15-2005 by Ord. No. 813]**

LOCAL RUNOFF CONVEYANCE FACILITIES — Any natural channel or man-made conveyance system which has the purpose of transporting runoff from the site to the mainstem.

LOW IMPACT DEVELOPMENT — A development approach that promotes practices that will minimize post-development runoff rates and volumes thereby minimizing needs for artificial conveyance and storage facilities. Site design practices include preserving natural drainage features, minimizing impervious surface area, reducing the hydraulic connectivity of impervious surfaces and protecting natural depression storage. **[Amended 6-15-2005 by Ord. No. 813]**

MAINSTEM (MAIN CHANNEL) — Any stream segment or other conveyance used as a reach in the Little Lehigh Creek and Jordan Creek hydrologic models. In the Coplay

Creek watershed, any stream segment or other conveyance in a dual release rate or conditional no detention I subarea used as a reach in the hydrologic model. In conditional no detention II subareas the main channel is the Lehigh River.

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.

MARYLAND STORMWATER DESIGN MANUAL — A stormwater design manual written by the Maryland Department of the Environment and the Center for Watershed Protection. As of January 2004, the manual can be obtained through the following web site: www.mde.state.md.us. **[Amended 6-15-2005 by Ord. No. 813]**

MINIMUM DISTURBANCE/MINIMUM MAINTENANCE PRACTICES (MD/MM) — A site design practice in which careful limits are placed on site clearance prior to development allowing for maximum retention of existing vegetation (woodlands and other), minimum disturbance and compaction of existing soil mantle and minimum site application of chemicals post-development. Typically, MD/MM includes disturbance setback criteria from buildings as well as related site improvements such as walkways, driveways, roadways and any other improvements. These criteria may vary by community context as well as by type of development being proposed. Additionally, MD/MM also shall include provisions (e.g., deed restrictions, conservation easements) to protect these areas from future disturbance and from application of fertilizers, pesticides and herbicides. **[Amended 6-15-2005 by Ord. No. 813]**

MUNICIPALITY — The Township of South Whitehall, Lehigh County, Pennsylvania.

NO HARM OPTION — The option of using a less restrictive runoff quantity control if it can be shown that adequate and safe runoff conveyance exists and that the less restrictive control would not adversely affect health, safety and property. **[Amended 6-15-2005 by Ord. No. 813]**

NPDES REGULATIONS — National pollutant discharge elimination system regulations.

NRCS — Natural Resource Conservation Service, U.S. Department of Agriculture (formerly the Soil Conservation Service).

OIL/WATER SEPARATOR — A structural mechanism designed to remove free oil and grease (and possibly solids) from stormwater runoff. **[Amended 6-15-2005 by Ord. No. 813]**

OUTFALL — "Point source" as described in 40 CFR § 122.2 at the point where the Township's storm sewer system discharges to surface waters of the Commonwealth. **[Amended 6-15-2005 by Ord. No. 813]**

OWNER — One with an interest in and often dominion over a property. **[Added 4-18-2007 by Ord. No. 855]**

PEAK DISCHARGE — The maximum rate of flow of stream runoff at a given location and time resulting from a specified storm event.

PENN STATE RUNOFF MODEL (PSRM) — The computer-based hydrologic modeling technique adapted to each watershed for the Act 167 Plans. The model was calibrated to reflect actual flow values by adjusting key model input parameters. **[Amended 4-18-2007 by Ord. No. 855]**

PERSON — An individual, partnership, public or private association or corporation, or a governmental unit, public utility or other for or not for profit statutory entity or other legal entity whatsoever which is recognized by law as the subject of rights and duties. **[Amended 6-15-2005 by Ord. No. 813]**

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. **[Amended 6-15-2005 by Ord. No. 813]**

PRELIMINARY SITE INVESTIGATION — The determination of the depth to bedrock, the depth to the seasonal high water table and the soil permeability for a possible infiltration location on a site through the use of published data and on-site surveys. In carbonate bedrock areas, the location of special geologic features must also be determined along with the associated buffer distance to the possible infiltration area.[2] **[Amended 6-15-2005 by Ord. No. 813]**

PUBLIC WATER SUPPLIER — A person who owns or operates a public water system. **[Amended 6-15-2005 by Ord. No. 813]**

PUBLIC WATER SYSTEM — A system which provides water to the public for human consumption which has at least 15 service connections or regularly serves an average of at least 25 individuals daily at least 60 days out of the year. (see 25 Pa. Code Chapter 109) **[Amended 6-15-2005 by Ord. No. 813]**

QUALIFIED GEOTECHNICAL PROFESSIONAL — A licensed professional engineer who has a background or expertise in geology, hydrogeology or geotechnical engineering. **[Amended 6-15-2005 by Ord. No. 813; 4-18-2007 by Ord. No. 855]**

RATIONAL METHOD — A method of peak runoff calculation using a standardized runoff coefficient (rational 'c'), acreage of tract and rainfall intensity determined by return period and by the time necessary for the entire tract to contribute runoff. The rational formula is stated as follows: Q = ciA, where "Q" is the calculated peak flow rate in cubic feet per second, "c" is the dimensionless runoff coefficient (see Appendix C)[3] , "i" is the rainfall intensity in inches per hour, and "A" is the area of the tract in acres.

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

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2. **Editor's Note: Appendix G is on file in the Township offices.**

3. **Editor's Note: Appendix C is on file in the Township offices.**

RECHARGE VOLUME (RE_v) — The portion of the water quality volume (WQ_v) used to maintain groundwater recharge rates at development sites. (See § 296-12J) **[Added 4-18-2007 by Ord. No. 855]**

REGULATED ACTIVITIES — Actions or proposed actions which impact upon proper management of stormwater runoff and which are governed by this chapter as specified in § 296-5D.

REGULATION EARTH DISTURBANCE ACTIVITIES — Earth disturbance activity other than agricultural plowing or tilling of one acre or more with a point source discharge to surface waters or to the Township's storm sewer system or earth disturbance activity of five acres or more regardless of the planned runoff. This includes earth disturbance on any portion of, part or during any stage of a larger common plan of development. **[Amended 6-15-2005 by Ord. No. 813]**

RELEASE RATE — The percentage of the predevelopment peak rate of runoff for a development site to which the post-development peak rate of runoff must be controlled to avoid peak flow increases throughout the watershed.

RETURN PERIOD — The average interval in years over which an event of a given magnitude can be expected to recur. For example, the twenty-five-year return period rainfall or runoff event would be expected to recur on the average once every 25 years.

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. **[Amended 6-15-2005 by Ord. No. 813]**

RUNOFF — That part of precipitation which flows over the land.

SEDIMENT TRAPS/CATCH BASIN SUMPS — A chamber which provides storage below the outlet in a storm inlet to collect sediment, debris and associated pollutants, typically requiring periodic clean out. **[Amended 6-15-2005 by Ord. No. 813]**

SEEPAGE PIT/SEEPAGE TRENCH — An area of excavated earth filled with loose stone or similar material and into which surface water is directed for infiltration into the ground.

SEPARATE STORM SEWER SYSTEM — A conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels or storm drains) primarily used for collecting and conveying stormwater runoff. **[Amended 6-15-2005 by Ord. No. 813]**

SHEET FLOW — Stormwater runoff flowing in a thin layer over the ground surface. **[Amended 6-15-2005 by Ord. No. 813]**

SOIL-COVER-COMPLEX METHOD — A method of runoff computation developed by NRCS which is based upon relating soil type and land use/cover to a runoff parameter called a curve number.

SPECIAL GEOLOGIC FEATURES — Carbonate bedrock features including, but not limited to, closed depressions, existing sinkholes, fracture traces, lineaments, joints, faults, caves and pinnacles, which may exist and must be identified on a site when stormwater management BMPs are being considered. **[Amended 6-15-2005 by Ord. No. 813]**

SPILL PREVENTION AND RESPONSE PROGRAM — A program that identifies procedures for preventing and, as needed, cleaning up potential spills and makes such procedures known and the necessary equipment available to appropriate personnel. **[Amended 6-15-2005 by Ord. No. 813]**

STATE WATER QUALITY REQUIREMENTS — As defined under state regulations, protection of designated and existing uses (see 25 Pa. Code 93 and 96), including:

(1) Each stream segment in Pennsylvania has a "designated use," such as "cold water fishes" or "potable water supply," which are listed in Chapter 93. These uses must be protected and maintained, under state regulations.

(2) "Existing uses" are those attained as of November 1975, regardless whether they have been designated in Chapter 93. Regulated earth disturbance activities must be designed to protect and maintain existing uses and maintain the level of water quality necessary to protect those uses in all streams and to protect and maintain water quality in special protection streams.

(3) Water quality involves the chemical, biological and physical characteristics of surface water bodies. After regulated earth disturbance activities are complete, these characteristics can be impacted by addition of pollutants such as sediment and changes in habitat through increased flow volumes and/or rates as a result of changes in land surface area from those activities. Therefore, permanent discharges to surface waters must be managed to protect the stream bank, streambed and structural integrity of the waterway, to prevent these impacts. **[Amended 6-15-2005 by Ord. No. 813]**

STORAGE INDICATION METHOD — A method of routing or moving an inflow hydrograph through a reservoir or detention structure. The method solves the mass conservation equation to determine an outflow hydrograph as it leaves the storage facility. **[Amended 6-15-2005 by Ord. No. 813]**

STORM DRAINAGE PROBLEM AREAS — Areas which lack adequate stormwater collection and/or conveyance facilities and which present a hazard to persons or property. These areas are either documented in Appendix B of this chapter[4] or identified by the Township or Township Engineer.

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

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4. Editor's Note: Appendix B is on file in the Township offices.

STORMWATER — The surface runoff generated by precipitation reaching the ground surface. **[Amended 6-15-2005 by Ord. No. 813]**

STORMWATER FILTERS — Any number of structural mechanisms such as multichamber catch basins, sand/peat filers, sand filters and so forth, which are installed to intercept stormwater flow and remove pollutants prior to discharge. Typically, these systems require periodic maintenance and clean out. **[Amended 6-15-2005 by Ord. No. 813]**

STORMWATER MANAGEMENT PLAN — The plan for managing stormwater runoff adopted by Lehigh County for the Little Lehigh Creek, Jordan Creek, and Coplay Creek Watersheds as required by the Act of October 4, 1978, P.L. 864, (Act 167), as amended, and known as the "Stormwater Management Act."

STREAM — A watercourse.

SUBAREA — The smallest unit of watershed breakdown for hydrologic modeling purposes for which the runoff control criteria have been established in the stormwater management plan.

SUBDIVISION — 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 or ownership or building or lot development: Provided, however, that the subdivision by lease of land for agricultural purposes into parcels of more than 10 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, impoundments, ditches, watercourses, storm sewers, lakes, damned water, wetlands, ponds, springs and all other bodies or channels of conveyance of surface water, or parts thereof, whether natural or artificial, within or on the boundaries of this Commonwealth. **[Amended 6-15-2005 by Ord. No. 813]**

SWALE — A low lying stretch of land which gathers or carries surface water runoff. See also "vegetated swale." **[Amended 4-18-2007 by Ord. No. 855]**

TECHNICAL BEST MANAGEMENT PRACTICE MANUAL AND INFILTRATION FEASIBILITY REPORT, NOVEMBER 2002 — The report written by Cahill Associates that addresses the feasibility of infiltration in carbonate bedrock areas in the Little Lehigh Creek Watershed. The report is available at the LVPC offices. **[Amended 6-15-2005 by Ord. No. 813]**

TRASH/DEBRIS COLLECTORS — Racks, screens or other similar devices installed in a storm drainage system to capture coarse pollutants (trash, leaves, etc.). **[Amended 6-15-2005 by Ord. No. 813]**

VEGETATED BUFFERS — Gently sloping areas that convey stormwater as sheet flow over a broad, densely vegetated earthen area, possibly coupled with the use of level spreading devices. Vegetated buffers should be situated on minimally disturbed soils,

have low-flow velocities and extended residence times. **[Amended 6-15-2005 by Ord. No. 813]**

VEGETATED ROOFS — Vegetated systems installed on roofs that generally consist of a waterproof layer, a root-barrier, drainage layer (optional), growth media and suitable vegetation. Vegetated roofs store and eventually evapotranspirate the collected rooftop rainfall; overflows may be provided for larger storms. **[Amended 6-15-2005 by Ord. No. 813]**

VEGETATED SWALES — **[Amended 6-15-2005 by Ord. No. 813; 4-18-2007 by Ord. No. 855]**

(1) Vegetated earthen channels designed to convey stormwater. These swales are not considered to be water quality BMPs.

(2) Broad, shallow, densely vegetated, earthen channels designed to treat stormwater while slowly infiltrating, evapotranspirating, and conveying it. Swales should be gently sloping with low flow velocities to prevent erosion. Check dams may be added to enhance performance.

WATERCOURSE — Any channel of conveyance of surface water having defined bed and banks, whether natural or artificial, with perennial or intermittent flow. **[Added 4-18-2007 by Ord. No. 855]**

WATER QUALITY INSERTS — Any number of commercially available devices that are inserted into storm inlets to capture sediment, oil, grease, metals, trash, debris, etc. **[Amended 6-15-2005 by Ord. No. 813]**

WATER QUALITY VOLUME (WQ_v) — The volume needed to capture and treat 90% of the average annual rainfall volume. (See § 296-12B) **[Added 4-18-2007 by Ord. No. 855]**

WATERSHED — The entire region or area drained by a river or other body of water whether natural or artificial. **[Amended 6-15-2005 by Ord. No. 813]**[5]

WET DETENTION PONDS — A basin that provides for necessary stormwater storage as well as a permanent pool of water. To be successful, wet ponds must have adequate natural hydrology (both runoff inputs as well as oils and water table which allow for maintenance of a permanent pool of water) and must be able to support a healthy aquatic community so as to avoid creation of mosquito and other health and nuisance problems. **[Amended 6-15-2005 by Ord. No. 813]**

B. Any word, term or phrase used in this chapter, but not specifically defined herein, shall be given its normal and customary meaning.

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5. **Editor's Note: The original additional definition of "watershed," which immediately followed this definition, was repealed 4-18-2007 by Ord. No. 855.**

ARTICLE III
Stormwater Management Requirements

§ 296-9. General requirements. [Amended 7-17-2002 by Ord. No. 756; 3-16-2005 by Ord. No. 811]

A. All regulated activities in the Township shall be subject to the stormwater management requirements of this chapter. **[Amended 6-15-2005 by Ord. No. 813]**

B. Storm drainage system shall be provided to permit unimpeded flow in natural watercourses except as modified by stormwater detention facilities or open channels consistent with this chapter.

C. The existing points of concentrated drainage discharge onto adjacent property shall not be altered without written approval of the affected property owner(s).

D. Areas of existing diffused drainage discharge onto adjacent property shall be managed such that, at minimum, the peak diffused flow does not increase in the general direction of discharge, except as otherwise provided in this chapter. If diffused flow is proposed to be concentrated and discharged onto adjacent property (including flows from detention basin emergency spillways), the developer's engineer must document and certify that there are adequate downstream conveyance facilities to safely transport the concentrated discharge to the point of predevelopment flow concentration, to the stream reach, or otherwise prove that no harm will result from the concentrated discharge. It is recommended the developer obtain written permission from the downstream property owner(s) for the proposed discharges. Areas of existing diffused drainage discharge shall be subject to any applicable release rate criteria in the general direction of existing discharge where they are proposed to be concentrated or maintained as diffused drainage areas. **[Amended 4-18-2007 by Ord. No. 855]**

E. Where a site is traversed by watercourses, swales, ditches, etc., there shall be provided drainage easements conforming substantially with the line of such watercourses, swales, ditches, etc. The width of any easement shall be adequate to provide for unimpeded flow of post-development storm runoff based on either calculations completed by the developer in conformance with § 296-15 for the one-hundred-year return period runoff, the Little Lehigh Creek, Coplay Creek or Jordan Creek Act 167 one-hundred-year return period flows, or Federal Emergency Management Agency (FEMA) one-hundred-year frequency flood flows and to provide a freeboard allowance of 0.5 foot above the design water surface level. In all areas, the flow rate to be utilized shall be the maximum rate identified through either developer's calculations, the Little Lehigh Creek, Coplay Creek or Jordan Creek Act 167 or (if applicable) FEMA study flows. In areas where the Act 167 flow rate is the maximum rate, this rate shall be used unless a reduced flow rate is determined by the Lehigh Valley Planning Commission to take precedence over the Act 167 flow rate. This maximum flow rate shall be used to determine the one-hundred-year water surface elevations based on HEC-RAS modeling (or other modeling method as approved by the municipality). The terms of the easement shall prohibit excavation, the placing of fill or structures, and any alterations which may adversely affect the flow of stormwater within any portion of the easement in the post-development condition. Also, periodic maintenance of the easement to ensure proper runoff conveyance shall be

required. Watercourses for which the one-hundred-year floodplain is formally defined by FEMA studies are subject to the applicable municipal floodplain regulations. All proposed buildings within or adjacent to a floodplain as defined by FEMA studies shall have first floor elevations at lease 1.5 feet above the one-hundred-year frequency flood elevation. The one-hundred-year flood elevation to be used to establish the first floor elevation shall be determined using the greater of the maximum flow rate referenced in FEMA study flows, Act 167 flows, or calculated flows as set forth above. **[Amended 4-18-2007 by Ord. No. 855]**

F. Any drainage facilities or structures required by this chapter that are located on state highway rights-of-way shall be subject to approval by the Pennsylvania Department of Transportation.

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

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

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

J. Within areas containing soils identified by the Soils Conservation Service to be sinkhole prone, basins shall be lined with a material which, after installation, attains a permeability rate of less than or equal to 1×10^{-7} cm/sec. **[Amended 4-18-2007 by Ord. No. 855]**

K. Groundwater recharge methods shall not be permitted in the areas of limestone geology.

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

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

N. No earth disturbance activities associated with any regulated activities shall commence until approval by the Township of a plan which demonstrates compliance with the requirements of this chapter. **[Amended 6-15-2005 by Ord. No. 813]**

O. Techniques described in Appendix F (Low Impact Development)[6] of this chapter are encouraged because they reduce the costs of complying with the requirements of this chapter and the State Water Quality Requirements. **[Amended 6-15-2005 by Ord. No. 813]**

P. Infiltration for stormwater management is encouraged where soils and geology permit, consistent with the provisions of this chapter and, where appropriate, the Recommendation Chart for Infiltration Stormwater Management BMPs in Carbonate Bedrock in Appendix D.[7] Infiltration is encouraged for capturing and treating the Water Quality Volume (as calculated in § 296-12), any part of the Water Quality volume or for otherwise meeting the purposes of this chapter. **[Amended 6-15-2005 by Ord. No. 813]**

§ 296-10. Permit requirements by other government entities. [Amended 3-16-2005 by Ord. No. 811; 6-15-2005 by Ord. No. 813]

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

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

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

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

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

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

§ 296-11. Erosion and sediment control during regulated earth disturbance activities. [Amended 3-16-2005 by Ord. No. 811; 6-15-2005 by Ord. No. 813]

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

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6. **Editor's Note: Appendix F is on file in the Township offices.**

7. **Editor's Note: Appendix D is on file in the Township offices.**

B. An erosion and sediment control plan is required by DEP regulations for any earth disturbance activity of 5,000 square feet or more under Pa. Code § 102.4(b).

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

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

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

§ 296-12. Postconstruction water quality criteria. [Amended 3-16-2005 by Ord. No. 811; 6-15-2005 by Ord. No. 813; 4-18-2007 by Ord. No. 855]

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

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

(1) First, WQ_v shall be calculated using the following formula:

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

Where:

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

(2) Second, the WQ_v shall be calculated as the difference in runoff volume from predevelopment to post-development for the two-year return period storm. The effect of closed depressions on the site shall be considered in this calculation. The larger of these two calculated volumes shall be used as the WQ_v to be captured and treated, except that in no case shall the WQ_v be permitted to exceed 1.25 inches of runoff over the site area. This standard does not limit the volume of infiltration an applicant may propose for purposes of water quantity/peak rate control.

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

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

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

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

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

H. For each proposed regulated activity in the watershed where an applicant intends to use infiltration BMP's, the applicant shall conduct a preliminary site investigation, including gathering data from published sources, a field inspection of the site, a minimum of one test pit and a minimum of two percolation tests, as outlined in Appendix G.[8] This investigation will determine depth to bedrock, depth to the seasonal high water table, soil permeability and location of special geologic features, if applicable. This investigation may be done by a certified Sewage Enforcement Officer (SEO) except that the location(s) of special geologic features shall be verified by a qualified geotechnical professional. Additionally, the Township Geotechnical Consultant or its authorized representative shall be notified of the soil testing in order to observe any such testing as determined to be necessary.

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

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

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

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8. Editor's Note: Appendix G is on file in the Township offices.

(3) Soil permeability (as measured by the adapted 25 PA Code § 73.15. percolation test in Appendix G[9]) greater than or equal to 0.5 inches/hour and less than or equal to 12 inches per hour.

(4) Setback distances or buffers as follows:

(a) One hundred feet from water supply wells.

(b) Fifteen feet down gradient or 100 feet upgradient from building foundations; except for residential development where the required setback is 15 feet downgradient or 40 feet upgradient from building foundations.

(c) Fifty feet from septic system drainfields; except for residential development where the required setback is 25 feet from septic system drainfields.

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

(e) One hundred feet from the property line unless documentation is provided to show that all setbacks from existing or potential future wells, foundations and drainfields on neighboring properties will be met; except for one- and two-family residential dwellings where the required setback is 40 feet unless documentation is provided to show that all setbacks from existing or potential future wells, foundations and drainfields on neighboring properties will be met.

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

(1) The RE_v shall be calculated as follows:

$$RE_v = (0.25)*(I)/12$$

Where:

RE_v = Recharge volume in acre-feet

I = Impervious area in acres

(2) The preliminary site investigation described in Subsection H is required and shall continue on different areas of the site until a potentially suitable infiltration location is found or the entire site is determined to be infeasible for infiltration. For infiltration areas that appear to be feasible based on the preliminary site

9. **Editor's Note: Appendix G is on file in the Township offices.**

investigation, the additional site investigation and testing as outlined in Appendix G[10] shall be completed.

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

(4) The site must meet the conditions listed in Subsection I.

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

(6) If RE_v is infiltrated, it may be subtracted from the WQ_v required to be captured and treated.

