

STORMWATER MANAGEMENT

ORDINANCE

Schuylkill River Watershed

Tulpehocken Creek Watershed

I, LINDA A. KELLEHER, City Clerk of the City of Reading, Pa., do hereby certify, that the foregoing is a true and correct copy of the original Ordinance passed by the Council of the City of Reading, on the 25th day of Aug. A. D. 2008. Witness my hand and seal of the said City this 27th day of Aug. A. D. 2008.

ORDINANCE NO. 49-2008

CITY CLERK

City of Reading, Berks County,

PENNSYLVANIA

Adopted at a Public Meeting Held on

August 25, 2008

TABLE OF CONTENTS

	<u>PAGE</u>
ARTICLE I- GENERAL PROVISIONS	5
Section 101. Short Title.....	5
Section 102. Statement of Findings.....	5
Section 103. Purpose.....	6
Section 104. Statutory Authority.....	7
Section 105. Applicability/Regulated Activities.....	7
Section 106. Repealer.....	8
Section 107. Severability.....	8
Section 108. Compatibility with Other Ordinance Requirements.....	8
ARTICLE II-DEFINITIONS	9
ARTICLE III-STORMWATER MANAGEMENT	20
Section 301. General Requirements.....	20
Section 302. Permit Requirements by Other Government Entities.....	23
Section 303. Erosion and Sediment Control During Regulated Earth Disturbance Activities.....	23
Section 304. Nonstructural Project Design (Sequencing to Minimize Stormwater Impacts).....	24
Section 305. Ground Water Recharge (Infiltration/Recharge/Bioretenion).....	25
Section 306. Water Quality Requirements.....	33
Section 307. Streambank Erosion Requirements.....	35
Section 308. Stormwater Management Districts.....	35
Section 309. Calculation Methodology.....	40
Section 310. Other Requirements.....	42
Section 311. NPDES Requirements.....	43
ARTICLE IV-DRAINAGE PLAN REQUIREMENTS	44
Section 401. General Requirements.....	44
Section 402. Exemptions.....	44
Section 403. Drainage Plan Contents.....	46
Section 404. Plan Submission.....	49
Section 405. Drainage Plan Review.....	49
Section 406. Modification of Plans.....	51
Section 407. Resubmission of Disapproved Drainage Plans.....	51
ARTICLE V-INSPECTIONS	52
Section 501. Schedule of Inspections.....	52
ARTICLE VI-FEES AND EXPENSES	52
Section 601. Municipality Drainage Plan Review and Inspection Fee.....	52
Section 602. Expenses Covered by Fees.....	53
ARTICLE VII-MAINTENANCE RESPONSIBILITIES	53
Section 701. Performance Guarantee.....	53

Section 702. Responsibilities for Operations and Maintenance of Stormwater Controls and BMPs	54
Section 703. Municipality Review of Stormwater Control and BMP Operations and Maintenance Plan.....	55
Section 704. Adherence to Approved Stormwater Control and BMP Operations and Maintenance Plan.....	55
Section 705. Operations and Maintenance Agreement for Privately Owned Stormwater Controls and BMPs.....	56
Section 706. Stormwater Management Easements.....	56
Section 707. Maintenance Agreement for Privately Owned Stormwater Facilities.....	56
Section 708. Recording of Approved Stormwater Control and BMP Operations and Maintenance Plan and Related Agreements	56
Section 709. Municipal Stormwater Control and BMP Operation and Maintenance Fund	57
ARTICLE VIII- PROHIBITIONS	58
Section 801. Prohibited Discharges.....	58
Section 802. Prohibited Connections.....	59
Section 803. Roof drains.....	59
Section 804. Alteration of BMPs.....	59
ARTICLE IX-ENFORCEMENT AND PENALTIES	60
Section 901. Right-of-Entry.....	60
Section 902. Public Nuisance	60
Section 903. Enforcement Generally.....	60
Section 904. Suspension and Revocation of Permits and Approvals	61
Section 905. Penalties.....	61
Section 906. Notification.....	62
Section 907. Enforcement.....	62
Section 908. Appeals	63