K. In entirely carbonate areas, where the applicant intends to us infiltration BMPs, the preliminary site investigation described in Subsection H shall be conducted. For infiltration areas that appear feasible based on the preliminary site investigation, the applicant shall conduct the additional site investigation and testing as outlined in Appendix G.[11] The soil depth, percolation rate and proposed loading rate, each weighted as described in § 296-15, along with the buffer from special geologic features shall be compared to the Recommendation Chart for Infiltration Stormwater Management BMPs in Carbonate Bedrock in Appendix D[12] to determine if the site is recommended for infiltration. In addition to the recommendation from Appendix D, the conditions listed in Subsection I are required for infiltration in carbonate areas. Applicants are encouraged to infiltrate the RE_v, as calculated in Subsection J, but are not required to use infiltration BMPs on a carbonate site even if the site falls in the "Recommended" range on the chart in Appendix D. Any amount of volume infiltrated can be subtracted from the WQ_v to be treated by noninfiltration BMPs. If infiltration is not proposed, the full WQ_v shall be treated by two acceptable BMPs, as specified in Subsection O.

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

M. If infiltration BMPs are proposed in carbonate areas, the post-development two-year runoff volume leaving the site shall be 80% or more of the predevelopment runoff

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10. Editor's Note: Appendix G is on file in the Township offices.

11. Editor's Note: Appendix G is on file in the Township offices.

12. Editor's Note: Appendix D is on file in the Township offices.

volume for the carbonate portion of the site to prevent infiltration of volumes far in excess of the predevelopment infiltration volume.

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

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

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

NOTES:

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

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

[C] See table below.

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

Design Reference Title

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

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

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

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

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

6 "Evaporation Maps of the United States," U.S. Weather Bureau (now NOAA/National Weather Service) Technical Paper 37, Published by Department of Commerce, Washington D.C., 1959.

7 "Georgia Stormwater Manual," AMEC Earth and Environmental, Center for Watershed Protection, Debo and Associates, Jordan Jones and Goulding, Atlanta Regional Commission, Atlanta, Georgia, 2001.

8 "Hydraulic Design of Highway Culverts," Federal Highway Administration, FHWA HDS 5, Washington, D.C., 1985 (revised May 2005).

9 "Low Impact Development Design Strategies An Integrated Design Approach," Prince Georges County, Maryland Department of Environmental Resources, June 1999.

10 "Maryland Stormwater Design Manual," Maryland Department of the Environment, Baltimore, Maryland, 2000.

11 "Pennsylvania Handbook of Best Management Practices for Developing Areas," Pennsylvania Department of Environmental Protection, 1998.

12 "Recommended Procedures for Act 167 Drainage Plan Design," LVPC, Revised 1997.

13 "Roof Gardens History, Design, and Construction," Osmundson, Theodore. New York: W.W. Norton and Company, 1999.

14 "The Texas Manual on Rainwater Harvesting," Texas Water Development Board, Austin, Texas, Third Edition, 2005.

15 "VDOT Manual of Practice for Stormwater Management," Virginia Transportation Research Council, Charlottesville, Virginia, 2004.

16 "Virginia Stormwater Management Handbook," Virginia Department of Conservation and Recreation, Richmond, Virginia, 1999.

17 "Water Resources Engineering," Mays, L. W., John Wiley and Sons, Inc., 2005.

Design Reference	Title
18	"Urban Hydrology for Small Watersheds," Technical Report 55, US Department of Agriculture, Natural Resources Conservation Service, 1986.
19	US EPA, Region 1 New England web site (as of August 2005) http://www.epa.gov/NE/assistance/ceitts/stormwater/techs/html.

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

Hot Spot Land Use	Pretreatment Method(s)
Vehicle maintenance and repair facilities, including auto parts stores	Water quality inlets Use of drip pans and/or dry sweep material under vehicles/equipment Use of absorbent devices to reduce liquid releases Spill prevention and response program
Vehicle fueling stations	Water quality inlets Spill prevention and response program
Storage areas for public works	Water quality inlets Use of drip pans and/or dry sweep material under vehicles/equipment Use of absorbent devices to reduce liquid releases Spill prevention and response program Diversion of stormwater away from potential contamination areas
Outdoor storage of liquids	Spill prevention and response program
Commercial nursery operations	Vegetated swales/filter strips Constructed wetlands Stormwater collection and reuse
Salvage yards and recycling facilities*	BMPs that are a part of a stormwater pollution prevention plan under an NPDES permit
Fleet storage yards and vehicle cleaning facilities*	BMPs that are a part of a stormwater pollution prevention plan under an NPDES permit
Facilities that store or generate regulated substances*	BMPs that are a part of a stormwater pollution prevention plan under an NPDES permit
Marinas*	BMPs that are a part of a stormwater pollution prevention plan under an NPDES permit
Certain industrial uses (listed under NPDES)*	BMPs that are a part of a stormwater pollution prevention plan under an NPDES permit

NOTES:

* Regulated under the NPDES Stormwater Program

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

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

NOTES:

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

Q. The use of infiltration BMPs is prohibited on hot spot land use areas.

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

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

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

U. The municipality may, after consultation with DEP, approve alternative methods for meeting the state water quality requirements other than those in this section, provided that they meet the minimum requirements of and do not conflict with state law, including but not limited to the Clean Streams Law.[13]

13. **Editor's Note: See 35 P.S. § 691.1 et seq.**

§ 296-13. Stormwater management districts. [Amended 7-17-2002 by Ord. No. 756; 3-16-2005 by Ord. No. 811; 6-15-2005 by Ord. No. 813]

A. Mapping of Stormwater management districts. To implement the provisions of the Little Lehigh Creek Watershed, Coplay Creek Watershed and Jordan Creek Watershed stormwater management plan, the Township is hereby divided into stormwater management districts consistent with the Little Lehigh Creek, Coplay Creek and Jordan Creek release rate maps presented in the plan. The boundaries of the stormwater management districts are shown on an official map which is available for inspection at the Township Community Development Department office. A copy of the official map at a reduced scale is included in Appendix A[14] for general reference.

B. Description of stormwater management districts. Two types of stormwater management districts may be applicable to the Township, namely conditional/provisional no detention districts and dual release rate districts as described below: **[Amended 4-18-2007 by Ord. No. 855]**

(1) Conditional/provisional no detention districts. Within these districts, the capacity of the "local" runoff conveyance facilities (as defined in Article II) must be calculated to determine if adequate capacity exists. For this determination, the developer must calculate peak flows assuming that the site is developed as proposed and that the remainder of the local watershed is in the existing condition. The developer must also calculate peak flows assuming that the entire local watershed is developed per current zoning and that all new development would use the runoff controls specified by this chapter. The larger of the two peak flows calculated will be used in determining if adequate capacity exists. If adequate capacity exists to safely transport runoff from the site to the main channel (as defined in Article II), these watershed areas may discharge post-development peak runoff without detention facilities. If the capacity calculations show that the local runoff conveyance facilities lack adequate capacity, the developer shall either use a 100% release rate control or provide increased capacity of downstream elements to convey increased peak flows consistent with § 296-14P. Any capacity improvements must be designed to convey runoff from development of all areas tributary to the improvement consistent with the capacity criteria specified in § 296-14D. By definition, a storm drainage problem area associated with the local runoff conveyance facilities indicates that adequate capacity does not exist. Sites in these districts are still required to meet all of the water quality requirements in § 296-12.

(2) Dual release rate districts. Within these districts, the two-year post-development peak discharge must be controlled to 30% of the predevelopment two-year runoff peak. Further, the ten-year- , twenty-five-year- and one-hundred-year post-development peak runoff must be controlled to the stated percentage of the predevelopment peak. Release rates associated with the ten- through one-hundred-year events vary from 50% to 100% depending upon location in the watershed.

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14. Editor's Note: Appendix A is on file in the Township offices.

§ 296-14. Stormwater management district implementation provisions. [Amended 3-16-2005 by Ord. No. 811; 6-15-2005 by Ord. No. 813; 4-18-2007 by Ord. No. 855]

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

B. Any stormwater management controls required by this chapter and subject to a dual release rate criteria shall meet the applicable release rate criteria for each of the two- , ten- , twenty-five- and one-hundred-year return period runoff events consistent with the calculation methodology specified in § 296-15.

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

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

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

(2) Natural or man-made channels or swales must be able to convey the increased twenty-five-year return period runoff without creating any hazard to persons or property.

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

E. For a proposed development site located within one release rate category subarea, the total runoff from the site shall meet the applicable release rate criteria. For development sites with multiple directions of runoff discharge, individual drainage directions may be designed for up to a 100% release rate so long as the total runoff from the site is controlled to the applicable release rate.

F. For a proposed development site located within two or more release category subareas, the peak discharge rate from any subarea shall be the predevelopment peak discharge for that subarea multiplied by the applicable release rate. The calculated peak discharges shall apply regardless of whether the grading plan changes the drainage area by subarea. An exception to the above may be granted if discharges from multiple subareas recombine in proximity to the site. In this case, peak discharge in any direction may be a

100% release rate provided that the overall site discharge meets the weighted average release rate.

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

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

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

J. Off-site areas which drain through a proposed development site are not subject to release rate criteria when determining allowable peak runoff rates. However, on-site drainage facilities shall be designed to safely convey off-site flows through the development site using the capacity criteria in Subsection D and the detention criteria in § 296-15.

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

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

M. Development proposals which, through groundwater recharge or other means, do not increase either the rate or volume of runoff discharged from the site compared to predevelopment are not subject to the release rate provisions of this chapter.

N. "No harm" water quantity option. For any proposed development site not located in a conditional/provisional no detention district, the developer has the option of using a less restrictive runoff control (including no detention) if the developer can prove that special circumstances exist for the proposed development site and that no harm would be caused by discharging at a higher runoff rate than that specified by the plan. Special circumstances are defined as any hydrologic or hydraulic aspects of the development itself not specifically considered in the development of the plan runoff control strategy.

Proof of no harm would have to be shown from the development site through the remainder of the downstream drainage network to the confluence of the creek with the Delaware or Lehigh River. Proof of no harm must be shown using the capacity criteria specified in Subsection D if downstream capacity analysis is a part of the no harm justification. Attempts to prove no harm based upon downstream peak flow versus capacity analysis shall be governed by the following provisions:

(1) The peak flow values to be used for downstream areas for the design return period storms (two- , ten- , twenty-five- and one-hundred-year) shall be the values from the calibrated PSRM Model for the Little Lehigh Creek, Coplay Creek or Jordan Creek or as calculated by an applicant using an alternate method acceptable to the municipality. The flow values from the PSRM Model would be supplied to the developer by the Lehigh Valley Planning Commission upon request.

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

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

Any no harm justifications shall be submitted by the developer as part of the drainage plan submission per Article IV. Developers submitting no harm justifications must still meet all of the water quality requirements in § 296-12.

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

P. Capacity improvements. In certain instances, primarily within the conditional/provisional no detention areas, local drainage conditions may dictate more stringent levels of runoff control than those based upon protection of the entire watershed. In these instances, if the developer could prove that it would be feasible to provide capacity improvements to relieve the capacity deficiency in the local drainage network, then the capacity improvements could be provided by the developer in lieu of runoff controls on the development site. Peak flow calculations shall be done assuming that the local watershed is in the existing condition and then assuming that the local watershed is developed per current zoning and using the specified runoff controls. Any capacity improvements would be designed using the larger of the above peak flows and the capacity criteria specified in Subsection D. All new development in the entire subarea(s) within which the proposed

development site is located shall be assumed to implement the developer's proposed discharge control, if any. Capacity improvements may also be provided as necessary to implement any regional detention alternatives or to implement a modified no harm option which proposes specific capacity improvements to provide that a less stringent discharge control would not create any harm downstream.

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

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

S. In any stormwater management district, storm sewer piping, swales and inlet systems shall be designed for a twenty-five-year return period storm, or a one-hundred-year return period storm where the system is designed to convey one-hundred-year storm flows to a detention facility. Bridges and culverts along roadways shall be designed to convey the one-hundred-year return period storm. Flows from off-site upstream areas shall be determined in accordance with the procedure identified in § 296-9E.

§ 296-15. Calculation methodology. [Amended 3-16-2005 by Ord. No. 811; 6-15-2005 by Ord. No. 813]

A. Stormwater runoff from all development sites shall be calculated using either the Rational Method or the Soil-Cover-Complex methodology. The following requirements apply unless an alternate methodology is expressly approved by the municipality: **[Amended 4-18-2007 by Ord. No. 855]**

(1) For drainage areas of less than 100 acres, the Rational Method shall be used.

(2) For drainage areas of 100 acres or more, the Soil Conservation Service Method shall be used.

B. Infiltration BMP loading rate percentages in the Recommendation Chart for Infiltration Stormwater Management BMPs in Carbonate Bedrock in Appendix D[15] shall be calculated as follows:

15. **Editor's Note: Appendix D is on file in the Township offices.**

$$\frac{\text{Area Tributary to infiltration BMP}}{\text{Base area of infiltration BMP}} * 100\%$$

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

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

C. Soil thickness is to be measured from the bottom of any proposed infiltration system. The effective soil thickness in the Recommendation Chart for Infiltration Stormwater Management BMPs in Carbonate Bedrock in Appendix D[16] is the measured soil thickness multiplied by the thickness factor based on soil permeability (as measured by the adapted 25 PA Code § 73.15 percolation test in Appendix G[17]), as follows: **[Amended 4-18-2007 by Ord. No. 855]**

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

NOTES:

* If the permeability rate (as measured by the adapted 25 PA Code § 73.15 percolation test in Appendix G[18]) falls on a break between two thickness factors, the smaller thickness factor shall be used.

Sites with soil permeability greater than 12.0 in/hr or less than 0.5 in/hr, as measured by the adapted 25 PA Code § 73.15 percolation test in Appendix G, are not recommended for infiltration.

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16. **Editor's Note: Appendix D is on file in the Township offices.**

17. **Editor's Note: Appendix G is on file in the Township offices.**

18. **Editor's Note: Appendix G is on file in the Township offices.**

D. The design of any detention basin intended to meet the requirements of this chapter shall be verified by routing the design storm hydrograph through the proposed basin using the storage indication method or other methodology demonstrated to be more appropriate. For basins designed using the Rational Method technique, the design hydrograph for routing shall be the Universal Rational Hydrograph unless another methodology is approved by the municipality. **[Amended 4-18-2007 by Ord. No. 855]**

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

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

G. Wet detention ponds designed to have a permanent pool for the WQ_v shall assume that the permanent pool volume below the primary outlet is full at the beginning of design event routing for the purposes of evaluating peak outflows. All wet detention ponds shall be subject to review by the Township Geotechnical Consultant. **[Amended 4-18-2007 by Ord. No. 855]**

H. All stormwater detention facilities shall provide a minimum 1.0 foot freeboard above the maximum pool elevation associated with the two- through twenty-five-year runoff events. A 0.5 foot freeboard shall be provided above the maximum pool elevation of the one-hundred-year runoff event. The freeboard shall be measured from the maximum pool elevation to the invert of the emergency spillway. The two through one-hundred-year storm events shall be controlled by the primary outlet structure. An emergency spillway for each basin shall be designed to pass the one-hundred-year return frequency storm peak basin inflow rate with a minim 0.5 feet freeboard measured to the top of basin. The freeboard criteria shall be met considering any off-site areas tributary to the basin as developed, as applicable. If this detention facility is considered to be a dam as per DEP Chapter 105, the design of the facility must be consistent with the Chapter 105 regulations, and may be required to pass a storm greater than the one-hundred-year event.

I. The minimum circular orifice diameter for controlling discharge rates from detention facilities shall be three inches. Designs where a lesser size orifice would be required to fully meet release rates shall be acceptable provided that as much of the site runoff as practical is directed to the detention facilities.

J. Runoff calculations using the Soil-Cover-Complex Method shall use the Natural Resources Conservation Service Type II twenty-four-hour rainfall distribution. The twenty-four-hour rainfall depths for the various return periods to be used consistent with this chapter may be taken from NOAA Atlas 14, Volume 2 or the PennDOT Intensity-Duration-Frequency Field Manual (PDT-IDF) (May 1986) for Region 4. The following values are taken from the PDT-IDF Field Manual:

Return Period	24 Hour Rainfall Depth
1 year	2.40 inches
2 year	3.00 inches
5 year	3.60 inches

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

NOTES:

A graphical and tabular presentation of the Type II 24 hour distribution is included in Appendix C. [19]

K. Runoff calculations using the Rational Method shall use rainfall intensities consistent with appropriate times of concentration and return periods and NOAA Atlas 14, Volume 2, Version 2.1, 2004 or the Intensity-Duration-Frequency Curves as presented in Appendix C.[20] **[Amended 4-18-2007 by Ord. No. 855]**

L. Runoff Curve Numbers (CN's) to be used in the soil-cover-complex method shall be based upon the matrix presented in Appendix C.[21]

M. Runoff coefficients for use in the Rational Method shall be based upon the table presented in Appendix C.[22]

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

(1) Sheet Flow (overland flow) calculations shall use either the NRCS average velocity chart (Figure 3-1, Technical Release-55, 1975) or the modified kinematic wave travel time equation (equation 3-3, NRCS TR-55, June 1986). If using the modified kinematic wave travel time equation, the sheet flow length shall be limited to 50 feet for designs using the Rational Method and limited to 150 feet for designs using the Soil-Cover-Complex method.

(2) Shallow concentrated flow travel times shall be determined from the watercourse slope, type of surface and the velocity from Figure 3-1 of TR-55, June 1986.

(3) Open channel flow travel times shall be determined from velocities calculated by the Manning Equation. Bankfull flows shall be used for determining velocities. Manning 'n' values shall be based on the table presented in Appendix C.[23]

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19. Editor's Note: Appendix C of this article is on file in the Department of Community Development.

20. Editor's Note: Appendix C of this article is on file in the Department of Community Development.

21. Editor's Note: Appendix C of this article is on file in the Department of Community Development.

22. Editor's Note: Appendix C of this article is on file in the Department of Community Development.

23. Editor's Note: Appendix C of this article is on file in the Department of Community Development.

(4) Pipe flow travel times shall be determined from velocities calculated using the Manning Equation assuming full flow and the Manning 'n' values from Appendix C.[24]

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

P. The Manning Equation shall be used to calculate the capacity of watercourses. Manning 'n' values used in the calculations shall be consistent with the table presented in Appendix C[25] or other appropriate standard engineering 'n' value resources. Pipe capacities shall be determined by methods acceptable to the Township Engineer.

Q. The Pennsylvania DEP, Chapter 105, Rules and Regulations, applies to the construction, modification, operation or maintenance of both existing and proposed dams, water obstructions and encroachments throughout the watershed. Criteria for design and construction of stormwater management facilities according to this chapter may differ from the criteria that are used in the permitting of dams under the Dam Safety Program. **[Amended 4-18-2007 by Ord. No. 855]**

ARTICLE IV
Drainage Plan Requirements

§ 296-16. General requirements. [Amended 3-16-2005 by Ord. No. 811; 6-15-2005 by Ord. No. 813]

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

§ 296-17. Exemptions. [Amended 3-16-2005 by Ord. No. 811; 6-15-2005 by Ord. No. 813; 4-18-2007 by Ord. No. 855]

A. Impervious cover. Any proposed regulated activity, except those defined in § 296-5D(5) and (6), which would create 10,000 square feet or less of additional impervious cover is exempt from the drainage plan preparation provisions of this chapter. All of the impervious cover added incrementally to a site above the initial 10,000 square feet shall be subject to the drainage plan preparation provisions of this chapter. If a site has previously received an exemption and is proposing additional development such that the total impervious cover on the site exceeds 10,000 square feet, the total impervious cover on the site proposed since the original ordinance date must meet the provisions of this chapter.

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24. Editor's Note: Appendix C of this article is on file in the Department of Community Development.

25. Editor's Note: Appendix C of this article is on file in the Department of Community Development.

(1) The date of the Township ordinance adoption of the original Act 167 Stormwater Management Ordinance 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. Predevelopment impervious cover is that which is in place as of May 18, 1989, within the Little Lehigh Creek Watershed, March 17, 1993, within the Jordan Creek Watershed, and March 1, 1995, within the Coplay Creek Watershed. These dates reflect the original ordinance adoption date in each watershed.

(2) For development taking place in stages, the entire development plan must be used in determining conformance with these criteria.

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

(4) Any additional areas proposed to initially be gravel, crushed stone, porous pavement, etc., shall be assumed to be impervious for the purposes of comparison to the exemption criteria. Any existing gravel, crushed stone or hard packed soil areas on a site shall be considered as previous cover for the purpose of exemption evaluation.

B. Prior drainage plan approval. Any regulated activity for which a drainage plan was previously prepared as part of a subdivision or land development proposal that received preliminary plan approval from the municipality prior to the effective date of this chapter is exempt from the drainage plan preparation provisions of this chapter, except as cited in Subsection C, provided that the approved drainage plan included design of stormwater facilities to control runoff from the site currently proposed for regulated activities consistent with ordinance provisions in effect at the time of approval and the approval has not lapsed under the Municipalities Planning Code. If significant revisions are made to the drainage plan after both the preliminary plan approval and the effective date of this chapter, preparation of a new drainage plan, subject to the provisions of this chapter, shall be required. Significant revisions would include a change in control methods or techniques, relocation or redesign of control measures or changes necessary because soil or other conditions are not as stated on the original drainage plan.

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

D. No exemptions shall be provided for regulated activities as defined in § 296-5D(5) and (6).

§ 296-18. Drainage plan contents. [Amended 3-16-2005 by Ord. No. 811; 6-15-2005 by Ord. No. 813]

The following items shall be included in the drainage plan:

A. General.

(1) General description of project.

(2) General description of proposed permanent stormwater controls.

(3) The name and address of the project site, the name and address of the owner of the property and the name of the individual or firm preparing the drainage plan.

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

(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%), five-foot contour intervals may be used. Off-site drainage areas impacting the project including topographic detail.

(3) Streams, lakes, ponds or other bodies of water within the project area.

(4) Other features, including flood hazard boundaries, existing drainage swales, wetlands, closed depressions, sinkholes and areas of natural vegetation to be preserved. **[Amended 4-18-2007 by Ord. No. 855]**

(5) Locations of proposed underground utilities, sewers and water lines. The locations of all existing and proposed utilities, sanitary sewers and water lines within 50 feet of property lines of the project site.

(6) An overlay showing soil types and boundaries based on the Lehigh County Soil Survey, as applicable, latest edition. Any hydric soils present on the site should be identified as such. **[Amended 4-18-2007 by Ord. No. 855]**

(7) Proposed changes to land surface and vegetative cover.

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

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

(10) Stormwater management district boundaries applicable to the site.

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

(12) Clear identification of the location and nature of permanent stormwater BMPs.

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

(14) The location of all public water supply wells within 400 feet of the project and all private water supply wells within 100 feet of the project.

(15) An overlay showing geologic types, boundaries and any special geologic features present on the site. **[Amended 4-18-2007 by Ord. No. 855]**

C. Stormwater management controls and BMPs.

(1) All stormwater management controls must be shown on a map and described, including:

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

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

(2) All calculations, assumptions and criteria used in the design of the control device or method must be shown.

(3) All site testing data used to determine the feasibility of infiltration on a site.

(4) All details and specifications for the construction of the stormwater management controls and BMPs. **[Amended 4-18-2007 by Ord. No. 855]**

D. The BMP operations and management plan, as required in Article VIII, describing how each permanent stormwater BMP will be operated and maintained and the identity of the person(s) responsible for operations and maintenance. A statement must be included, signed by the landowner, acknowledging that the stormwater BMPs are fixtures that cannot be altered or removed without approval by the Township. **[Amended 4-18-2007 by Ord. No. 855]**

E. An environmental resources site design assessment that describes the following: **[Amended 4-18-2007 by Ord. No. 855]**

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

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

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

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

§ 296-19. Plan submission. [Amended 7-17-2002 by Ord. No. 756; 3-16-2005 by Ord. No. 811; 6-15-2005 by Ord. No. 813]

A. For regulated activities specified in § 296-5D(1) and (2):

(1) The drainage plan shall be submitted by the developer to the Township Secretary (or other appropriate person) as part of the preliminary plan submission for the subdivision or land development.

(2) Five copies of the drainage plan shall be submitted.

(3) Distribution of the drainage plan will be as follows:

(a) One copy to the Township of South Whitehall Planning Commission.

(b) Two copies to the Township Engineer.

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

(4) Drainage plans involving more than 10,000 square feet of additional impervious cover shall be submitted by the developer (possibly through the Township) to the Lehigh Valley Planning Commission as part of the preliminary plan submission. The Lehigh Valley Planning Commission will conduct an advisory review of the drainage plan for consistency with the Little Lehigh Creek Watershed, Coplay Creek Watershed or the Jordan Creek Watershed Stormwater Management Plan. The LVPC will not review details of the erosion and sedimentation plan or the BMP operations and maintenance plan. **[Amended 4-18-2007 by Ord. No. 855]**

(a) Two copies of the drainage plan shall be submitted.

(b) The Lehigh Valley Planning Commission will provide written comments to the developer and the Township, within a time frame consistent with established procedures under the Municipalities Planning Code, as to whether the drainage plan has been found to be consistent with the stormwater management plan.

B. For regulated activities specified in § 296-5D(3) and (4), the drainage plan shall be submitted by the developer to the Township Director of Community Development, or his designee, as part of the building permit application.

C. For regulated activities specified in § 296-5D(5), (6), and (7):

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

(2) One copy of the drainage plan shall be submitted.

D. Earthmoving for all regulated activities under § 296-5D shall be conducted in accordance with the current federal and state regulations relative to the NPDES and DEP Chapter 102 regulations.

§ 296-20. Drainage plan review. [Amended 7-17-2002 by Ord. No. 756; 3-16-2005 by Ord. No. 811; 6-15-2005 by Ord. No. 813]

A. The Township Engineer shall review the drainage plan, including the BMP operations and maintenance plan, for consistency with the adopted stormwater management plan as embodied by this chapter and with any permits issued by DEP. The Township Engineer shall also review the drainage plan against any additional storm drainage provisions contained in the Township Subdivision and Land Development, Chapter 312 or Chapter 350, Zoning , as applicable.

B. The Township shall not approve any subdivision or land development [regulated activities § 296-5D(1) and (2)] or building permit application [regulated activities § 296-5D(3) and (4)] if the drainage plan has been found to be inconsistent with the stormwater management plan as determined by the Township Engineer.

C. The Township shall notify the applicant in writing whether the drainage plan, including the BMP operations and maintenance plan, is approved. **[Amended 4-18-2007 by Ord. No. 855]**

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

§ 296-21. Modifications of plans. [Amended 3-16-2005 by Ord. No. 811; 6-15-2005 by Ord. No. 813]

A modification to a submitted drainage plan for a proposed development site which involves a change in control methods or techniques, or which involves the relocation or redesign of control measures or which is necessary because soil or other conditions are not as stated on the drainage plan (as determined by the Township Engineer) shall require a resubmission of the modified drainage plan consistent with § 296-19 subject to review per § 296-20 of this chapter.

§ 296-22. Hardship waiver procedure. [Amended 3-16-2005 by Ord. No. 811; 6-15-2005 by Ord. No. 813[26]]

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

26. Editor's Note: Amended at time of adoption of Code (see Ch. 1, General Provisions, Art. I).

Lehigh Valley Planning Commission. The request shall fully document the nature of the alleged hardship.

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

(1) That there are unique physical circumstances or conditions, including irregularity of lot size or shape, or exceptional topographical or other physical conditions peculiar to the particular property, and that the unnecessary hardship is due to such conditions, and not the circumstances or conditions generally created by the provisions of this chapter in the stormwater management district in which the property is located;

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

(3) That such unnecessary hardship has not been created by the applicant; and

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

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

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

(1) For regulated activities described in § 296-5D(1) and (2), the Board of Commissioners shall hear requests for and decide on hardship waiver requests on behalf of the Township.

(2) For regulated activities in § 296-5D(3), (4), (5) and (6), the Zoning Hearing Board shall hear requests for and decide on hardship waiver requests on behalf of the Township.

(3) The Township shall not waive the water quality provisions of this chapter.

ARTICLE V
Inspections

§ 296-23. Schedule of inspections. [Amended 3-16-2005 by Ord. No. 811; 6-15-2005 by Ord. No. 813]

A. For each phase of development, the developer shall provide notification to the Township Engineer and the Township a minimum three days prior to the installation of the permanent stormwater control facilities so that general observation of the work can be scheduled. The developer shall furnish to the Township record drawings of the subject facilities (including detention basin grades) which are certified by a registered land surveyor. Full acceptance and approval of the stormwater management facilities will not occur until installation is observed to be acceptable and record plans are approved.

B. If at any stage of the work the Township Engineer determines that the permanent stormwater control facilities are not being installed in accordance with the approved development plan, the Township shall revoke any existing permits until a revised development plan is submitted and approved as required by § 296-21.

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

D. During any stage of the regulated earth disturbance activities, if the Township or its designee determines that any BMPs are not being implemented in accordance with this chapter, the Township may suspend or revoke any existing permits or other approvals issued by the Township until the deficiencies are corrected.

ARTICLE VI
Fees and Expenses

§ 296-24. General. [Amended 3-16-2005 by Ord. No. 811; 6-15-2005 by Ord. No. 813]

A fee shall be established by the Township Board of Commissioners to defray municipal costs for review and processing of drainage plans and BMP operations and maintenance plans.

§ 296-25. Expenses covered by fees. [Amended 3-16-2005 by Ord. No. 811; 6-15-2005 by Ord. No. 813]

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

A. The review of the drainage plan and the BMP operations and maintenance plan by the Township Engineer.

B. The site inspection.

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

D. The final inspection upon completion of the controls and improvements required in the plan.

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

F. Administrative and clerical costs.

ARTICLE VII
Maintenance Responsibilities for Permanent Stormwater Runoff Controls

§ 296-26. Maintenance responsibilities. [Amended 3-16-2005 by Ord. No. 811; 6-15-2005 by Ord. No. 813]

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

A. Single entity ownership. In all cases where the permanent stormwater runoff control facilities are designed to manage runoff from property in a single entity ownership as defined below, the maintenance responsibility for the stormwater control facilities shall be with the single entity owner. The single entity owner shall enter into an agreement with the Township which specifies that the owner will properly maintain the facilities consistent with accepted practice as determined by the Township Engineer. The agreement shall provide for regular inspections by the Township, shall contain such provisions as are necessary to ensure timely correction of any maintenance deficiencies by the single entity owner, and shall be recorded in the miscellaneous docket in the Office of the Recorder of Deeds of Lehigh County, Pennsylvania. For the purposes of this chapter, the term "single entity" shall be defined as an individual, association, public or private corporation, partnership firm, trust, estate or any other legal entity empowered to own real estate.

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

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

ARTICLE VIII
Stormwater BMP Operations and Maintenance Plan General Requirements

§ 296-27. General requirements. [Amended 3-16-2005 by Ord. No. 811; 6-15-2005 by Ord. No. 813]

No regulated earth disturbance activities within the Township shall commence until approval by the Township of the BMP operations and maintenance plan which describes how the

permanent (e.g., post-construction) stormwater BMPs will be properly operated and maintained.

§ 296-28. Responsibilities for operations and maintenance of BMPs. [Amended 3-16-2005 by Ord. No. 811; 6-15-2005 by Ord. No. 813]

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

(1) If a plan includes structures or lots which are to be separately owned and in which streets, sewers and other public improvements are to be dedicated to the Township, stormwater BMPs may also be dedicated to and maintained by the Township.

(2) If a plan includes operations and maintenance by a single ownership or if sewers and other public improvements are to be privately owned and maintained, then the operation and maintenance of stormwater BMPs shall be the responsibility of the owner or private management entity.

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

§ 296-29. Adherence to approved BMP operations and maintenance plan. [Amended 3-16-2005 by Ord. No. 811; 6-15-2005 by Ord. No. 813]

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

§ 296-30. Operations and maintenance agreement for privately owned stormwater BMPs. [Amended 3-16-2005 by Ord. No. 811 6-15-2005 by Ord. No. 813]

A. The property owner shall sign an operations and maintenance agreement with the Township covering all stormwater BMPs that are to be privately owned. The agreement shall include the terms of the format agreement referenced in Appendix E[26] of this chapter.

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

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26. Editor's Note: Appendix E is on file in the Township offices.

§ 296-31. Stormwater management easements. [Amended 3-16-2005 by Ord. No. 811; 6-15-2005 by Ord. No. 813]

Stormwater management easements shall be provided by the property owner if necessary for access for inspections and maintenance or for preservation of stormwater conveyance, infiltration, detention areas and other BMPs by persons other than the property owner. The purpose of the easement shall be specified in any agreement under § 296-30.

§ 296-32. Recording of approved BMP operations and maintenance plan and related agreements. [Amended 3-16-2005 by Ord. No. 811; 6-15-2005 by Ord. No. 813]

A. The owner of any land upon which permanent BMPs will be placed, constructed or implements, as descried in the BMP operations and maintenance plan, shall record the following documents in the Office of the Recorder of Deeds for Lehigh County, within 90 days of approval of the BMP operations plan by the Township:

   (1) Operations and maintenance plan or a summary thereof.

   (2) Operations and Maintenance Agreements under § 296-30.

   (3) Easements under § 296-31.

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

§ 296-33. Township stormwater BMP Operation and Maintenance Fund. [Amended 3-16-2005 by Ord. No. 811; 6-15-2005 by Ord. No. 813]

A. If stormwater BMPs are accepted by the Township for dedication, the Township may require persons installing stormwater BMPs to pay a specified amount to the Township Stormwater BMP Operation and Maintenance Fund to help defray costs of operations and maintenance activities. The amount may be determined as follows:

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

   (2) The amount shall then be converted to present worth of the annual series values.

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

ARTICLE IX
Prohibitions

§ 296-34. Prohibited discharges. [Amended 3-16-2005 by Ord. No. 811; 6-15-2005 by Ord. No. 813]

A. No person in the Township shall allow or cause to allow stormwater discharges into the Township's separate storm sewer system which are not composed entirely of stormwater except as provided in Subsection B below or as allowed under a state or federal permit.

B. Discharges that may be allowed based on the Township finding that the discharge(s) do not significantly contribute pollution to surface waters of the Commonwealth are listed below:

(1) Discharges from fire-fighting activities.

(2) Potable water sources, including dechlorinated water line and fire hydrant flushings.

(3) Irrigation drainage.

(4) Routine external building wash down which does not use detergents or other compounds.

(5) Air conditioning condensate.

(6) Water from individual residential car washing.

(7) Springs.

(8) Water from crawl space pumps.

(9) Uncontaminated water from foundation or from footing drains.

(10) Flows from riparian habitats and wetlands.

(11) Lawn watering.

(12) Pavement washwaters 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.

(13) Dechlorinated swimming pool discharges.

(14) Uncontaminated groundwater.

C. In the event that the Township determines that any of the discharges identified in Subsection B significantly contribute to pollution of waters of the Commonwealth or is so notified by DEP, the Township will notify the responsible person to cease the discharge.

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

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

§ 296-35. Prohibited connections. [Amended 3-16-2005 by Ord. No. 811; 6-15-2005 by Ord. No. 813]

The following connections are prohibited, except as provided in § 296-34B above:

A. Any drain or conveyance, whether on the surface or subsurface, which allows any nonstormwater discharge, including sewage, process wastewater and wash water to enter the separate storm sewer system and any connections to the storm drain system from indoor drains and sinks.

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

§ 296-36. Roof drains. [Amended 3-16-2005 by Ord. No. 811; 6-15-2005 by Ord. No. 813]

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

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

C. Roof drains shall discharge to infiltration area or vegetative BMPs to the maximum extent practicable.

§ 296-37. Alteration of BMPs. [Amended 3-16-2005 by Ord. No. 811; 6-15-2005 by Ord. No. 813]

A. No person shall modify, remove, fill, landscape or alter any existing stormwater BMP without the written approval of the Township, unless it is part of an approved maintenance program.

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

ARTICLE X
Right-of-Entry, Notification and Enforcement

§ 296-38. Right-of-entry. [Amended 3-16-2005 by Ord. No. 811; 6-15-2005 by Ord. No. 813; 4-18-2007 by Ord. No. 855]

A. Upon presentation of proper credentials and with the consent of the landowner, duly authorized representatives of the Township may enter at reasonable times upon any property within the Township to inspect the implementation, condition or operation and maintenance of the stormwater BMPs or to investigate or ascertain the condition of the subject property in regard to any aspect regulated by this chapter.

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

§ 296-39. Notification. [Amended 3-16-2005 by Ord. No. 811; 6-15-2005 by Ord. No. 813]

A. Whenever the municipality finds that a person has violated a prohibition or failed to meet a requirement of this chapter, the municipality may order compliance by written notice to the responsible person. Such notice may require without limitation: **[Amended 4-18-2007 by Ord. No. 855]**

(1) The name of the owner of record and any other person against whom the municipality intends to take action.

(2) The location of the property in violation.

(3) The performance of monitoring, analyses and reporting.

(4) The elimination of prohibited connections or discharges.

(5) Cessation of any violating discharges, practices or operations.

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

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

(8) The implementation of stormwater BMPs.

(9) Operation and maintenance of stormwater BMPs.

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

C. Failure to comply with the time specified shall also subject such person to the penalty provisions of this chapter. All such penalties shall be deemed cumulative and shall not

prevent the Township from pursuing any and all other remedies available in law or equity.

§ 296-40. Public nuisance. [Amended 3-16-2005 by Ord. No. 811; 6-15-2005 by Ord. No. 813]

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

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

§ 296-41. Suspension and revocation of permits and approvals. [Amended 3-16-2005 by Ord. No. 811; 6-15-2005 by Ord. No. 813]

A. Any building, land development or other permit or approval issued by the Township may be suspended or revoked by the Township for:

(1) Noncompliance with or failure to implement any provision of the permit.

(2) A violation of any provision of this chapter.

(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 endanger the life or property of others.

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

(1) The Township or designee has inspected and approved the corrections to the stormwater BMPs or the elimination of the hazard or nuisance.

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

(3) Payment of all Township fees, costs and expenses related to or arising from the violation has been made.

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

§ 296-42. Violations and penalties. [Amended 3-16-2005 by Ord. No. 811; 6-15-2005 by Ord. No. 813; 4-18-2007 by Ord. No. 855]

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

B. In addition, the Township may institute an action at law or equity in a court of competent jurisdiction seeking injunctive or other appropriate relief for the enforcement of this chapter.

§ 296-43. Appeals. [Amended 3-16-2005 by Ord. No. 811; 6-15-2005 by Ord. No. 813]

Any person aggrieved by any action of the Township or its designee relevant to the provisions of this chapter may appeal using the appeal procedures established in the Pennsylvania Municipalities Planning Code.

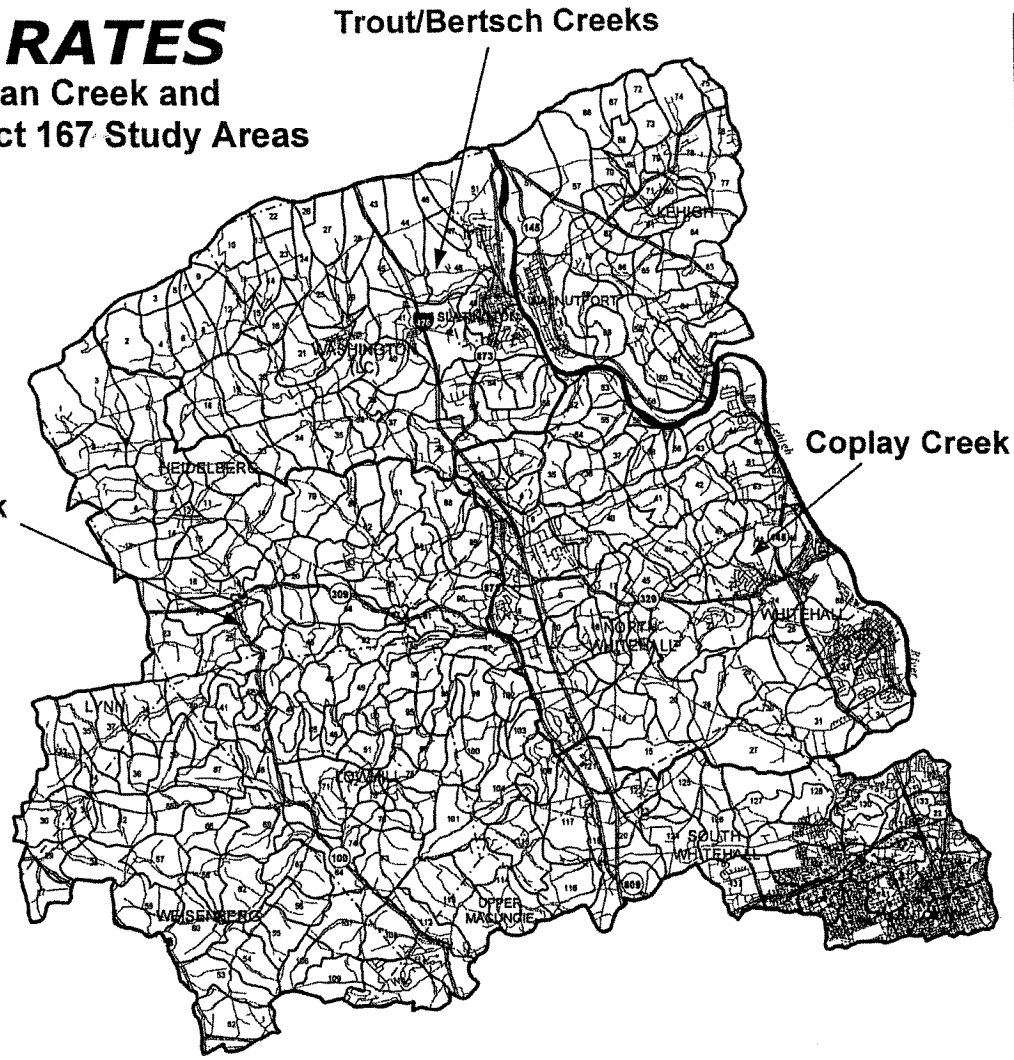
APPENDIX A

Maps of Jordan Creek, Coplay Creek and Little Lehigh Creek Watersheds

MAP 4

RELEASE RATES

Coplay Creek, Jordan Creek and Trout/Bertsch Creeks Act 167 Study Areas



23 Subarea Boundaries

Watershed Boundaries

Municipal Boundaries

Major Roads

Minor/Other Roads

River

Streams

RELEASE RATE SUMMARY TABLES

Dual Release Rate Categories (30/--) define a 30% Release Rate for the 2-Year storm and the indicated Release Rate for the 10-, 25- and 100-Year storms.

COPLAY CREEK STUDY AREA

Subarea	Release Rate (%)	Subarea	Release Rate (%)
1 - 11	30/100	35	30/100
12 - 15	30/90	36 – 38	30/CND I*
16 - 19	30/100	39 – 40	30/100
20 - 21	30/90	41 – 44	30/CND I*
22	30/100	45	30/100
23 - 26	30/CND I*	46 – 50	30/CND I*
27	30/100	51 – 53	30/CND II*
28	30/90	54	30/100
29	30/100	55	30/CND I*
30 - 34	30/CND I*	56 – 65	30/CND II*

JORDAN CREEK STUDY AREA

Subarea	Release Rate (%)	Subarea	Release Rate (%)
1 - 95	30/100	118	30/100
96	30/PND*	119 - 120	30/PND*
97	30/100	121 - 122	30/100
98 - 101	30/PND*	123 - 131	30/PND*
102	30/100	132	30/100
103 - 105	30/PND*	133	30/PND*
106 - 113	30/100	134 - 135	30/100
114 - 115	30/PND*	136	30/PND*
116	30/100	137 - 138	30/100
117	30/PND*	139 - 145	30/PND*

TROUT/BERTSCH CREEKS STUDY AREA

Subarea	Release Rate (%)	Subarea	Release Rate (%)
1 - 20	30/100	53	30/100
21	30/CND I*	54 - 55	30/CND I*
22 - 29	30/100	56 - 58	30/CND II*
30 - 32	30/CND I*	59 - 60	30/100
33 - 37	30/100	61 - 62	30/CND II*
38 - 42	30/CND I*	63 - 64	30/100
43 - 44	30/100	65	30/CND I*
45	30/90	66 - 81	30/100
46 - 48	30/100	82	30/CND I*
49 - 50	30/CND I*	83 - 84	30/100
51 - 52	30/CND II*	85 - 89	30/CND I*

*Conditional/Provisional No Detention Areas do not need detention controls for the 10-, 25- or 100-Year storms, provided that adequate downstream capacity can be shown for increased peak flows. (See Plan Update for additional details.)