APPENDICES

ORDINANCE APPENDIX A	-	STORMWATER CONTROLS AND BEST MANAGEMENT PRACTICES OPERATION AND MAINTENANCE AGREEMENT
ORDINANCE APPENDIX B	-	STORMWATER MANAGEMENT DESIGN CRITERIA
ORDINANCE APPENDIX C	-	SAMPLE DRAINAGE PLAN APPLICATION AND PROPOSED SCHEDULE OF FEES
ORDINANCE APPENDIX D	-	STORMWATER MANAGEMENT DISTRICT WATERSHED MAP*
ORDINANCE APPENDIX E	-	LOW IMPACT DEVELOPMENT PRACTICES
ORDINANCE APPENDIX F	-	WEST NILE VIRUS GUIDANCE
ORDINANCE APPENDIX G	-	REFERENCES

ARTICLE I- GENERAL PROVISIONS

Section 101. Short Title

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

Section 102. Statement of Findings

The governing body of the Municipality finds that:

- A. Inadequate management of accelerated stormwater runoff resulting from development throughout a watershed increases flood flows and velocities, contributes to erosion and sedimentation, overtaxes the carrying capacity of existing streams and storm sewers, greatly increases the cost of public facilities to convey and manage stormwater, undermines floodplain management and flood reduction efforts in upstream and downstream communities, reduces groundwater recharge, and threatens public health and safety.
- B. Inadequate planning and management of stormwater runoff resulting from land development and redevelopment throughout a watershed can also harm surface water resources by changing the natural hydrologic patterns, accelerating stream flows (which increase scour and erosion of stream-beds and stream-banks thereby elevating sedimentation), destroying aquatic habitat and elevating aquatic pollutant concentrations and loadings such as sediments, nutrients, heavy metals and pathogens. Groundwater resources are also impacted through loss of recharge.
- C. A comprehensive program of stormwater management (SWM), including minimization of impacts of development, redevelopment and activities causing accelerated erosion, is fundamental to the public health, safety, welfare, and the protection of the people of the Municipality and all the people of the Commonwealth, their resources, and the environment.
- D. Inadequate management of accelerated stormwater runoff resulting from development throughout a watershed poses a threat to surface and groundwater quality.
- E. Stormwater can be an important water resource by providing groundwater recharge for water supplies and base flow of streams, which also protects and maintains surface water quality.
- F. Impacts from stormwater runoff can be minimized by using project designs that maintain the natural hydrologic regime, and sustain high water quality, groundwater recharge, stream baseflow and aquatic ecosystems. The most cost effective and environmentally advantageous way to manage storm water runoff is through nonstructural project design, minimizing impervious surfaces and sprawl, avoiding sensitive areas (i.e. stream buffers, floodplains, steep slopes), and designing to topography and soils to maintain the natural hydrologic regime.

- G. Public education on the control of pollution from stormwater is an essential component in successfully addressing stormwater.
- H. Federal and state regulations require certain municipalities to implement a program of stormwater controls. These municipalities are required to obtain a permit for stormwater discharges from their separate storm sewer systems under the National Pollutant Discharge Elimination System (NPDES).
- I. Non-stormwater discharges to municipal separate storm sewer systems can contribute to pollution of waters of the Commonwealth by the Municipality.

Section 103. Purpose

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

- A. Promote alternative project designs and layout that minimizes impacts to surface and ground water.
- B. Promote nonstructural Best Management Practices (BMPs).
- C. Minimize increases in stormwater volume.
- D. Minimize impervious surfaces.
- E. Manage accelerated runoff and erosion and sedimentation problems at their source by regulating activities that cause these problems.
- F. Provide review procedures and performance standards for stormwater planning and management.
- G. Utilize and preserve the existing natural drainage systems.
- H. Manage stormwater impacts close to the runoff source, which requires a minimum of structures and relies on natural processes.
- I. Focus on infiltration of stormwater where compatible, to maintain groundwater recharge, to prevent degradation of surface and groundwater quality and to otherwise protect water resources.
- J. Maintain existing base flows and quality of streams and watercourses, where possible.
- K. Meet legal water quality requirements under state law, including regulations at 25 Pa. Code Chapter 93.4a to protect and maintain "existing uses" and maintain the level of water quality to support those uses in all streams, and to protect and maintain water quality in "special protection" streams.
- L. Address the quality and quantity of stormwater discharges from the development site.