N

0 10,000 20,000 Feet

1" = 10,000'

Source: Lehigh Valley Planning Commission

LEHIGH VALLEY PLANNING COMMISSION
961 Marcon Boulevard, Suite 310
Allentown, PA 18109-9368
(610) 264-4544

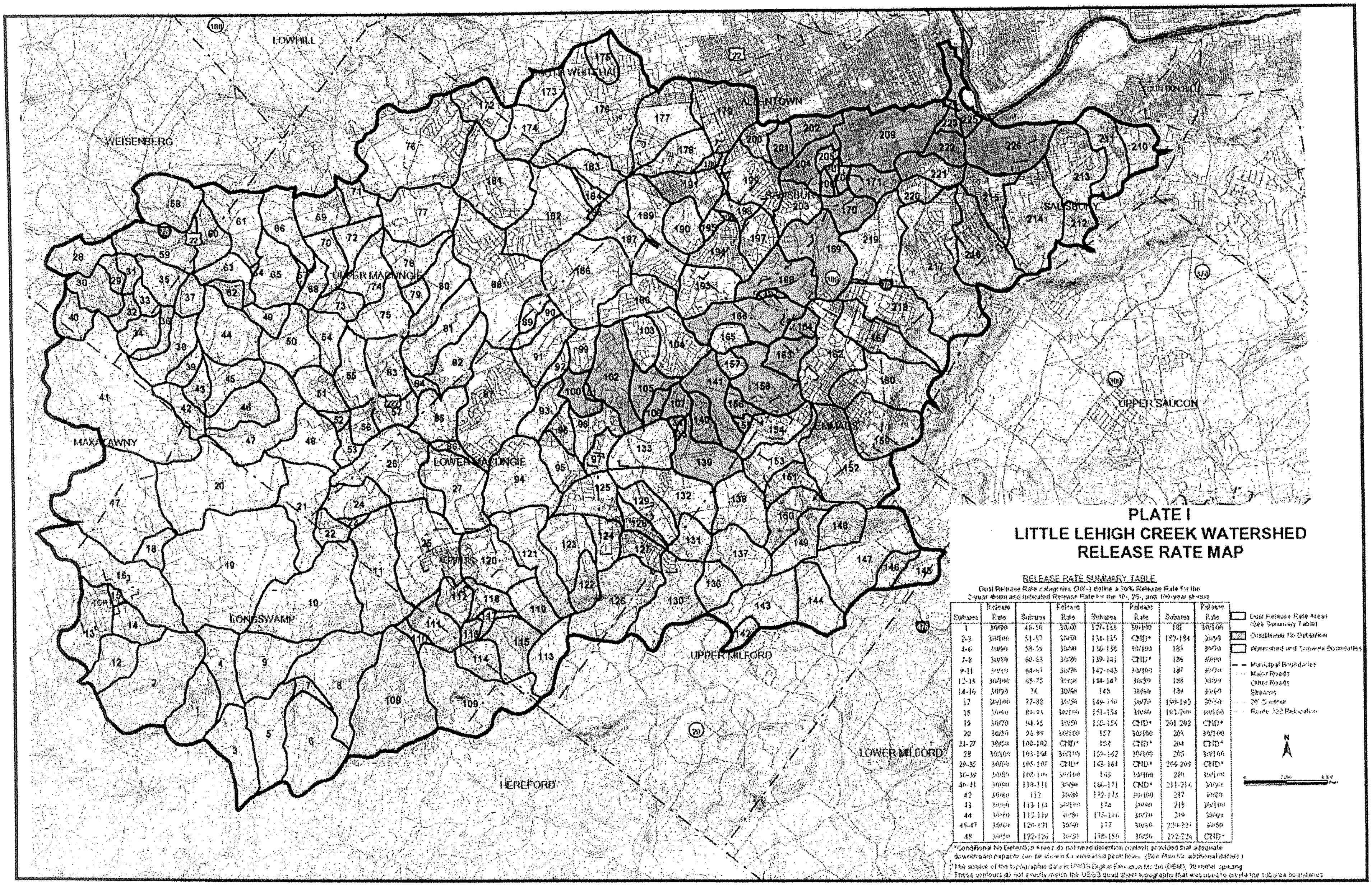


PLATE I
LITTLE LEHIGH CREEK WATERSHED
RELEASE RATE MAP

RELEASE RATE SUMMARY TABLE

Dual Release Rate categories (30/-) define a 30% Release Rate for the 2-year storm and indicated Release Rate for the 10-, 25-, and 100-year storms

Subarea	Release Rate	Subarea	Release Rate	Subarea	Release Rate	Subarea	Release Rate
1	30/90	48-50	30/60	127-133	30/100	181	30/100
2-3	30/100	51-57	30/50	134-135	CND*	182-184	30/50
4-6	30/90	58-59	30/90	136-138	30/100	185	30/70
7-8	30/50	60-63	30/80	139-141	CND*	186	30/90
9-11	30/[illegible]	64-67	30/70	142-143	30/100	187	30/70
12-13	30/100	68-75	30/90	144-147	30/80	188	30/90
14-16	30/90	76	30/60	148	30/60	189	30/60
17	30/100	77-88	30/50	149-150	30/70	190-192	30/50
18	30/60	89-93	30/100	151-154	30/60	193-200	30/100
19	30/70	94-95	30/90	155-156	CND*	201-202	CND*
20	30/25	96-99	30/100	157	30/100	203	30/100
21-27	30/50	100-102	CND*	158	CND*	204	CND*
28	30/100	103-104	30/100	159-162	30/100	205	30/100
29-35	30/90	105-107	CND*	163-164	CND*	206-209	CND*
36-39	30/80	108-109	30/100	165	30/100	210	30/100
40-41	30/60	110-111	30/90	166-171	CND*	211-216	30/90
42	30/80	112	30/80	172-173	30/100	217	30/80
43	30/90	113-114	30/100	174	30/60	218	30/100
44	30/60	115-119	30/90	175-176	30/70	219	30/90
45-47	30/60	120-121	30/90	177	30/60	220-221	30/60
48	30/50	122-126	30/90	178-180	30/50	222-226	CND*

*Conditional No Detention Areas do not need detention controls provided that adequate downstream capacity can be shown for unrestricted peak flows. (See Plan for additional details.)

[1] The source of the topographic data is USGS's Digital Elevation Model (DEM), 30 meter spacing. These contours do not exactly match the USGS quad sheet topography that was used to create the subarea boundaries.

APPENDIX B

B-1 Maps and Descriptions of Storm Drainage Problem Areas for Coplay Creek

B-2 Maps and Descriptions of Storm Drainage Problem Areas for Jordan Creek

B-3 Maps and Descriptions of Storm Drainage Problem Areas for Little Lehigh Creek

CHAPTER V. COPLAY CREEK STUDY AREA EXISTING STORM DRAINAGE PROBLEM AREAS AND SIGNIFICANT OBSTRUCTIONS

A. Existing Storm Drainage Problem Areas

An important goal of Act 167 is to prevent any existing storm drainage problem areas from getting worse. The first step toward that goal is to identify the existing problem areas. Each municipality in the Coplay Creek Study Area was provided with an opportunity to document the existing drainage problems within its borders. The starting point for the drainage problem inventory was the JPC Regional Storm Drainage Plan (RSDP) which documented no problems throughout the study area based on a municipal survey conducted prior to 1975. This process resulted in the documentation of twenty-one (21) existing drainage problems in the study area. The type of problem identified was typically street and/or property flooding. Figure 8 is a map of the Coplay Creek Study Area indicating the storm drainage problem areas as identified as part of the Storm Water Management Plan. The problem areas on Figure 8 are number coded and keyed to the problem area descriptions presented in Table 11. The "Subarea" and "Reach No." columns in Table 11 refer to the location of the problem areas relative to the study area breakdown for modeling purposes. A subarea is the finest unit of breakdown of a watershed for which runoff values have been calculated. A reach is the swale, channel or stream segment which drains a particular subarea. Note that eleven (11) of the drainage problems are on an identified reach indicating that peak runoff values are readily available from the modeling process for this problem area. This runoff value could be used as input for design of remedial measures.

The final column in Table 11 lists generalized proposed solutions to the identified storm drainage problem areas. These generalized solutions have been provided by municipal representatives whether as part of the original problem area documentation or subsequent discussions. Proposed solutions listed include specific proposals based upon municipal studies of the problem areas, where available, and solutions which are readily apparent to the municipal representatives for the less complicated problem areas. For certain other problem areas, the solutions are not quite so apparent and may require detailed engineering evaluations to determine the most cost-effective solution. No solutions to these problem areas are available and are listed as "None proposed" in Table 11.

FIGURE 8
COPLAY CREEK WATERSHED
PROBLEM AREA MAP

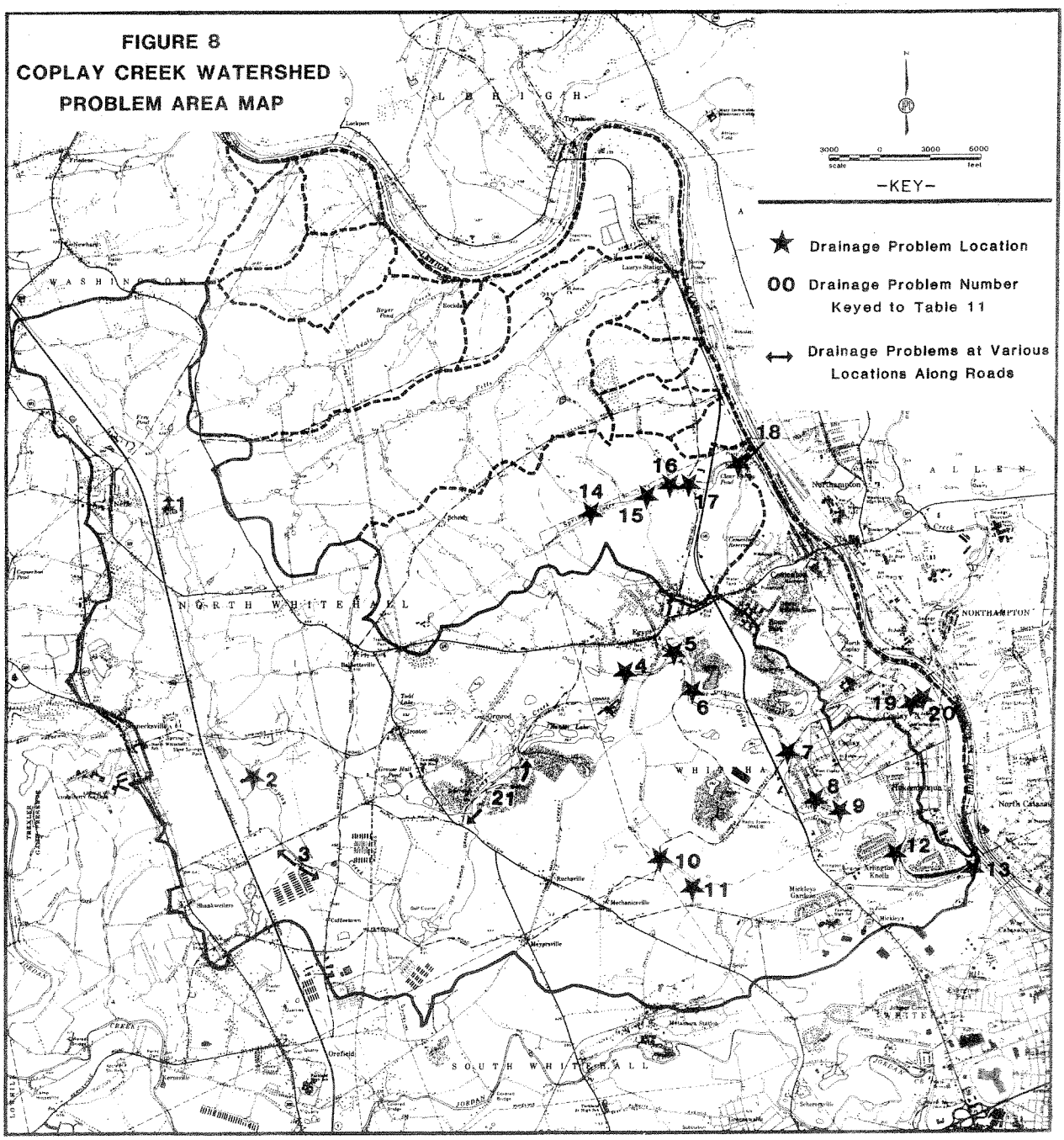


TABLE 11

COPLAY CREEK STUDY AREA
STORM DRAINAGE PROBLEM AREAS

No.	Location	Municipality	Problem Description	Subarea No.	Reach No.	Proposed Solution
1	Neffs Valley Park	North Whitehall Twp.	Stream and property flooding	7	6	None proposed
2	Wood Street	North Whitehall Twp.	Street flooding	11,12	--	None proposed
3	Coplay Creek Rd. between Coffeetown Rd. and Levans Rd.	North Whitehall Twp.	Street and property flooding	13,14	12,13	None proposed
4	Reliance Street	Whitehall Twp.	Street and property flooding	22,23	--	Replace bridge
5	South Church Street (SR 1023)	Whitehall Twp.	Street and property flooding	24	23	Replace bridge
6	Chestnut Street	Whitehall Twp.	Street and property flooding	24,25	--	Replace bridge
7	Columbia Street	Whitehall Twp.	Street and property/building flooding	26	25	Replace bridge
8	Center Street and South Fifth Avenue	Whitehall Twp.	Street and property flooding	32	--	Upgrade existing storm sewer
9	South Fifth Avenue Dead End at Barkley Village Apartments	Whitehall Twp.	Street and property/building flooding	32	--	Upgrade existing storm sewer

TABLE 11 (cont'd)

COPLAY CREEK STUDY AREA
STORM DRAINAGE PROBLEM AREAS

No.	Location	Municipality	Problem Description	Subarea No.	Reach No.	Proposed Solution
10	Columbia Street	Whitehall Twp.	Street and property flooding	30	29	Culvert & channel improvements
11	Ringer Road	Whitehall Twp.	Street and property flooding	30	29	Culvert & channel improvements
12	Lehigh Street (SR 1014)	Whitehall Twp.	Street and property/building flooding	33,34	--	Replace bridge
13	Water Street and Eberhart Rd.	Whitehall Twp.	Street and building flooding	34	33	Replace bridge
14	Peach Bottom Road	Whitehall Twp.	Street flooding	47	46	Culvert improvements
15	Overlook Lane	Whitehall Twp.	Street flooding	48	47	Culvert improvements
16	Robin Street	Whitehall Twp.	Street and property flooding	48	47	Culvert improvements
17	Roosevelt Street	Whitehall Twp.	Street and property/building flooding	48	47	Culvert improvements
18	Northampton Borough Municipal Authority Spring Creek Reservoir Dam	Whitehall Twp.	Flooding over dam embankment	49,50	--	Spllway improvements

TABLE 11 (cont'd)

COPLAY CREEK STUDY AREA
STORM DRAINAGE PROBLEM AREAS

No.	Location	Municipality	Problem Description	Subarea No.	Reach No.	Proposed Solution
19	North 2nd Street	Borough of Coplay	Property flooding	65	--	None proposed
20	Center Street and Front Street	Borough of Coplay	Property flooding	65	--	None proposed
21	Quarry Street	North Whitehall Twp.	Street flooding	20, 21	19, 20	Remove debris in channel

B. Significant Obstructions

An obstruction in a watercourse can be defined borrowing from Chapter 105 of DER's Rules and Regulations as follows:

> "Any dike, bridge, culvert, wall, wingwall, fill, pier, wharf, embankment, abutment or other structure located in, along, or across or projecting into any ... channel or conveyance of surface water having defined bed and banks, whether natural or artificial, with perennial or intermittent flow."

Using the above-definition, one hundred and fifty-seven (157) obstructions have been identified and measured within the Coplay Creek Study Area. For each of these, an estimated flow capacity has been calculated. For the purposes of Act 167, it is necessary to refine the list of obstructions to include only those obstructions which are "significant" on a watershed basis. For the Coplay Creek Watershed and Lehigh River Sub-basin 2 Storm Water Management Plan, the following distinction has been used:

> An obstruction in a stream or channel shall be deemed "significant" if it has an estimated flow capacity which is less than the 10-year return period peak flow from the calibrated hydrologic model of a watershed prepared as part of the Act 167 Plan.

Using the refined definition, ninety-six (96) significant obstructions have been identified within the Coplay Creek Study Area and are shown in Figure 9. A list of the significant obstructions is presented in Table 12 which indicates the obstruction number, description, municipality and approximate flow capacity. Obstruction capacities have been estimated based on their upstream geometry as measured and bed slope and roughness factors (where applicable) consistent with the calibrated Penn State Runoff Models for the Coplay Creek, Rockdale Creek, Fells Creek and Spring Creek Watersheds and the watershed associated with the unnamed creek just north of the Rockdale Creek. The estimates reflect reasonable flow capacities of the obstructions for "open channel" flow conditions (i.e. where the obstructions are not submerged). These estimated capacities are for illustration only and shall not be used as absolute capacities for storm water management decisions. The capacity of any obstruction when used to meet the requirements of this Plan shall be based upon a detailed hydraulic investigation including possible headwater and tailwater conditions, obstruction configuration

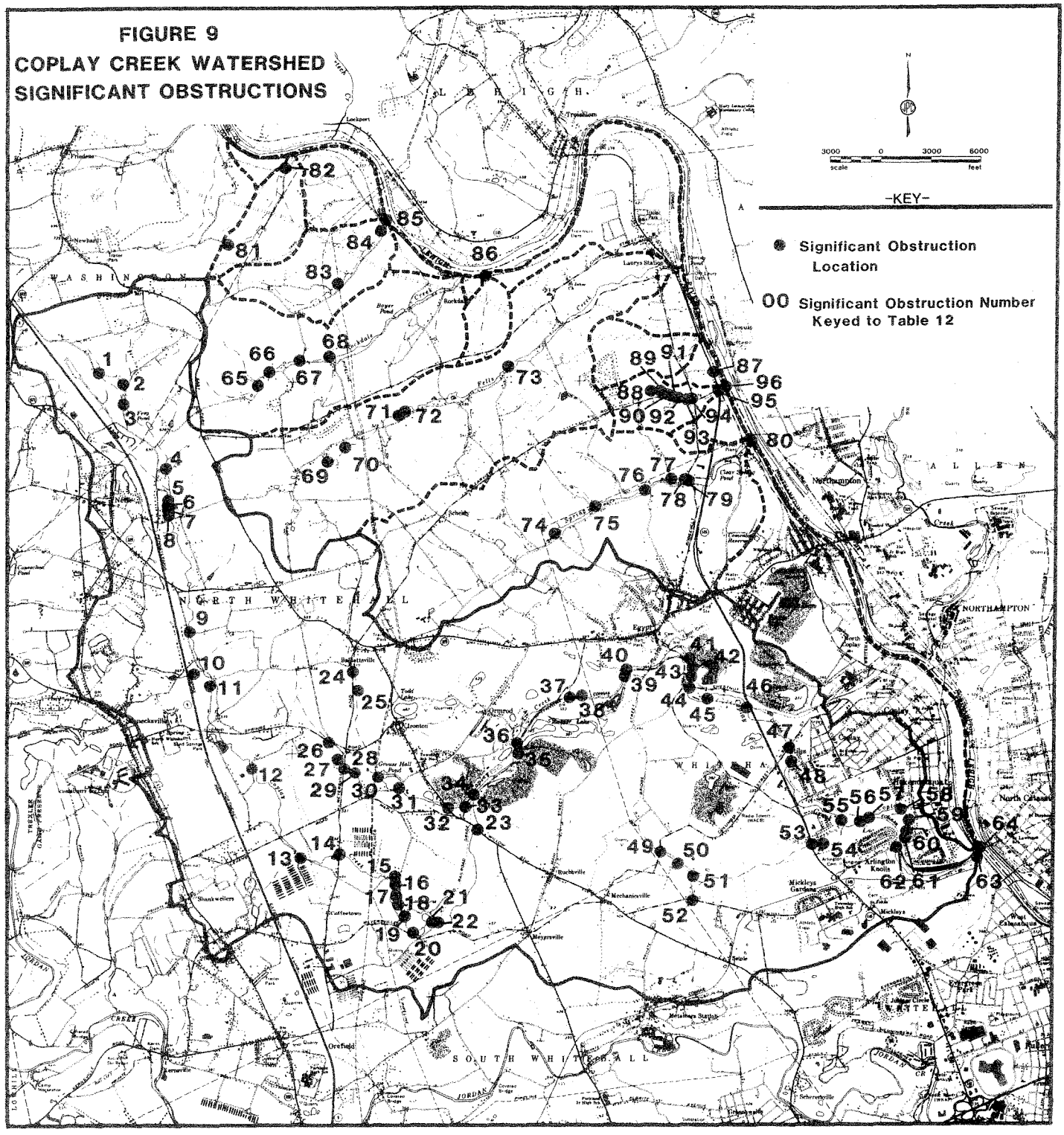


FIGURE 9
COPLAY CREEK WATERSHED
SIGNIFICANT OBSTRUCTIONS
-KEY-
Significant Obstruction Location
00 Significant Obstruction Number Keyed to Table 12
3000 0 3000 6000
scale feet
N
WASHINGTON
NORTH WHITEHALL
SOUTH WHITEHALL
WHITEHALL
ALLEN
NORTHAMPTON
LEHIGH

(abutments, wingwalls, piers, etc.) field measured slopes and other conditions as may affect capacity for design flows.

There are thirteen (13) identified significant obstructions which coincide with documented storm drainage problem areas as indicated in Table 12. Each obstruction which coincides with a drainage problem area is footnoted in Table 12 with the corresponding problem area number identified at the end of the table. The importance of the identified significant obstructions and problem areas as part of the development of a runoff control strategy is discussed in Chapter VIII.