- M. Provide a mechanism to identify controls necessary to meet the NPDES permit requirements.
- N. Implement an illegal discharge detection and elimination program to address non-stormwater discharges into the Municipality's separate storm sewer system.
- O. Preserve and restore the flood-carrying capacity of streams.
- P. Prevent scour and erosion of streambanks and streambeds.
- Q. Provide performance standards and design criteria for watershed-wide stormwater management and planning.
- R. Provide proper operation and maintenance of all permanent stormwater management facilities and BMPs that are implemented in the Municipality.

Section 104. Statutory Authority

The Municipality is empowered to regulate land use activities that affect runoff, surface and groundwater quality and quantity by the authority of:

- A. Act of October 4, 1978 32 P.S., P.L. 864 (Act 167) Section 680.1 et seq., as amended, the "Stormwater Management Act" (hereinafter referred to as "the Act").
- B. Water Resources Management Act of 2002, as amended.
- C. Pennsylvania Municipalities Planning Code (MPC), Act 247, as amended and the Third Class City Code, Act 317, as amended.

Section 105. Applicability/Regulated Activities

This Ordinance shall apply to those areas of the City of Reading within the Schuylkill River and Tulpehocken Creek Watersheds, as delineated in Appendix D which is hereby adopted as part of this Ordinance.

This Ordinance shall only apply to permanent nonstructural and structural stormwater management Best Management Practices (**BMPs**) constructed as part of any of the Regulated Activities listed in this Section.

This Ordinance contains only the stormwater management performance standards and design criteria that are necessary or desirable from a watershed-wide perspective. Local stormwater management design criteria (e.g., inlet spacing, inlet type, collection system design and details, outlet structure design, etc.) shall continue to be regulated by the applicable Municipal Ordinances and applicable State Regulations.

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

- A. Land development.

- B. Subdivisions.
- C. Alteration of the natural hydrologic regime.
- D. Construction or reconstruction of, or additional impervious or semi-pervious surfaces (driveways, parking lots, roads, etc.).
- E. Construction of new buildings or additions to existing buildings.
- F. Redevelopment of a site which will increase runoff or change a discharge point. Any redevelopment that does not increase the runoff must still comply with Section 304 (Nonstructural Project Design), Section 305 (Groundwater Recharge), Section 306 (Water Quality), and Section 307 (Streambank Erosion).
- G. Diversion piping or encroachments in any natural or man-made channel.
- H. Nonstructural and structural storm water management **BMPs** or appurtenances thereto.
- I. Regulated Earth Disturbance¹.
- J. City permit-regulated construction activities.
- K. Any of the above Regulated Activities which were approved more than 5 years prior to the effective date of this ordinance and resubmitted for municipal approval.

Section 106. Repealer

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

Section 107. Severability

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

Section 108. Compatibility with Other Ordinance Requirements

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

Nothing in this Ordinance shall be construed to affect any of the Municipality's requirements regarding stormwater matters which do not conflict with the provisions of this Ordinance, such as local stormwater management design criteria (e.g. inlet spacing, inlet type, collection system

¹ Earth Disturbance activities and associated stormwater management controls are also regulated under existing state law and implementing regulations. This Ordinance shall operate in coordination with those parallel requirements; the requirements of this Ordinance shall be no less restrictive in meeting the purposes of this Ordinance than state law.

design and details, outlet structure design, etc.). Conflicting provisions in other municipal ordinances or regulations shall be construed to retain the requirements of this ordinance addressing State Water Quality Requirements.

ARTICLE II-DEFINITIONS

Section 201. Interpretation

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

- A. Words used in the present tense include the future tense; the singular number includes the plural, and the plural number includes the singular; words of masculine gender include feminine gender; and words of feminine gender include masculine gender.
- B. The word "includes" or "including" shall not limit the term to the specific example, but is intended to extend its meaning to all other instances of like kind and character.
- C. The word "person" includes an individual, firm, association, organization, partnership, trust, company, corporation, unit of government, or any other similar entity.
- D. The words "shall" and "must" are mandatory; the words "may" and "should" are permissive.
- E. The words "used or occupied" include the words "intended, designed, maintained, or arranged to be used, occupied or maintained."