TABLE 12

COPLAY CREEK STUDY AREA SIGNIFICANT OBSTRUCTIONS

Number*	Obstruction	Municipality	Approximate Flow Capacity (cfs)**
1	Hickory Road	Washington Twp.	43
2	Hickory Road	"	49
3	Creek Road	"	201
4	Park Circle	N. Whitehall Twp.	119
5	Neffs Valley Park Bridge[1]	"	164
6	Neffs Valley Park Bridge[1]	"	389
7	Neffs Valley Park Bridge[1]	"	267
8	Neffs Valley Park Bridge[1]	"	351
9	Excelsior Road	"	414
10	Private Driveway	"	151
11	Concrete Dam (Private)	"	187
12	Wood Street[2]	"	391
13	Coffeetown Road[3]	"	25
14	Meyersville Road	"	953
15	Golf Course Road	"	694
16	Twin Lakes Golf Course Bridge	"	430
17	Twin Lakes Golf Course Bridge	"	481
18	Twin Lakes Golf Course Bridge	"	511
19	Twin Lakes Golf Course	"	950
20	Twin Lakes Golf Course Bridge	"	283
21	Twin Lakes Golf Course Bridge	"	1,154
22	Golf Course Entrance Rd.	"	1,117
23	Willow Street	"	981
24	Meyersville Road	"	107

TABLE 12 (cont'd)

COPLAY CREEK STUDY AREA SIGNIFICANT OBSTRUCTIONS

Number*	Obstruction	Municipality	Approximate Flow Capacity (cfs)**
25	Private Driveway	N. Whitehall Twp.	262
26	Sand Spring Rd.	"	122
27	Private Driveway	"	44
28	Meyersville Road	"	54
29	Maple Road	"	69
30	Grouse Hall Entrance	"	520
31	Grouse Hall Pond	"	560
32	Willow Street	"	53
33	Quarry Street	"	76
34	Quarry Street	"	536
35	Private Road	"	818
36	Abandoned Railroad	"	917
37	Private Road	"	594
38	Abandoned Railroad	"	345
39	Abandoned Railroad	Whitehall Twp.	685
40	Reliance Street[4]	"	525
41	Private Road	"	650
42	Private Dam	"	612
43	Private Road	"	1,904
44	Chestnut Street[5]	"	184
45	Abandoned Railroad	"	1,754
46	Abandoned Railroad	"	345
47	Columbia Street[6]	"	1,058
48	Abandoned Railroad	"	611
49	Columbia Street[7]	"	60
50	Private Driveway	"	60
51	Ringer Road	"	29
52	Mechanicsville Rd.	"	10
53	MacArthur Road (Rte. 145)	"	688
54	Municipal Building Entrance	"	665
55	Private Foot Bridge	"	269
56	Private Road	"	987
57	Abandoned Railroad	"	455
58	Whitehall Twp. Park	"	1,193
59	Whitehall Twp. Park	"	587
60	Whitehall Twp. Park	"	548
61	Whitehall Twp. Park	"	782
62	Lehigh Street[9]	"	791
63	Railroad Bridge at Eberhart Rd.[10]	"	884
64	Railroad Bridge at Water St.[10]	"	337

TABLE 12 (cont'd)

COPLAY CREEK STUDY AREA SIGNIFICANT OBSTRUCTIONS

Number*	Obstruction	Municipality	Approximate Flow Capacity (cfs)**
65	Rockdale Road	N. Whitehall Twp.	69
66	Rockdale Road	"	348
67	Rockdale Road		145
68	Rockdale Road	"	226
69	Private Road	"	328
70	Private Road	"	91
71	Private Road	"	364
72	Private Road	"	309
73	Neffs-Laurys Road	"	403
74	Private Road	Whitehall Twp.	87
75	Peach Bottom Rd.[11]	"	617
76	Overlook Lane[12]	"	846
77	Robin Street[13]	"	977
78	Private Road	"	419
79	Private Foot Bridge	"	348
80	Railroad Bridge	"	401
81	High Hill Road	Washington Twp.	6
82	Riverview Road	"	143
83	Red Hill Road	N. Whitehall Twp.	147
84	Riverview Road	"	70
85	Railroad Bridge	"	69
86	Railroad Bridge	"	***
87	Route 145	"	48
88	Private Driveway	"	123
89	Private Driveway	"	123
90	Private Driveway	"	15
91	Private Pond Entrance	"	78
92	Private Pond Outflow	"	10
93	Clearview Road	"	96
94	Private Road	"	200
95	Route 145	"	96
96	Railroad Bridge	"	118

*Numbers are keyed to significant obstructions map (Figure 9).
**Estimated capacities are for illustration only and should not be used as absolute capacities for stormwater management decisions.
***Unable to estimate capacity due to collapse of structure.

[1]Significant Obstruction Nos. 5-8 coincide with Problem Area No. 1

[2]Significant Obstruction No. 12 coincides with Problem Area No. 2

[3]Significant Obstruction No. 13 coincides with Problem Area No. 3

[4]Significant Obstruction No. 40 coincides with Problem Area No. 4

[5]Significant Obstruction No. 44 coincides with Problem Area No. 6

[6]Significant Obstruction No. 47 coincides with Problem Area No. 7

[7]Significant Obstruction No. 49 coincides with Problem Area No. 10

[8]Significant Obstruction No. 51 coincides with Problem Area No. 11

[9]Significant Obstruction No. 62 coincides with Problem Area No. 12

[10]Significant Obstruction Nos. 63 and 64 coincide with Problem Area No. 13

[11]Significant Obstruction No. 76 coincides with Problem Area No. 14

[12]Significant Obstruction No. 77 coincides with Problem Area No. 15

[13]Significant Obstruction No. 78 coincides with Problem Area No. 16

B-2 Maps and Descriptions of Storm Drainage Problem Areas for Jordan Creek

JORDAN CREEK WATERSHED EXISTING STORM DRAINAGE PROBLEM AREAS AND SIGNIFICANT OBSTRUCTIONS

A. Existing Storm Drainage Problem Areas

An important goal of Act 167 is to prevent any existing storm drainage problem areas from getting worse. The first step toward that goal is to identify the existing problem areas. Each municipality in the Jordan Creek Watershed was provided with an opportunity to document the existing drainage problems within its borders. The starting point for the drainage problem inventory was the JPC Regional Storm Drainage Plan (RSDP) which documented sixteen (16) problems throughout the watershed based on a municipal survey conducted prior to 1975. Each municipality had an opportunity to review the RSDP data, provide an updated status on whether the RSDP problems remained or had been corrected, and provide information on additional problem areas. This process resulted in the documentation of sixteen (16) existing drainage problems in the watershed. The type of problem identified was typically street and/or property flooding. Figure 8 is a map of the Jordan Creek Watershed indicating the storm drainage problem areas as identified as part of the Storm Water Management Plan. The problem areas on Figure 8 are number coded and keyed to the problem area descriptions presented in Table 12. The "Subarea" and "Reach No." columns in Table 12 refer to the location of the problem areas relative to the watershed breakdown for modeling purposes. A subarea is the finest unit of breakdown of the watershed for which runoff values have been calculated. A reach is the swale, channel or stream segment which drains a particular subarea. Note that three (3) of the drainage problems are on identified reaches indicating that peak runoff values are readily available from the modeling process for those problem areas. These runoff values could be used as input for design of remedial measures.

The final column in Table 12 lists generalized proposed solutions to the identified storm drainage problem areas. These generalized solutions have been provided by municipal representatives whether as part of the original problem area documentation or subsequent discussions. Proposed solutions listed include specific proposals based upon municipal studies of the problem areas, where available, and solutions which are readily apparent to the municipal representatives for the less complicated problem areas. For certain other problem areas, the solutions are not quite so apparent and may require detailed engineering evaluations to determine the most

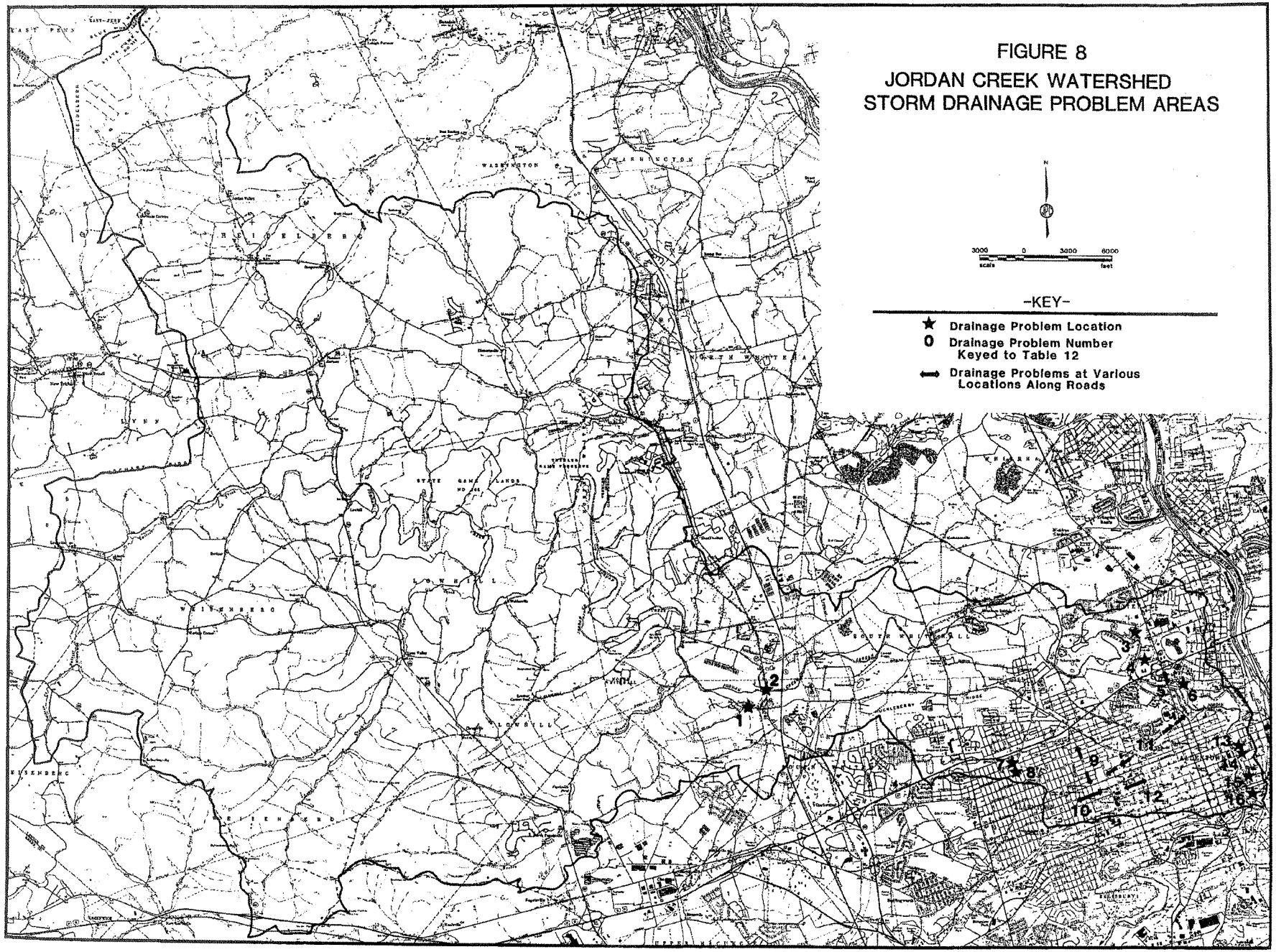


FIGURE 8
JORDAN CREEK WATERSHED
STORM DRAINAGE PROBLEM AREAS
N
3000 0 3000 6000
scale feet
-KEY-
Drainage Problem Location
Drainage Problem Number Keyed to Table 12
Drainage Problems at Various Locations Along Roads

TABLE 12
JORDAN CREEK WATERSHED
STORM DRAINAGE PROBLEM AREAS

No.	Location	Municipality	Problem Description	Subarea No.	Reach No.	Proposed Solution
1	Main Street at Guthsville	South Whitehall	Street Flooding	117	115, 116	None proposed
2	Rt. 309 over Jordan Creek at Guthsville	South Whitehall	Street Flooding	120	119	None proposed
3	Helfrich Springs Apts.	Whitehall	Property Flooding	130	--	None proposed
4	Whitehall Estates Townhouses	Whitehall	Street and Property Flooding	131	--	None proposed
5	North 7th Street (between City Line and Rt. 22)	Whitehall	Street Flooding	131, 133, 143	--	None proposed
6	Park View Apts.	Whitehall	Property Flooding	143	136	None proposed
7	Pennsylvania Street (between 26th and 27th Streets)	South Whitehall	Street Flooding	139	--	Storm Sewers
8	26th and Highland Streets	Allentown	Street Flooding	139	--	Improve collection system (by South Whitehall Township)
9	19th Street (between Tilghman and Highland Streets)	Allentown	Street Flooding	140	--	Relief Line
10	Andrew Street (between 18th and 21st)	Allentown	Street Flooding, Undersized collection conduit	140	--	None proposed

TABLE 12 (cont'd)
JORDAN CREEK WATERSHED
STORM DRAINAGE PROBLEM AREAS

No.	Location	Municipality	Problem Description	Subarea No.	Reach No.	Proposed Solution
11	Sumner Avenue (between 6th and 17th Streets)	Allentown	Street Flooding	141, 142, 143	--	Add/Improve inlets
12	Liberty Street (between 13th and 15th Streets)	Allentown	Street Flooding	142	--	Improve Inlets
13	224 North 3rd Street	Allentown	Street and Property Flooding	144	--	None proposed
14	3rd & Gordon Streets	Allentown	Street Flooding	145	--	None proposed
15	3rd & Linden Streets	Allentown	Street Flooding from debris	145	--	Removal of RR piers and bridge
16	3rd & Union Streets	Allentown	Street Flooding	145	--	None proposed

cost-effective solution. No solutions to these problem areas are available and are listed as "None proposed" in Table 12.

B. Significant Obstructions

An obstruction in a watercourse can be defined borrowing from Chapter 105 of DER's Rules and Regulations as follows:

> "Any dike, bridge, culvert, wall, wingwall, fill, pier, wharf, embankment, abutment or other structure located in, along, or across or projecting into any ... channel or conveyance of surface water having defined bed and banks, whether natural or artificial, with perennial or intermittent flow."

Using the above-definition, two hundred and nine (209) obstructions have been identified and measured within the Jordan Creek Watershed. For each of these, an estimated flow capacity has been calculated. For the purposes of Act 167, it is necessary to refine the list of obstructions to include only those obstructions which are "significant" on a watershed basis. For the Jordan Creek Storm Water Management Plan, the following distinction has been used:

> An obstruction in a stream or channel shall be deemed "significant" if it has an estimated flow capacity which is less than the 10-year return period peak flow from the calibrated hydrologic model of the watershed prepared as part of the Act 167 Plan.

Using the refined definition, one hundred and eighteen (118) significant obstructions have been identified within the Jordan Creek Watershed and are shown in Figure 9. A list of the significant obstructions is presented in Table 13 which indicates the obstruction number, description, municipality and approximate flow capacity. Obstruction capacities have been estimated based on their upstream geometry as measured and bed slope and roughness factors (where applicable) consistent with the calibrated Penn State Runoff Model for the Jordan Creek Watershed. The estimates reflect reasonable flow capacities of the obstructions for "open channel" flow conditions (i.e. where the obstructions are not submerged). These estimated capacities are for illustration only and shall not be used as absolute capacities for storm water management decisions. The capacity of any obstruction when used to meet the requirements of this Plan shall be

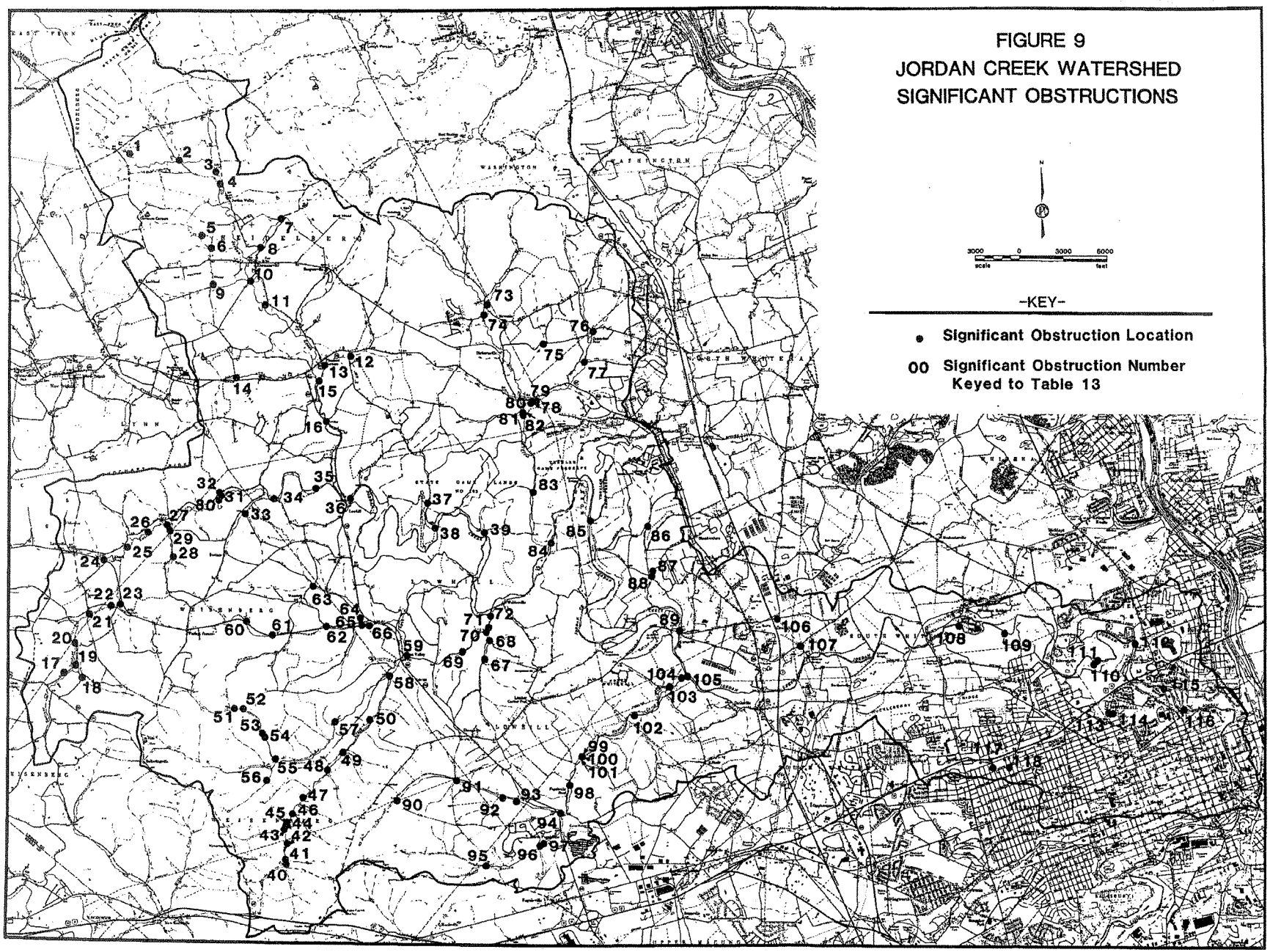


FIGURE 9
JORDAN CREEK WATERSHED
SIGNIFICANT OBSTRUCTIONS
N
3000 0 3000 6000
scale feet
-KEY-
Significant Obstruction Location
00 Significant Obstruction Number
Keyed to Table 13

based upon a detailed hydraulic investigation including possible headwater and tailwater conditions, obstruction configuration (abutments, wingwalls, piers, etc.) field measured slopes and other conditions as may affect capacity for design flows.

There is one identified significant obstruction which coincides with a documented storm drainage problem area as indicated in Table 13. The obstruction which coincides with a drainage problem area is located at Pennsylvania and 27th Streets in South Whitehall Township. The importance of the identified significant obstructions and problem areas as part of the development of a runoff control strategy is discussed in Chapter VIII.

TABLE 13

JORDAN CREEK WATERSHED SIGNIFICANT OBSTRUCTIONS

Number*	Obstruction	Municipality	Aproximate Flow Capacity (cfs)**
1	Private Road	Heidelberg Twp.	160
2	Private Road	"	20
3	Reidy Mill Road	"	550
4	Mantz Road	"	600
5	Private Road	"	130
6	Central Road	"	170
7	Bachman Road	"	250
8	Bake Oven Road	"	180
9	Central Road	"	130
10	Hunters Hill Road	"	1,700
11	Private Road	"	1,500
12	Kistler Road	"	120
13	Water Pond Road	"	140
14	Snyder Road	"	10
15	Water Pond Road	"	420
16	Old Route 100	"	1,900
17	Private Road	Weisenberg Twp.	60
18	Private Road	"	10
19	Kline's Dam Road	"	90
20	Kistler Lane	"	230
21	Schochary Road	Lynn Twp.	550
22	Creamery Road	Weisenberg Twp.	570
23	Winding Road	"	220
24	Snyder Road	Lynn Twp.	70
25	Private Road	"	1,100
26	Private Road	"	200
27	Ross Valley Road	"	970
28	Ross Valley Road	Weisenberg Twp.	50
29	Ross Valley Road	Lynn Twp.	40

TABLE 13 (cont'd)

JORDAN CREEK WATERSHED SIGNIFICANT OBSTRUCTIONS

Number*	Obstruction	Municipality	Aproximate Flow Capacity (cfs)**
30	Private Road	Weisenberg Twp.	680
31	Private Road	"	640
32	Private Road	"	890
33	Gun Club Road	"	40
34	Bittner's Corner Road	Lowhill Twp.	350
35	Narris Road	"	1,300
36	Game Warden Road	"	3,900
37	Game Warden Road	"	140
38	Private Road	"	40
39	Scheirers Road	"	340
40	Seipstown Road	Weisenberg Twp.	410
41	Private Road	"	140
42	Valley Road	"	40
43	Dam	"	520
44	Private Walk Bridge	"	380
45	Private Road	"	370
46	Boger Stadt Road	"	300
47	Private Road	"	140
48	Distillery Road	"	290
49	Valley Road	"	780
50	Masters Hill Road	"	330
51	Run Road	"	90
52	Tannery Road	"	80
53	Dam	"	10
54	Private Road	"	180
55	Blacksmith Road	"	150
56	Kuhn's Hill Road	"	200
57	Moyer Road	"	920
58	Valley Road	"	1,500
59	Lyon Valley Hill	Lowhill Twp.	860
60	Holben's Valley Road	Weisenberg Twp.	70
61	Private Road	"	50
62	Weisenberg Church Road	"	470
63	Seibert Road	"	40
64	Holben's Valley Road	Lowhill Twp.	360
65	Holben's Valley Road - Old Bridge	"	70
66	Private Road	"	940
67	Private Road	"	60
68	Church Road	"	90

TABLE 13 (cont'd)

JORDAN CREEK WATERSHED SIGNIFICANT OBSTRUCTIONS

Number*	Obstruction	Municipality	Aproximate Flow Capacity (cfs)**
69	Orchard Road	Lowhill Twp.	70
70	Orchard Road	"	150
71	Orchard Road	"	590
72	Private Walk Bridge	"	530
73	Church Road	Heidelberg Twp.	190
74	Heidelberg Heights Road	"	300
75	Washington Street	Washington (L) Twp.	140
76	Washington Street	"	120
77	Copeechan Road	North Whitehall Twp.	300
78	Private Road	Heidelberg Twp.	380
79	Private Road	"	740
80	Dam	"	340
81	Dam	"	480
82	Private Road	"	2,000
83	Schneck Road	Lowhill Twp.	2,000
84	Mill Creek Road	"	5,700
85	Game Preserve - Ford	North Whitehall Twp.	1,700
86	Old Packhouse Road	"	80
87	Dam	"	20
88	Gristmill Road	"	240
89	Dam	"	1,200
90	Mohr Lane	Weisenberg Twp.	60
91	Apple Drive	"	250
92	Private Road	Lowhill Twp.	20
93	Orchard Road	"	200
94	Mohr's Road	Upper Macungie Twp.	170
95	Apple Drive	"	230
96	Orchard Road	"	330
97	Old Bridge - Abandoned	"	420
98	Dam	"	180
99	Dam	"	770
100	Private Walk Bridge	"	680
101	Dam	"	720
102	Private Road	South Whitehall Twp.	1,500
103	Valley Road	"	1,100
104	Private Road	"	680
105	Jordan Road	"	1,100
106	Orefield Road	"	10
107	Parkland Terrace	"	50
108	Dam	"	2,500
109	Dam	"	1,700

TABLE 13 (cont'd)

JORDAN CREEK WATERSHED SIGNIFICANT OBSTRUCTIONS

Number*	Obstruction	Municipality	Aproximate Flow Capacity (cfs)**
110	Jordan Park Bridge	Whitehall Twp.	5,600
111	Jordan Park Bridge	"	3,600
112	Mickley Road	"	5,300
113	14th Street	"	10
114	Spring Ridge Apartments	"	60
115	7th Street	Allentown	3,500
116	Dam - Jordan Park	"	50
117	28th Street	South Whitehall Twp.	40
118[1]	Pennsylvania/ 27th Street	"	0

*Numbers are keyed to significant obstructions map (Figure 9).
**Estimated capacities are for illustration only and should not be used as absolute capacities for stormwater management decisions.

[1]This coincides with problem area No. 7.

B-3 Maps and Descriptions of Storm Drainage Problem Areas for Little Lehigh Creek

LITTLE LEHIGH CREEK WATERSHED EXISTING STORM DRAINAGE PROBLEM AREAS AND SIGNIFICANT OBSTRUCTIONS

A. Existing Storm Drainage Problem Areas

An important goal of Act 167 is to prevent any existing storm drainage problem areas from getting worse. The first step toward that goal is to identify the existing problem areas. Each municipality in the Little Lehigh Creek Watershed was provided with an opportunity to update the documentation of existing drainage problems within its borders. The starting point for the drainage problem inventory was the LVPC *Regional Storm Drainage Plan* (RSDP) which documented ten problems in the study area based on a municipal survey conducted prior to 1975. The 1988 Plan documented a total of 71 existing drainage problems in the study area. The type of problem identified was typically street and/or property flooding. Based on updated municipal information, there are now 62 existing problems in the study area. Figure 7 is a map of the Little Lehigh Creek Watershed indicating the storm drainage problem areas as identified as part of the Storm Water Management Plan. The problem areas on Figure 7 are number coded and keyed to the problem area descriptions presented in Table 12. The "Subarea" and "Reach No." columns in Table 12 refer to the location of the problem areas relative to the study area breakdown for modeling purposes. A subarea is the finest unit of breakdown of a watershed for which runoff values have been calculated. A reach is the swale, channel or stream segment which drains a particular subarea. Note that 43 of the drainage problems are on an identified reach indicating that peak runoff values are readily available from the modeling process for these problem areas. These runoff values could be used as input for design of remedial measures.

The final column in Table 12 was provided to list generalized solutions suggested by municipal representatives. Proposed solutions listed include specific proposals based on municipal studies of the problem areas, where available, and solutions which are readily apparent to the municipal representatives for the less complicated problem areas. For certain other problem areas, the solutions are not quite so apparent and may require detailed engineering evaluations to determine the most cost-effective solution.

B. Significant Obstructions

An obstruction in a watercourse can be defined borrowing from Chapter 105 of DER's Rules and Regulations as follows:

> "Any dike, bridge, culvert, wall, wingwall, fill, pier, wharf, embankment, abutment or other structure located in, along, or across or projecting into any ... channel or conveyance of surface water having defined bed and banks, whether natural or artificial, with perennial or intermittent flow."

Figure 7
Little Lehigh Creek Watershed
Problem Area Map

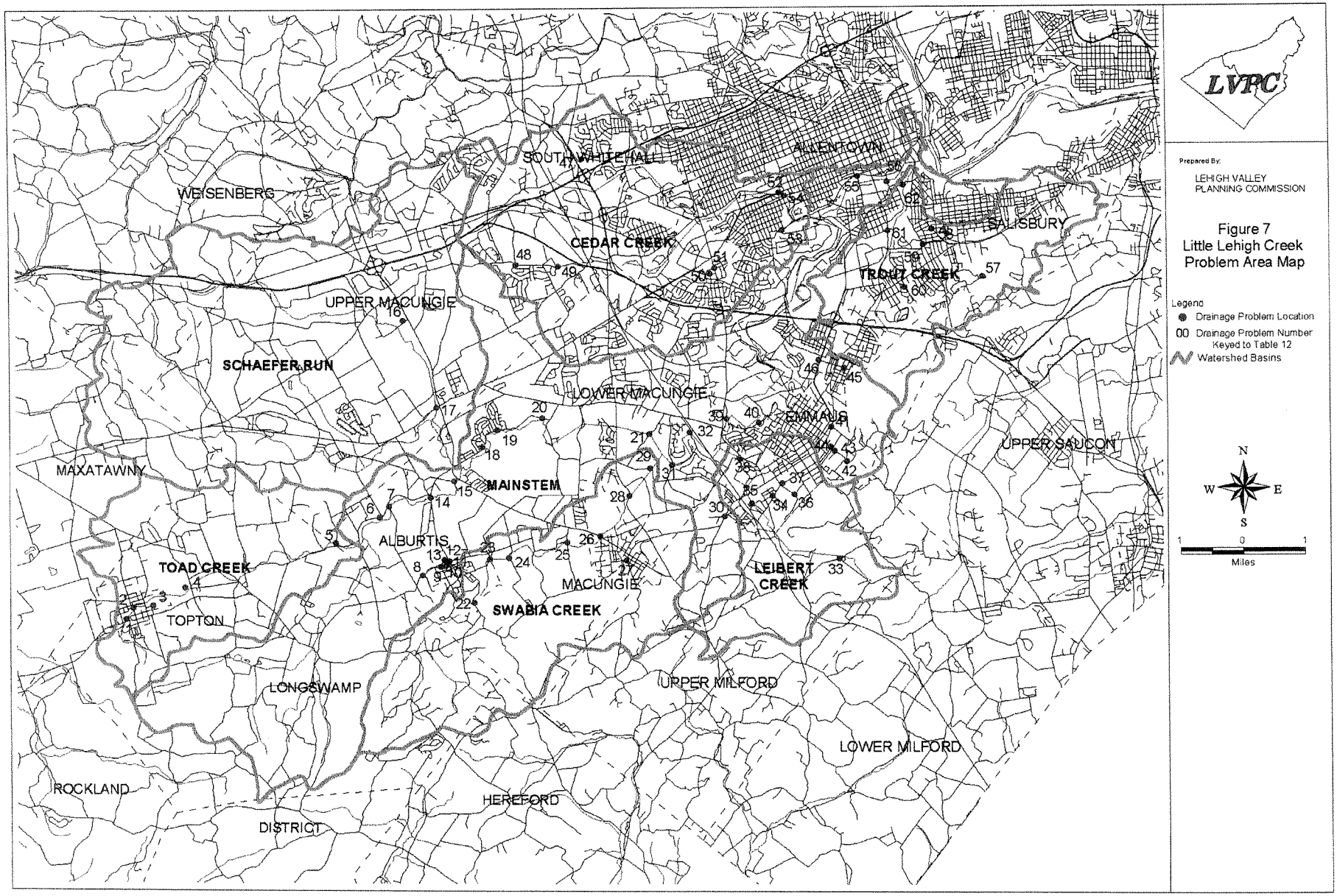

LVPC
Prepared By:
LEHIGH VALLEY
PLANNING COMMISSION
Figure 7
Little Lehigh Creek
Problem Area Map
Legend
Drainage Problem Location
00 Drainage Problem Number
Keyed to Table 12
Watershed Basins
N
W
E
S
1 0 1
Miles
WEISENBERG
SOUTH WHITEHALL
ALLENTOWN
SALISBURY
CEDAR CREEK
TROUT CREEK
UPPER MACUNGIE
SCHAEFER RUN
LOWER MACUNGIE
EMMAUS
UPPER SAUCON
MAXATAWNY
MAINSTEM
ALBURTIS
TOAD CREEK
TOPTON
MACUNGIE
LEIBERT CREEK
SWABIA CREEK
LONGSWAMP
UPPER MILFORD
LOWER MILFORD
ROCKLAND
HEREFORD
DISTRICT

TABLE 12

LITTLE LEHIGH CREEK WATERSHED
STORM DRAINAGE PROBLEM AREAS

No.	Location	Municipality	Problem Description	Subarea No.	Reach No.	Proposed Solution
			TOAD CREEK			
1.	Borough Park	Topton	Flooding and bank erosion	13	12	Dredging and Rip-Rap
2.	W. Franklin St. and Haas St.	Topton	Street flooding	13	12	Dredging and Rip-Rap
3.	Furnace Street	Topton	Street flooding	16	15	Dredging and Channel Modification
4.	Topton Sewage Treatment Plant	Longswamp	Flooding	16	15	Dredging and Rip-Rap
5.	Ash Lane north of Mertztown Rd.	Lower Macungie	Street Flooding	22	21	Channel Dredging/Realignment
			LITTLE LEHIGH MAINSTEM			
6.	Mertztown Rd. west of Butz Rd.	Lower Macungie	Street Flooding	24	23	Channel Dredging/Realignment
7.	Smith Lane south of Mertztown Rd.	Lower Macungie	Street Flooding	24	23	Channel Dredging/Realignment
8.	Front Street - west end	Alburtis	Street Flooding	25	-	Enlarged Culvert
9.	Front and Walnut Streets	Alburtis	Street and field flooding	25	-	Enlarged Culvert
10.	Front and Chestnut Streets	Alburtis	Street Flooding	25	-	Enlarged Culvert
11.	Main and East Penn. Ave.	Alburtis	Street and property flooding	25	-	Storm Sewers
12.	West Penn Ave.	Alburtis	Street and building flooding	25	-	Enlarged Culvert

TABLE 12

LITTLE LEHIGH CREEK WATERSHED
STORM DRAINAGE PROBLEM AREAS

No.	Location	Municipality	Problem Description	Subarea No.	Reach No.	Proposed Solution
13.	North of West Penn. Ave	Alburtis	Field flooding	25	-	Channel Improvement
14.	Weilers Rd. at Little Lehigh Creek	Lower Macungie	Street Flooding	27	26	Channel Dredging/Realignment
15.	Creamery Road at Little Lehigh Creek	Lower Macungie	Street Flooding	27	26	Channel Dredging/Realignment
			SCHAEFER RUN			
16.	Iron Run near Township School	Upper Macungie	Property flooding	75	74	Stream Cleaning
17.	Rt. 222 west of Trexlertown	Upper Macungie	Street flooding	84	57, 82, 83	Stream Cleaning
			LITTLE LEHIGH MAINSTEM			
18.	Spring Creek Rd. between Beech and Laurel	Lower Macungie	Street Flooding	87	86	Channel Dredging/Realignment
19.	Spring Creek Rd. between Heather and Oak	Lower Macungie	Street Flooding	87	86	Channel Dredging/Realignment
20.	Spring Creek Rd.- West of Mill Creek Road	Lower Macungie	Street and field flooding	93	-	Channel Dredging/Realignment
21.	Wild Cherry Lane at Little Lehigh	Lower Macungie	Street Flooding	106	105	Channel Dredging/Realignment

SWABIA CREEK						
22.	Franklin St. at Borough line South	Alburtis	Street flooding	112	111	Church St. Bridge Replacement
23.	Church St. at Borough line East	Alburtis/Lower Macungie	Street flooding	120	118	Bridge Replacement and Channel Dredging/Realignment
24.	Schoeneck Road at Swabia Creek	Lower Macungie	Street flooding	121	120	Channel Dredging/Realignment
25.	Gehman's Road at Swabia Creek	Lower Macungie	Street flooding	123	121	Channel Dredging/Realignment
26.	West Main Street	Macungie	Street flooding	125	124	None Proposed
27.	Vine Street and Carpenter Street	Macungie	Street flooding	127	-	Storm Sewers
28.	Brookside Road at Swabia Creek	Lower Macungie	Street flooding	132	129	Channel Dredging/Realignment
29.	Sauerkraut Lane at Swabia Creek	Lower Macungie	Street flooding	133	132	Channel Dredging/Realignment

LITTLE LEHIGH MAINSTEM						
30.	Chestnut Street	Upper Milford	Street Flooding	138	-	Storm Sewers
31.	Macungie Road at Little Lehigh	Lower Macungie	Street Flooding	139	135	Channel Dredging/Realignment
32.	Millrace Road at Little Lehigh	Lower Macungie	Street Flooding	140	139	Channel Dredging/Realignment
LEIBERT CREEK						
33	East Main Rd. at Acorn Drive	Upper Milford	Street flooding	147	146	Enlarged Culvert
34.	South 12th Street	Emmaus	Street flooding	151	-	Storm Sewers
35.	Emmaus Community Park and Pool	Emmaus	Pool and property flooding	151	150	Channelize/Dredge Stream
36.	Furnace Dam at 10th and Furnace	Emmaus	Property flooding North of dam	152	-	Detention Facility and Enlarged Conveyor Pipe
37.	Broad St. at Fir Street	Emmaus	Street and property flooding	152	-	Enlarged Culvert and Dredge Stream
38.	Indian Creek Road	Upper Milford	Street flooding	154	153	Replace PennDOT Culverts with Bridge

LITTLE LEHIGH MAINSTEM						
39.	Farr Road at Little Lehigh	Lower Macungie	Street Flooding	158	156	Channel Dredging/Realignment
40.	Orchid Place - West Of Orchid Circle	Lower Macungie	Street Flooding	158	156	Channel Dredging/Realignment
41.	Main Street at Klines Lane	Emmaus	Street Flooding	159	159	Enlarged Culverts
42.	South Second Street	Upper Milford	Street and property flooding	159	-	None proposed.
43.	Foundry Alley	Emmaus	Street and property flooding	159	-	None proposed.
44.	South Second St. at Adrian/ Peach/Keystone Sts.	Emmaus	Street and property flooding	159	-	Property Acquisition and Detention Facility
45.	Fox Street	Emmaus	Street Flooding	161	-	Storm Sewers and Detention Facility
46.	Lehigh Street (at South Mall)	Salisbury	Property Flooding	161	-	None proposed.
CEDAR CREEK						
47	Crackersport Rd. near Days Inn	South Whitehall	Street flooding	176	-	None Proposed
48.	Holiday Hills Area (Schantz Rd.)	Upper Macungie	Street, field and lawn flooding	181	-	Strom Sewers
49.	Muth Rd. / Schantz Rd. / Cetronia Rd. area	Upper Macungie	Street and field flooding/erosion	182	181	None Proposed

50.	Glick Avenue	South Whitehall	Street flooding	194	193	Storm Sewers
51.	Mosser Drive and Cedar Crest Blvd.	South Whitehall	Street flooding	198	-	Storm Sewers
52.	Hamilton St. between Saint Elmo and 21st Streets	Allentown	Stream overbanking	202	201	Stream Cleaning, Straightening, Widening
53.	Greenwood Rd. and Mosser St.	Allentown	Property flooding	204	203	Detention Facility
54.	Walnut St. between Lafayette and Saint Elmo Streets	Allentown	Stream overbanking	205	202	Stream Cleaning, Straightening, Widening
LITTLE LEHIGH MAINSTEM						
55.	10th and Martin Luther King Jr. Blvd.	Allentown	Street Flooding	209	-	None proposed.
56.	Lehigh Street at Mill Street	Allentown	Street Flooding and Stream Overbanking	209	208	Stream cleaning at bridge.
TROUT CREEK						
57.	East Mountain Road	Salisbury	Property flooding	215	-	Diversion Ditch
58.	Floodplain in vicinity of Paoli & Chapel Ave. and Trout Creek	Allentown	Street flooding and stream overbanking	215	-	Storm Sewers
59.	South 4th and Brookdale Sts.	Allentown	Street flooding	215	214	None Proposed

Using the above-definition, 364 obstructions have been identified and measured within the Little Lehigh Creek Watershed. For each of these, an estimated flow capacity has been calculated. For the purposes of Act 167, it is necessary to refine the list of obstructions to include only those obstructions which are "significant" on a watershed basis. For the Little Lehigh Creek Watershed Storm Water Management Plan, the following distinction has been used:

> An obstruction in a stream or channel shall be deemed "significant" if it has an estimated flow capacity which is less than the 10-year return period peak flow from the calibrated hydrologic model of a watershed prepared as part of the Act 167 Plan.

Using the refined definition, 187 significant obstructions have been identified within the Little Lehigh Creek Watershed and are shown in Figure 8. A list of the significant obstructions is presented in Table 13 which indicates the obstruction number, description, municipality and *approximate* flow capacity. Obstruction capacities have been estimated based on their upstream geometry as measured, bed slope and roughness factors (where applicable) consistent with the calibrated WATERSHED Model for the Little Lehigh Creek. The estimates reflect reasonable flow capacities of the obstructions for "open channel" flow conditions (i.e. where the obstructions are not submerged). These estimated capacities are for illustration only and shall not be used as absolute capacities for storm water management decisions. The capacity of any obstruction when used to meet the requirements of this Plan shall be based upon a detailed hydraulic investigation including possible headwater and tailwater conditions, obstruction configuration (abutments, wingwalls, piers, etc.), field measured slopes and other conditions as may affect capacity for design flows.

There are 12 areas where identified significant obstructions coincide with a documented storm drainage problem area as indicated in Table 13. The obstructions which coincide with a drainage problem are footnoted in Table 13 with the corresponding problem area number identified at the end of the table. The importance of the identified significant obstructions and problem areas as part of the development of a runoff control strategy is discussed in Chapter 8.

Figure 8
Little Lehigh Creek Watershed
Significant Obstructions

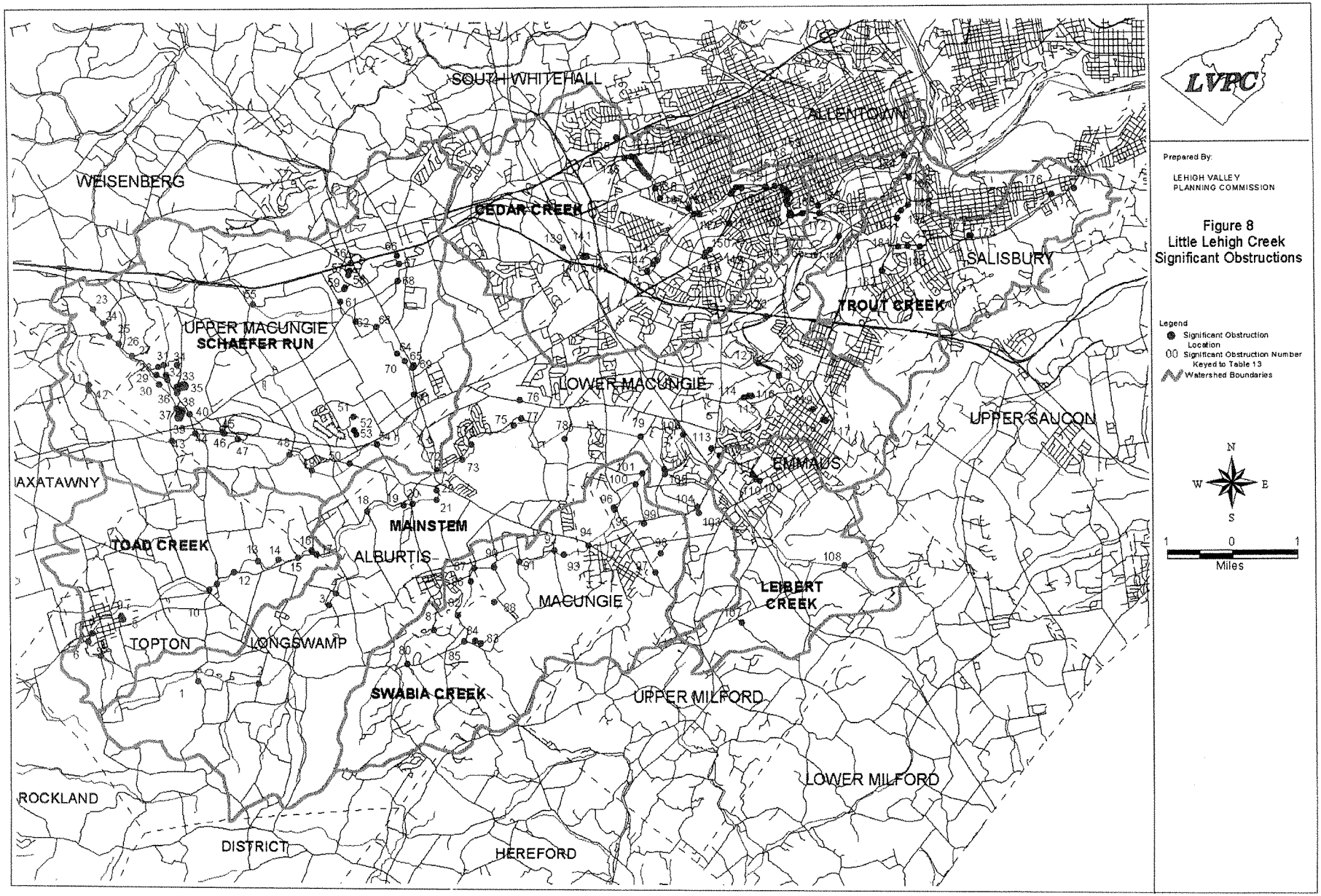

SOUTH WHITEHALL
ALLENTOWN
WEISENBERG
CEDAR CREEK
SALISBURY
TROUT CREEK
UPPER MACUNGIE
SCHAEFER RUN
LOWER MACUNGIE
UPPER SAUCON
EMMAUS
AXATAWNY
MAINSTEM
TOAD CREEK
ALBURTIS
MACUNGIE
LEIBERT CREEK
TOPTON
LONGSWAMP
SWABIA CREEK
UPPER MILFORD
LOWER MILFORD
ROCKLAND
DISTRICT
HEREFORD
LVPC
Prepared By:
LEHIGH VALLEY PLANNING COMMISSION
Figure 8
Little Lehigh Creek
Significant Obstructions
Legend
Significant Obstruction Location
00 Significant Obstruction Number Keyed to Table 13
Watershed Boundaries
N
W
E
S
1 0 1
Miles

TABLE 13

LITTLE LEHIGH CREEK WATERSHED SIGNIFICANT OBSTRUCTIONS

Number*	Obstruction	Municipality	Approximate Flow Capacity (cfs)**
1	Longsdale Road	Longswamp Township	51
2	Private Road	Longswamp Township	645
3	Hilltop Road	Longswamp Township	598
4	Ash Lane	Longswamp Township	153
5	Woodside Avenue	Longswamp Township	93
6	Callow Hill	Borough of Topton	32
7	Main Street	Borough of Topton	93
8	Smith Road	Borough of Topton	90
9	Penn Street	Borough of Topton	98
10	Barclay Street	Longswamp Township	150
11	Farmington Road	Longswamp Township	55
12	Brooksdale Road	Longswamp Township	53
13	Mertz Road	Longswamp Township	133
14	Private Road	Longswamp Township	482
15	Private Road	Longswamp Township	747
16	Ash Lane[1]	Lower Macungie Township	636
17	Mertztown Road[2]	Lower Macungie Township	777
18	Smith Lane[3]	Lower Macungie Township	1,265
19	Private Road	Lower Macungie Township	160
20	Spring Creek Road	Lower Macungie Township	2,271
21	Rail Road Bridge	Lower Macungie Township	1,671
22	Creamery Road[4]	Lower Macungie Township	253
23	Route 863 (Independent Road)	Weisenberg Township	59
24	Route 863 (Independent Road)	Weisenberg Township	88
25	Helfrich Road	Weisenberg Township	41
26	Route 863 (Independent Road)	Weisenberg Township	30
27	Route 863 (Independent Road)	Weisenberg Township	79
28	Private Drive	Upper Macungie Township	8
29	Route 863 (Independent Road)	Upper Macungie Township	18
30	Private Drive	Upper Macungie Township	251
31	Private Drive	Upper Macungie Township	15
32	Private Drive	Upper Macungie Township	45
33	Route 863 (Independent Road)	Upper Macungie Township	15
34	Private Drive	Upper Macungie Township	15
35	Zeigel's Church Rd.	Upper Macungie Township	15
36	Route 863 (Independent Drive)	Upper Macungie Township	15
37	Folk Road	Upper Macungie Township	122
38	Private Drive	Upper Macungie Township	58
39	Private Drive	Upper Macungie Township	43
40	Route 863 (Independent Drive)	Upper Macungie Township	444
41	Private Drive	Maxatawny Township	33

TABLE 13

LITTLE LEHIGH CREEK WATERSHED SIGNIFICANT OBSTRUCTIONS

Number*	Obstruction	Municipality	Approximate Flow Capacity (cfs)**
42	Albright Road	Maxatawny Township	98
43	Folk Road	Upper Macungie Township	71
44	Route 863 (Independent Drive)	Upper Macungie Township	136
45	Route 222	Upper Macungie Township	43
46	Picnic Grove Lane	Upper Macungie Township	511
47	Private Drive	Upper Macungie Township	86
48	Trexler Road	Upper Macungie Township	135
49	Wentz Road	Upper Macungie Township	139
50	Brookdale Road	Upper Macungie Township	379
51	Private Drive	Upper Macungie Township	14
52	Pond Inlet	Upper Macungie Township	326
53	Private Drive	Upper Macungie Township	292
54	Weiler's Road	Upper Macungie Township	128
55	Nestlé Way	Upper Macungie Township	237
56	Route 78	Upper Macungie Township	69
57	Route 78 Ramp	Upper Macungie Township	60
58	Sycamore Road	Upper Macungie Township	199
59	Stroh Drive	Upper Macungie Township	259
60	Railroad	Upper Macungie Township	66
61	Private Drive	Upper Macungie Township	249
62	Private Drive	Upper Macungie Township	417
63	Farm Lane near Twp. School	Upper Macungie Township	32
64	Private Drive	Upper Macungie Township	243
65	Private Drive	Upper Macungie Township	41
66	Off Mancor Drive	Upper Macungie Township	418
67	Penn Drive	Upper Macungie Township	418
68	Schantz Road	Upper Macungie Township	79
69	Parking Lot	Upper Macungie Township	13
70	Route 100	Upper Macungie Township	35
71	Railroad Street	Upper Macungie Township	157
72	Railroad	Lower Macungie Township	2,762
73	Private Drive	Lower Macungie Township	2,874
74	Private Drive	Lower Macungie Township	1,150
75	Seem Road	Lower Macungie Township	1,222
76	Lower Macungie Road	Lower Macungie Township	226
77	Spring Creek Road[5]	Lower Macungie Township	1
78	Private Drive	Lower Macungie Township	282
79	Wild Cherry Lane[6]	Lower Macungie Township	630
80	Mountain Street	Longswamp township	8
81	Gun Club Road	Lower Macungie Township	680
82	Chestnut Road	Lower Macungie Township	759
83	Private Drive	Lower Macungie Township	24

TABLE 13

LITTLE LEHIGH CREEK WATERSHED SIGNIFICANT OBSTRUCTIONS

Number*	Obstruction	Municipality	Approximate Flow Capacity (cfs)**
84	Private Drive	Lower Macungie Township	72
85	Mountain Road	Lower Macungie Township	19
86	Bike Path	Borough of Alburtis	1,321
87	Church Street	Borough of Alburtis	617
88	Private Drive	Lower Macungie Township	25
89	Schoeneck Road[7]	Lower Macungie Township	933
90	Railroad	Lower Macungie Township	816
91	Orchard Road	Lower Macungie Township	673
92	Gehman Road[8]	Lower Macungie Township	208
93	Railroad	Lower Macungie Township	600
94	Railroad	Borough of Macungie	1,238
95	Golf Course Bridge	Lower Macungie Township	274
96	Golf course Bridge	Lower Macungie Township	346
97	East Macungie Road	Upper Milford Township	176
98	Private Drive	Upper Milford Township	106
99	Railroad	Upper Milford Township	220
100	Private Drive	Lower Macungie Township	139
101	Sauerkraut Lane[9]	Lower Macungie Township	395
102	Macungie Road[10]	Lower Macungie Township	1,244
103	Railroad	Upper Milford Township	135
104	Indian Creek Road	Upper Milford Township	121
105	Private Drive	Lower Macungie Township	77
106	Mill Race Road[11]	Lower Macungie Township	1,024
107	German Road	Upper Milford Township	37
108	Main Road East[12]	Upper Milford Township	34
109	Route 29 (Cedar Crest Blvd.)	Borough of Emmaus	262
110	Golf Course Bridge	Borough of Emmaus	188
111	North Street	Borough of Emmaus	103
112	Camp Olympic	Lower Macungie Township	972
113	Camp Olympic	Lower Macungie Township	959
114	Riverbend Road	Lower Macungie Township	5,153
115	Lehigh Country Club	Lower Macungie Township	3,747
116	Lehigh Country Club	Lower Macungie Township	4,173
117	Private	Borough of Emmaus	245
118	Private	Borough of Emmaus	245
119	Harrison Street	Borough of Emmaus	266
120	Off Keystone Road	City of Allentown	574
121	Devonshire Road	City of Allentown	1,830
122	Private Drive	City of Allentown	2,064
123	Private Drive	City of Allentown	2,100
124	Lehigh Parkway North	City of Allentown	2,510
125	Rd. in front of Springhouse Jr. HS	South Whitehall Township	51

TABLE 13

LITTLE LEHIGH CREEK WATERSHED SIGNIFICANT OBSTRUCTIONS

Number*	Obstruction	Municipality	Approximate Flow Capacity (cfs)**
126	Golf Course	City of Allentown	469
127	Golf Course	City of Allentown	517
128	Golf Course	City of Allentown	214
129	Golf Course	City of Allentown	610
130	Golf Course	City of Allentown	175
131	Golf Course	City of Allentown	242
132	Golf Course	City of Allentown	273
133	Golf Course	City of Allentown	374
134	Golf Course	City of Allentown	274
135	Golf Course	City of Allentown	741
136	Trexler Park Path	City of Allentown	953
137	Trexler Park Path	City of Allentown	897
138	Trexler Park Path	City of Allentown	903
139	Werley Road	Upper Macungie Township	36
140	Spring Road	Upper Macungie Township	10
141	Private Drive	Upper Macungie Township	81
142	Private Drive	Upper Macungie Township	361
143	Dorney Park	South Whitehall Township	380
144	Dorney Park	South Whitehall Township	635
145	Dorney Park	South Whitehall Township	815
146	Route 309	South Whitehall Township	202
147	Cedar Creek Park	City of Allentown	1,635
148	Howard Johnson Parking	South Whitehall Township	88
149	Cedar Crest Boulevard	South Whitehall Township	67
150	Route 222 (Hamilton Boulevard)	South Whitehall Township	219
151	College Avenue	City of Allentown	59
152	Cedar Creek Park	City of Allentown	166
153	Ott Street	City of Allentown	2,074
154	Cedar Creek Park	City of Allentown	331
155	Cedar Creek Park	City of Allentown	165
156	Cedar Creek Park	City of Allentown	153
157	Cedar Creek Park	City of Allentown	304
158	Hamilton Boulevard	City of Allentown	1,716
159	Reading Road	City of Allentown	326
160	Foot Bridge	City of Allentown	333
161	Foot Bridge	City of Allentown	590
162	Union Street	City of Allentown	620
163	Union Street	City of Allentown	198
164	Foot Bridge	City of Allentown	192
165	Saint Elmo Street	City of Allentown	1,504
166	Saint Elmo Street	City of Allentown	1,062
167	Foot Bridge	City of Allentown	244

TABLE 13

LITTLE LEHIGH CREEK WATERSHED SIGNIFICANT OBSTRUCTIONS

Number*	Obstruction	Municipality	Approximate Flow Capacity (cfs)**
168	Mosser Street	City of Allentown	376
169	Driveway	City of Allentown	59
170	Driveway	City of Allentown	59
171	Martin Luther King Jr. Drive	City of Allentown	376
172	Private Drive	City of Allentown	490
173	Lehigh Parkway East	City of Allentown	4,687
174	Rail Road Bridge	City of Allentown	4,030
175	Private Drive	Salisbury Township	17
176	Park Entrance	Salisbury Township	51
177	Foot Bridge	Salisbury Township	429
178	Private Drive	Salisbury Township	297
179	Foot Bridge	City of Allentown	650
180	Foot Bridge	City of Allentown	238
181	Foot Bridge	City of Allentown	95
182	Fountain Street	City of Allentown	347
183	Foot Bridge	City of Allentown	611
184	Foot Bridge	City of Allentown	1,136
185	Private Drive	City of Allentown	752
186	Foot Bridge	City of Allentown	611

* Numbers are keyed to significant obstruction map (Figure 8).

** Estimated capacities are for illustration only and should not be used as absolute capacities for storm water management decisions.

[1]Significant Obstruction No. 16 coincides with Problem area No. 5.
[2]Significant Obstruction No. 17 coincides with Problem area No. 6.
[3]Significant Obstruction No. 18 coincides with Problem area No. 7.
[4]Significant Obstruction No. 22 coincides with Problem area No. 15.
[5]Significant Obstruction No. 77 coincides with Problem area Nos. 18, 19 and 20.
[6]Significant Obstruction No. 79 coincides with Problem area No. 21.
[7]Significant Obstruction No. 89 coincides with Problem area No. 24.
[8]Significant Obstruction No. 92 coincides with Problem area No. 25.
[9]Significant Obstruction No. 101 coincides with Problem area No. 29.
[10]Significant Obstruction No. 102 coincides with Problem area No. 31.
[11]Significant Obstruction No. 106 coincides with Problem area No. 32.
[12]Significant Obstruction No. 108 coincides with Problem area No. 33.

APPENDIX C

C-1 NRCS Type II 24-Hour Rainfall Distribution (Graphic & Tabular)

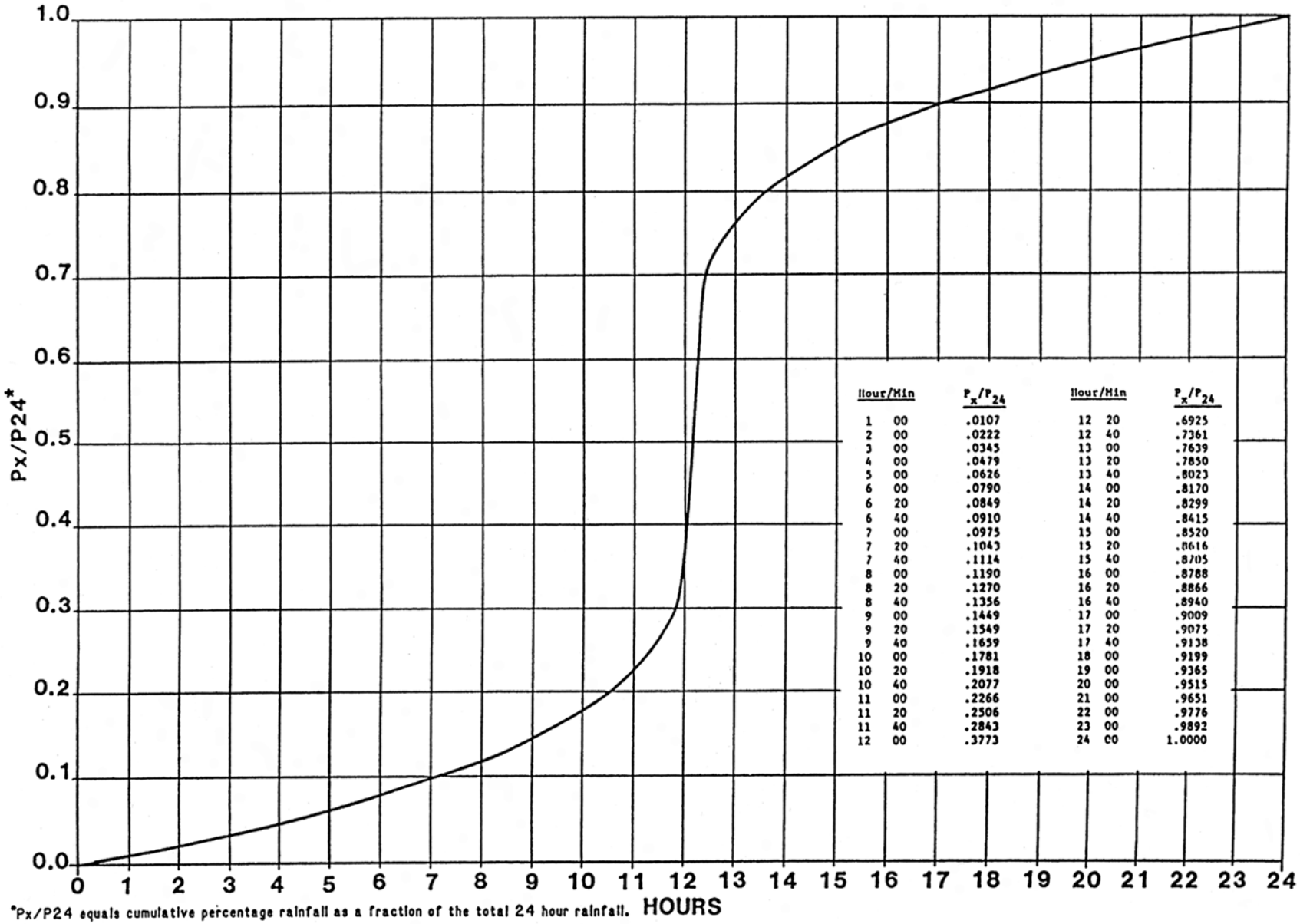
C-2 Intensity-Duration-Frequency Curves

C-3 Runoff Curve Numbers and Percent Imperviousness Values

C-4 Runoff Coefficients for the Rational Method

C-5 Manning ‘n’ Values

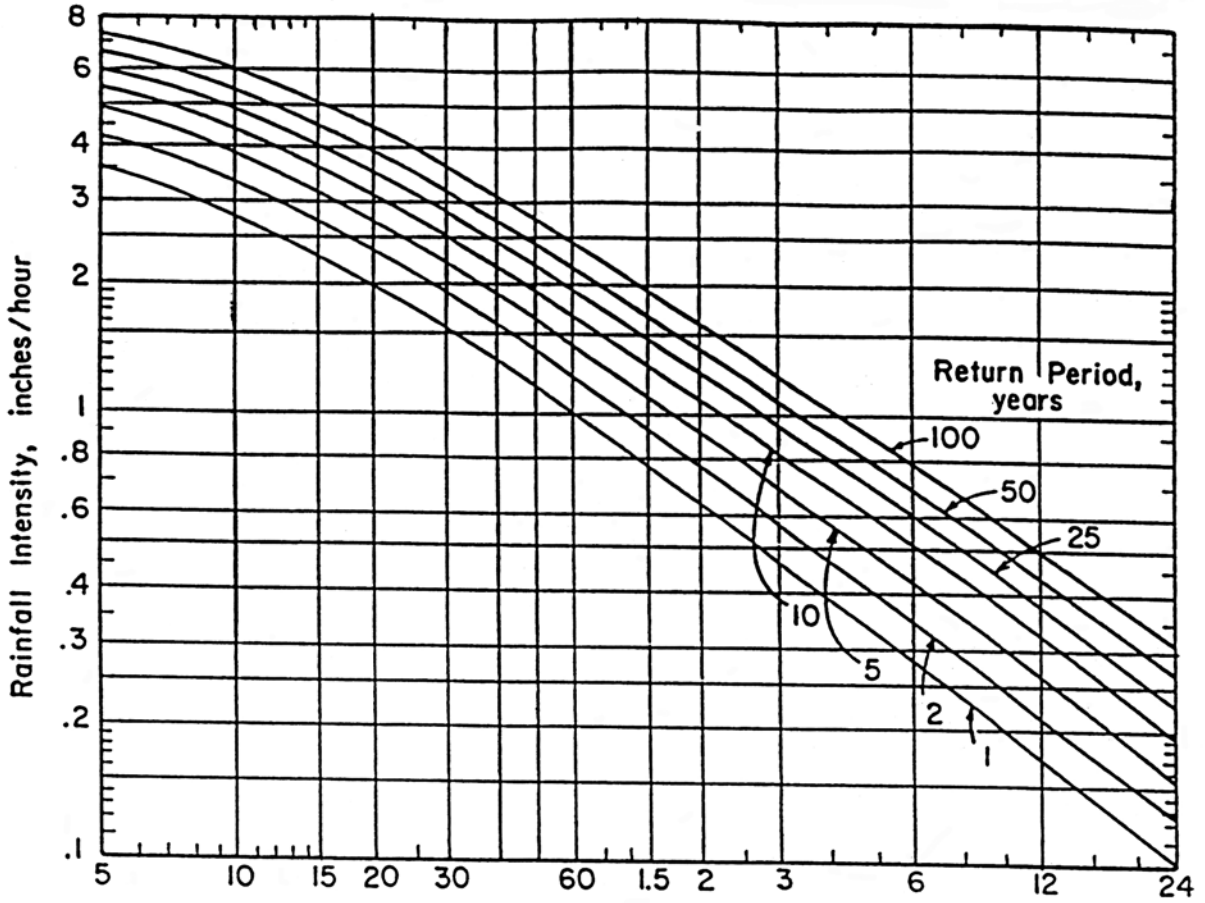
NRCS TYPE II RAINFALL DISTRIBUTION

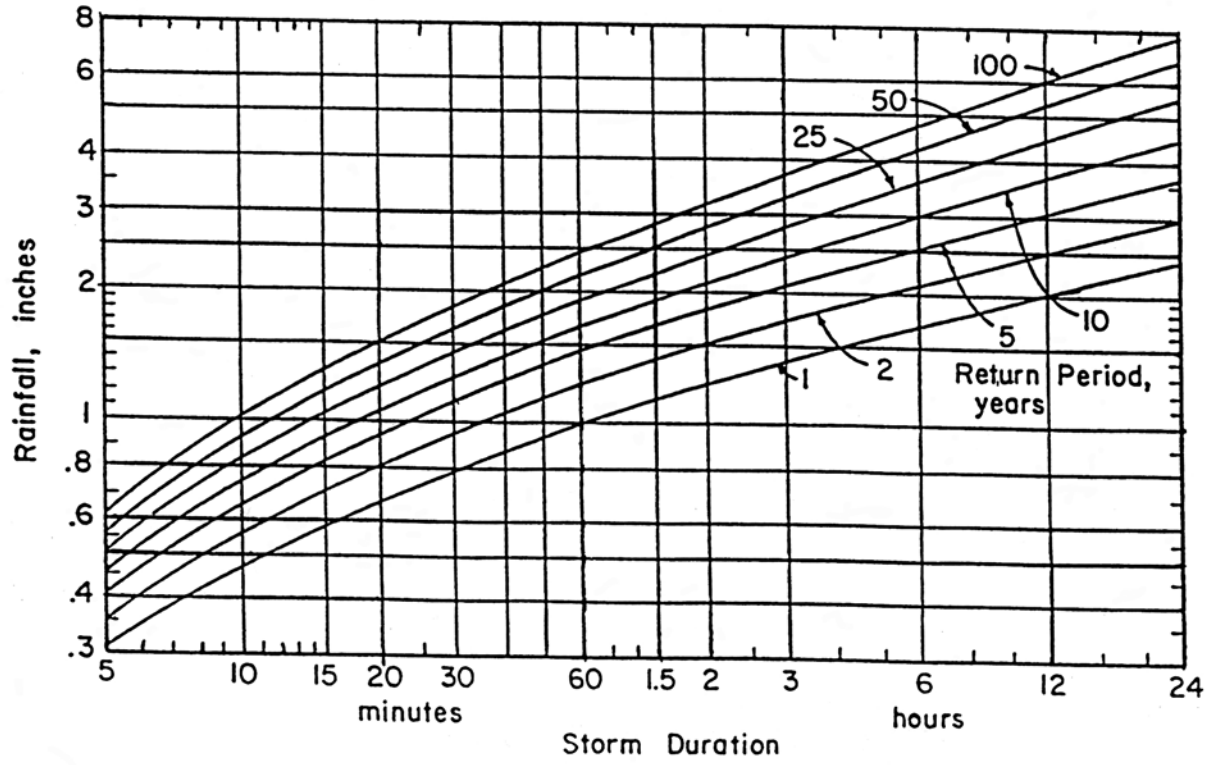


Hour/Min	P_x/P_{24}	Hour/Min	P_x/P_{24}
1 00	.0107	12 20	.6925
2 00	.0222	12 40	.7361
3 00	.0345	13 00	.7639
4 00	.0479	13 20	.7850
5 00	.0626	13 40	.8023
6 00	.0790	14 00	.8170
6 20	.0849	14 20	.8299
6 40	.0910	14 40	.8415
7 00	.0975	15 00	.8520
7 20	.1043	15 20	.8616
7 40	.1114	15 40	.8705
8 00	.1190	16 00	.8788
8 20	.1270	16 20	.8866
8 40	.1356	16 40	.8940
9 00	.1449	17 00	.9009
9 20	.1549	17 20	.9075
9 40	.1659	17 40	.9138
10 00	.1781	18 00	.9199
10 20	.1918	19 00	.9365
10 40	.2077	20 00	.9515
11 00	.2266	21 00	.9651
11 20	.2506	22 00	.9776
11 40	.2843	23 00	.9892
12 00	.3773	24 00	1.0000

*Px/P24 equals cumulative percentage rainfall as a fraction of the total 24 hour rainfall.

INTENSITY–DURATION–FREQUENCY CURVES*





*Source:Pennsylvania Dept. of Transp. Design Rainfall Curves (1986).

RUNOFF CURVE NUMBERS AND PERCENT IMPERVIOUSNESS VALUES*

Cover Description		Curve numbers for hydrologic soil group**			
Land Use/Cover Type	Average percent impervious area	A	B	C	D
Open space (lawns, parks, golf courses, cemeteries, etc.):					
Good condition (grass cover greater than 75%).....		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way).....		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way).....		98	98	98	98
Paved; open ditches (including right-of-way).....		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
c acre or less (townhouses)65	77	85	90	92	
¼ acre.....	38	61	75	83	87
a acre	30	57	72	81	86
½ acre.....	25	54	70	80	85
1 acre.....	20	51	68	79	84
2 acres	12	46	65	77	82
Woods		30	55	70	77
Agriculture		Refer to Table 2-2b in source document (TR55) by crop type and treatment.			

*Source: Natural Resources Conservation Service Technical Release No. 55, Second Edition, June 1986.

**Hydrologic Soil Group based on the County Soil Survey latest edition.

RUNOFF COEFFICIENTS FOR THE RATIONAL METHOD* HYDROLOGIC SOIL GROUP AND SLOPE RANGE**												
	A			B			C			D		
LAND USE	0-2%	2-6%	6%+	0-2%	2-6%	6%+	0-2%	2-6%	6%+	0-2%	2-6%	6%+
Cultivated[A]	[a]0.18 [b]0.23	0.23 0.29	0.28 0.34	0.24 0.30	0.29 0.36	0.33 0.40	0.30 0.36	0.34 0.41	0.38 0.45	0.33 0.39	0.37 0.44	0.41 0.48
Pasture[B]	0.09 0.12	0.13 0.17	0.17 0.23	0.19 0.24	0.24 0.30	0.29 0.36	0.27 0.33	0.31 0.38	0.36 0.43	0.31 0.37	0.35 0.42	0.39 0.46
Meadow, Lawn[C]	0.05 0.07	0.08 0.12	0.12 0.17	0.15 0.19	0.20 0.25	0.24 0.30	0.23 0.28	0.28 0.34	0.32 0.39	0.28 0.33	0.32 0.39	0.36 0.43
Forest, Woods	0.03 0.04	0.05 0.08	0.08 0.12	0.11 0.15	0.16 0.21	0.20 0.26	0.20 0.25	0.25 0.31	0.29 0.36	0.25 0.31	0.30 0.37	0.34 0.41
Gravel	0.24 0.30	0.29 0.36	0.33 0.40	0.32 0.38	0.36 0.43	0.40 0.47	0.35 0.42	0.39 0.46	0.43 0.50	0.37 0.44	0.41 0.48	0.44 0.51
Parking, Other Impervious	0.85 0.95	0.86 0.96	0.87 0.97	0.85 0.95	0.86 0.96	0.87 0.97	0.85 0.95	0.86 0.96	0.87 0.97	0.85 0.95	0.86 0.96	0.87 0.97
Residential, Commercial, Industrial and Other "Developed"	Runoff coefficients should be calculated based upon weighted average of impervious area coefficients and pervious area coefficients from above based upon soil type, slope and the particular development proposal.											

*Coefficients for all land uses except parking and other impervious cover are based on the Rossmiller Equation for translating NRCS curve numbers into Rational Method 'c' values. The source for the parking and other impervious cover coefficients is RAWLS, W.J., S.L. WONG and R.H. McCUEN, 1981. Comparison of urban flood frequency procedures. Preliminary draft report prepared for the Soil Conservation Service, Beltsville, MD.

**Hydrologic Soil Group based on the county soil survey latest edition.

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

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

[A]Represents average of cultivated land with and without conservation treatment from TR-55, January 1975. These values are consistent with several categories of cultivated lands from TR-55, June 1986.

[B]Represents grasslands in fair condition with 50% to 75% grass cover.

[C]Represents grasslands in good condition with greater than 75% grass cover.

MANNING 'n' VALUES BY TYPICAL REACH DESCRIPTION

Reach Description	Manning 'n'
Natural stream, clean, straight, no rifts Or pools	0.030
Natural stream, clean, winding, some pools And shoals	0.040
Natural stream, winding, pools, shoals, Stony with some weeds	0.050
Natural stream, sluggish with deep pools And weeds	0.070
Natural stream or swale, very weedy or With timber under brush	0.100
Concrete pipe, culvert or channel	0.012
Corrugated metal pipe	0.012-0.027*

*Depending upon type and diameter.

ROUGHNESS COEFFICIENTS (MANNING 'n') FOR SHEET FLOW

Surface Description	Manning 'n'[1]
Smooth surfaces (concrete, asphalt, gravel, or bare soil)	0.011
Fallow (no residue)	0.050
Cultivated soils:	
Residue cover <= 20%	0.060
Residue cover > 20%	0.170
Grass:	
Short grass prairie	0.150
Dense grasses[2]	0.240
Bermuda grass	0.410
Range (natural)	0.130
Woods:[3]	
Light underbrush	0.400
Dense underbrush	0.800

[1]The n values are a composite of information compiled by Engman (1986).

[2]Includes species such as weeping lovegrass, bluegrass, buffalo grass, blue grama grass and native grass mixtures.

[3]When selecting n, consider cover to a height of about 0.1 ft. this is the only part of the plant cover that will obstruct sheet flow.

APPENDIX D

*Recommendation Chart for Infiltration Stormwater Management BMPs in Carbonate Bedrock**

SITE RISK FACTORS	Geology Type	CARBONATE BEDROCK																											
	Effective Soil Thickness	Less than 2 Feet	2 to 4 Feet									Over 4 Feet to 8 Feet									Over 8 Feet								
	Special Geologic Features**	Low/Med/High Buffer	Low Buffer			Medium Buffer			High Buffer			Low Buffer			Medium Buffer			High Buffer			Low Buffer			Medium Buffer			High Buffer		
SITE INVESTIGATION RECOMMENDED		(Unacceptable)	Preliminary			Preliminary			Preliminary			Preliminary			Preliminary			Preliminary			Preliminary			Preliminary			Preliminary		
DESIGN FACTORS	Infiltration Loading Rates (% Increase) ***	(Unacceptable)	0-100%	100-300%	300 - 500%	0-100%	100-300%	300 - 500%	0-100%	100-300%	300 - 500%	0-100%	100-300%	300 - 500%	0-100%	100-300%	300 - 500%	0-100%	100-300%	300 - 500%	0-100%	100-300%	300 - 500%	0-100%	100-300%	300 - 500%	0-100%	100-300%	300 - 500%
PROGRAM SUMMARY GUIDANCE ****						1	1				1	2								1	2					1			

RECOMMENDED

NOT RECOMMENDED

*** Source: Developed by Cahill Associates based on information in "Technical Best Management Practice Manual & Infiltration Feasibility Report", November 2002 and input from the LVPC, 2003.**

**** Special Geologic Feature Buffer widths are as follows:**

Low Buffer is less than 50 feet
Medium Buffer is 50 feet to 100 feet
High Buffer is greater than 100 feet

***** Rates greater than 500% not recommended.**

****** Assumes adequately permeable soils and lack of natural constraints as required for all infiltration systems.**

1 Infiltration systems may be allowed at the determination of the Engineer and/or Geologist, provided that a Detailed Site Investigation is undertaken which confirms nature of rock, location of Special Geologic Features, and adequacy of the buffer between the SGF and the proposed stormwater system(s).

2 In these Special Geologic Features: Low Buffer situations, infiltration systems may be allowed at the determination of the Engineer and/or Geologist, provided that a Detailed Site Investigation is undertaken and a 25 foot buffer from SGFs is maintained.

APPENDIX E

STORMWATER BEST MANAGEMENT PRACTICES OPERATIONS AND MAINTENANCE AGREEMENT

THIS AGREEMENT, made and entered into this _____ day of _____, 200__, 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 _____ County, Pennsylvania, Deed Book _____ at Page _____, (hereinafter "Property").

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

WHEREAS, the stormwater management BMP Operations and Maintenance Plan approved by the municipality (hereinafter referred to as the "Plan") for the property identified herein, which is attached hereto as Appendix A and made part hereof, as approved by the municipality, provides for management of stormwater within the confines of the Property through the use of Best Management Practices (BMP's); and

WHEREAS, the municipality, and the Landowner, his successors and assigns, agree that the health, safety, and welfare of the residents of the municipality and the protection and maintenance of water quality require that on-site stormwater Best Management Practices be constructed and maintained on the Property; and

WHEREAS, for the purposes of this agreement, the following definitions shall apply:

- BMP – "Best Management Practice;" activities, facilities, designs, measures or procedures used to manage stormwater impacts from land development, to protect and maintain water quality and groundwater recharge and to otherwise meet the purposes of the Municipal Stormwater Management Ordinance, including but not limited to infiltration trenches, seepage pits, filter strips, bioretention, wet ponds, permeable paving, rain gardens, grassed swales, forested buffers, sand filters and detention basins.
- Infiltration Trench – A BMP surface structure designed, constructed, and maintained for the purpose of providing infiltration or recharge of stormwater into the soil and/or groundwater aquifer,
- Seepage Pit – An underground BMP structure designed, constructed, and maintained for the purpose of providing infiltration or recharge of stormwater into the soil and/or groundwater aquifer,
- Rain Garden – A BMP overlain with appropriate mulch and suitable vegetation designed, constructed, and maintained for the purpose of providing infiltration or recharge of stormwater into the soil and/or underground aquifer, and

WHEREAS, the municipality requires, through the implementation of the Plan, that stormwater management BMPs as required by said Plan and the Municipal Stormwater Management Ordinance be constructed and adequately operated and maintained by the Landowner, his successors and assigns, and

NOW, THEREFORE, in consideration of the foregoing promises, the mutual covenants contained herein, and the following terms and conditions, the parties hereto agree as follows:

1. The BMPs shall be constructed by the Landowner in accordance with the plans and specifications identified in the Plan.
2. The Landowner shall operate and maintain the BMP(s) as shown on the Plan in good working order acceptable to the municipality and in accordance with the specific maintenance requirements noted on the Plan.
3. The Landowner hereby grants permission to the municipality, its authorized agents and employees, to enter upon the property, at reasonable times and upon presentation of proper identification, to inspect the BMP(s) whenever it deems necessary. Whenever possible, the municipality shall notify the Landowner prior to entering the property.
4. In the event the Landowner fails to operate and maintain the BMP(s) as shown on the Plan in good working order acceptable to the municipality, the municipality or its representatives may enter upon the Property and take whatever action is deemed necessary to maintain said BMP(s). This provision shall not be construed to allow the municipality to erect any permanent structure on the land of the Landowner. It is expressly understood and agreed that the municipality is under no obligation to maintain or repair said facilities, and in no event shall this Agreement be construed to impose any such obligation on the municipality.
5. In the event the municipality, pursuant to this Agreement, performs work of any nature, or expends any funds in performance of said work for labor, use of equipment, supplies, materials, and the like, the Landowner shall reimburse the municipality for all expenses (direct and indirect) incurred within 10 days of receipt of invoice from the municipality *and if not timely paid, a municipal lien shall be placed upon the premises for 110% of the invoice amount, plus statutorily allowed fees, expenses and costs*.
6. The intent and purpose of this Agreement is to ensure the proper maintenance of the onsite BMP(s) by the Landowner; provided, however, that this Agreement shall not be deemed to create or effect any additional liability of any party for damage alleged to result from or be caused by stormwater runoff.
7. The Landowner, its executors, administrators, assigns, and other successors in interests, *hereby* release *and hold harmless* the municipality'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 the municipality, its designated representatives or employees, the municipality shall promptly notify the Landowner and the Landowner shall defend, at his own

expense, any suit based on the claim. If any judgment or claims against the municipality's employees or designated representatives shall be allowed, the Landowner shall pay all costs and expenses regarding said judgment or claim.

8. The municipality shall inspect the BMP(s) *as necessary* to ensure their continued functioning.

This Agreement shall be recorded at the Office of the Recorder of Deeds of _____ 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 the municipality:

_____

(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 _____, 200_, do hereby certify that _____ whose name(s) is/are signed to the foregoing Agreement bearing date of the _____ day of _____, 200_, has acknowledged the same before me in my said County and State.

GIVEN UNDER MY HAND THIS _____ day of _____, 200_.

_____ _____

NOTARY PUBLIC **(SEAL)**

APPENDIX F

LOW IMPACT DEVELOPMENT PRACTICES

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 may lead ultimately to the degradation of water quality as well as expenditure of additional resources for detaining and managing concentrated runoff at some downstream location.

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

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

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

- **Protecting Natural Depression Storage Areas**. Depression storage areas have no surface outlet, or drain very slowly following a storm event. They can be commonly seen as ponded areas in farm fields during the wet season or after large runoff events. Traditional development practices eliminate these depressions by filling or draining, thereby obliterating their ability to reduce surface runoff

volumes and trap pollutants. The volume and release-rate characteristics of depressions should be protected in the design of the development site. The depressions can be protected by simply avoiding the depression or by incorporating its storage as additional capacity in required detention facilities.

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

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

- **Routing Roof Runoff Over Lawns**. Roof runoff can be easily routed over lawns in most site designs. The practice discourages direct connections of downspouts to storm sewers or parking lots. The practice also discourages sloping driveways and parking lots to the street. By routing roof drains and crowning the driveway to run off to the lawn, the lawn is essentially used as a filter strip.

- **Reducing the Use of Storm Sewers**. By reducing use of storm sewers for draining streets, parking lots, and back yards, the potential for accelerating runoff from the development can be greatly reduced. The practice requires greater use of swales and may not be practical for some development sites, especially if there are concerns for areas that do not drain in a “reasonable” time. The practice requires educating local citizens and public works officials, who expect runoff to disappear shortly after a rainfall event.

- **Reducing Street Widths**. Street widths can be reduced by either eliminating on-street parking or by reducing roadway widths. Municipal planners and traffic designers should encourage narrower neighborhood streets which ultimately could lower maintenance.

- **Limiting Sidewalks to One Side of the Street**. A sidewalk on one side of the street may suffice in low-traffic neighborhoods. The lost sidewalk could be replaced with bicycle/recreational trails that follow back-of-lot lines. Where appropriate, backyard trails should be constructed using pervious materials.

- **Using Permeable Paving Materials**. These materials include permeable interlocking concrete paving blocks or porous bituminous concrete. Such materials should be considered as alternatives to conventional pavement surfaces, especially for low use surfaces such as driveways, overflow parking lots, and emergency access roads.

- **Reducing Building Setbacks**. Reducing building setbacks reduces driveway and entry walks and is most readily accomplished along low-traffic streets where traffic noise is not a problem.

- **Constructing Cluster Developments**. Cluster developments can also reduce the amount of impervious area for a given number of lots. The biggest savings is in street length, which also will reduce costs of the development. Cluster development clusters the construction activity onto less-sensitive areas without substantially affecting the gross density of development.

APPENDIX G

PRELIMINARY SITE INVESTIGATION AND TESTING REQUIRMENTS

Required Data and Site Information: The following data shall be gathered utilizing standard testing procedures as part of a Preliminary Site Investigation:

- Bedrock composition – Any apparent boundaries between carbonate and non-carbonate bedrock must be verified by a qualified geotechnical professional.
- Bedrock structural geology – This includes the possible presence of faults and mapping of conspicuous fracture traces or lineaments.
- Overburden and soil mantle composition and thickness
- Permeability of the soil
- Depth to the seasonal high water table
- Presence of special geologic features – This includes sinkholes, closed depressions, fracture traces, lineaments, joints, faults, caves , pinacles and geologic contacts between carbonate and non-carbonate bedrock

<u>Preliminary Site Investigation Required for Sites Intending to Use Infiltration</u>

Review of Available Data, Maps and Reports: Some of the required information, as listed above, can be found in existing published data. Suggested resources include the following:

- Geologic maps and references for the development area
- The Little Lehigh Creek Basin Carbonate Prototype Area Closed Depression Map – available at the LVPC
- USGS topographic maps
- Lehigh and Northampton County soil survey maps
- Aerial photographs from the LVPC or other sources
- Relevant Pennsylvania Geologic Survey Open File Reports that provide maps of sinkholes and Karst features for Lehigh County (OF 87-01) and Northampton County (OF 87-02)
- Kochanov and Reese (2003). Density of Mapped Karst Feature in South-Central and Southeastern Pennsylvania (Map 68)
- DCNR Online Sinkhole Inventory - (http://www.dcnr.state.pa.us/topogeo/hazards/sinkhole/default.asp)

Field Inspections: In addition to gathering data from published sources, a field inspection of the proposed site is required. A field inspection can provide additional information relating to site features such as carbonate bedrock features, indicators of seasonal high stream-level or water table levels, streams, springs, etc.

Soil Test Pit and Percolation Test Requirements: A minimum of one test pit and a minimum of 2 percolation tests are required for every site. A test pit is a 2-3 foot wide, 8 to 12 foot deep trench excavated with a backhoe for observing subsurface conditions. The test pits will be used to describe soil depth and quality, including soil horizons, and

testing of permeability or percolation rates and can be conducted by a certified Sewage Enforcement Officer.

Percolation tests are to be conducted as follows (adapted from § 73.15. "Percolation Tests" of the Pennsylvania Code)

1. The percolation tests shall be made in separate holes uniformly spaced over the possible infiltration area.

2. An "Initial Presoak" should not be performed.

3. Percolation holes located within the possible infiltration area shall be used in the calculation of the average percolation rate.

4. Holes having a uniform diameter of 6 to 10-inches shall be bored or dug as follows:
    a. To the depth of the bottom of the possible infiltration BMP
    b. Alternate depths if the test pits/auger holes indicate that the soils are more suitable at a different depth (i.e., if a clay horizon is identified and more suitable soils are located beneath the horizon, and infiltration test should be performed in the suitable horizon).

5. The bottom and sides of the hole shall be scarified with a knife blade or sharp-pointed instrument to completely remove any smeared soil surfaces and to provide a natural soil interface into which water may percolate. Loose material shall be removed from the hole. Two inches of coarse sand or fine gravel shall be placed in the bottom of the hole to protect the soil from scouring and clogging of the pores.

6. Immediately before the percolation test, as a final presoak, water shall be placed in the hole to a minimum depth of 6-inches over the gravel and readjusted every 30 minutes for 1 hour.

7. The drop in the water level during the last 30 minutes of the final presoaking period shall be applied to the following standard to determine the time interval between readings for each percolation hole:
    a. If water remains in the hole, the interval for readings during the percolation test shall be 30 minutes.
    b. If no water remains in the hole, the interval for readings during the percolation test may be reduced to 10 minutes.

8. After the final presoaking period, water in the hole shall again be adjusted to approximately 6-inches over the gravel and readjusted when necessary after each reading.
    a. Measurement to the water level in the individual percolation holes shall be made from a fixed reference point and shall continue at the

interval determined from step No. 7 (above) for each individual percolation hole until a minimum of eight readings are completed or until a stabilized rate of drop is obtained, whichever occurs first. A stabilized rate of drop means a difference of ¼-inch or less of drop between the highest and lowest readings of four consecutive readings.

b. The drop that occurs in the final period in percolation test holes, expressed as inches per hour, shall be used to calculate the average percolation rate.

c. When the rate of drop in a percolation test is too slow to obtain a measurable rate, the rate of 0.25 inches per hour shall be assigned to that hole for use in calculating the average percolation rate. The infiltration area may be placed over holes with no measurable rate when the average percolation rate for the possible infiltration area is within the acceptable range.

When a percolation test hole yields a percolation rate of greater than 12-inches per hour, the proposed infiltration area may not be designed or installed within 25-feet of this hole unless the municipality determines that a testing anomaly caused the fast percolation rate and a retest of the area yields acceptable percolation rates. This percolation rate limit is established to protect groundwater quality and to minimize the risk of subsidence.

Additional Site Investigation and Testing Required if Infiltration is Proposed

Soil Test Pit Requirements: The required number of test pits varies with Effective Soil Thickness. As risk factors increase, the number of test pits increases. A minimum of 2 test pits, uniformly spaced within the proposed infiltration area (e.g. the 2 pits should be centered on each half of the proposed infiltration area), are required for any site proposing infiltration unless the applicant can demonstrate that one test pit is adequately representative of the area proposed for infiltration. For larger infiltration areas, multiple test pits shall be developed at the densities as listed below:

Effective Soil Thickness (ft.)	Test Pit Density (per acre of proposed infiltration area)*	Percolation Tests (per acre of proposed infiltration area)**	Auger Grid Spacing (Feet On-Center)***
8	4	8	50
4 to 8	6	12	35
2 to 4	8	16	25

*No. of Test Pits required = Infiltration sq. ft./43,560 sq. ft. x test pit density from chart rounded up to the nearest whole number

** No. of Percolation Tests required = Infiltration sq. ft./43,560 sq. ft. x percolation tests from chart rounded up to the nearest whole number

***Auger testing is only required on Carbonate sites.

Soil Auger Testing Requirements for Carbonate Areas: Because soil depth is not uniform in many carbonate areas, test pits will not be sufficient to accurately determine the depth to bedrock. Augering provides this essential data as inexpensively as possible. Truck or track mounted rig with hollow or solid stem augers allows relatively

inexpensive, qualitative determination of the presence of overburden voids and will generally penetrate to the top-of-bedrock. Augers typically extend to depths of 20 feet. Special augers extend to as much as 50 feet. Augers do not extend into the bedrock. Auger testing should be performed in a grid pattern across the proposed infiltration area, spaced as indicated in the above table.

Percolation Testing Requirements: For each proposed infiltration area, a minimum of six percolation tests shall be conducted unless the applicant can demonstrate that fewer tests accurately represent the percolation rate of the proposed infiltration area. Additional testing shall be required if the initial test results show significant variability. For larger infiltration areas, percolation tests shall be conducted at the densities listed in the table above.