Section 202 - Definitions

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

Agricultural Activities - The work of producing crops and raising livestock including tillage, plowing, disking, harrowing, pasturing and installation of conservation measures. For purposes of regulation by this Ordinance construction of new buildings or impervious area is not considered an agricultural activity.

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

As-built drawings - Those maintained by the Contractor as he constructs the project and upon which he documents the actual locations of the building components and changes to the original contract documents. These, or a copy of same, are turned over to the Engineer, Municipal engineer, and Municipality in the current City standard format for hard copy, electronic copy, and reproducibles at the completion of the project. See also Record Drawing in this section.

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

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

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

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

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

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

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

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

Cistern - An underground reservoir or tank for storing rainwater.

Conservation District - The Berks County Conservation District.

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

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

Department - The Pennsylvania Department of Environmental Protection.

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

Design Professional (Qualified) - A Pennsylvania Registered Professional Engineer, Registered Landscape Architect, Professional Geologist, Qualified Soils Scientist or a Registered Professional Land Surveyor qualified to perform the specific design task at hand based upon the applicable code of ethics.

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

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

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

Developer – A person that seeks to undertake any Regulated Activities at a project site in the Municipality.

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

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

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

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

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

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

Ditch – An artificial waterway for irrigation or stormwater conveyance.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Impervious Surface - A surface that prevents the infiltration of water into the ground. Impervious surface includes, but is not limited to, any roof, parking or driveway areas, and any new streets and sidewalks. Any surface areas designed to be gravel or crushed stone shall be assumed to be impervious surfaces.

Improvements Agreement – An agreement made between the municipality and the developer that an approved subdivision and land development plan will be constructed according to the approved drawings and abide to specific conditions specified in the agreement.

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

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

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

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

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

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

Land Development – Any of the following activities:

- (i) The improvement of one lot or two or more contiguous lots, tracts, or parcels of land for any purpose involving:
 - a. A group of two or more residential or nonresidential buildings, whether proposed initially or cumulatively, or a single nonresidential building on a lot or lots regardless of the number of occupants or tenure, or
 - b. The division or allocation of land or space, whether initially or cumulatively, between or among two or more existing or prospective occupants by means of, or for the purpose of streets, common areas, leaseholds, condominiums, building groups, or other features;
- (ii) A subdivision of land;
- (iii) Development in accordance with Section 503(1.1) of the PA Municipalities Planning Code.

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

- (i) A seasonal high water table, whether perched or regional, determined by direct observation of the water table or indicated by soil mottling.
- (ii) A rock with open joints, fracture or solution channels, or masses of loose rock fragments, including gravel, with insufficient fine soil to fill the voids between the fragments.
- (iii) A rock formation, other stratum or soil condition which is so slowly permeable that it effectively limits downward passage of water.

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

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

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

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

Municipality – City of Reading, Berks County, Pennsylvania.

Natural Condition – Existing conditions

Natural Hydrologic Regime (see hydrologic regime)

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

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

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

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

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

NRCS - Natural Resource Conservation Service (previously SCS).

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

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

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

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

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

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

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

Planning Commission - The Planning Commission of the City of Reading.

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

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

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

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

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

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

Reconstruction - Demolition of and subsequent rebuilding of impervious surface.

Record Drawings - Original documents revised to suit the as-built conditions and subsequently provided by the Design Professional to the Municipality. The Design Professional takes the Contractor's as-builts, reviews them in detail with his/her own records for completeness, then either turns these over to the Client and transfers the information to a set of reproducibles, hard copy, and electronic format in the current City standard format in both cases for the Municipality's permanent records. See also As-Built Drawings.

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

Regulated Activities - Actions or proposed actions that have an impact on stormwater runoff quality or quantity and that are specified in Section 105 of this Ordinance.

Regulated Earth Disturbance Activity - Earth disturbance activity one acre or more with a point source discharge to surface waters or the Municipality's storm sewer system, or five acres or more regardless of the planned runoff. This includes earth disturbance on any portion of, part, or during any stage of, a larger common plan of development.

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

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

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

Retention Basin - A structure in which stormwater is stored and not released during the storm event. Retention basins do not have an outlet other than recharge and must infiltrate stored water in no more than 4 days.

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

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

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

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

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

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

SALDO – Subdivision and Land Development Ordinance.

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

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

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

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

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

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

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

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

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

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

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

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

State Water Quality Requirements - As defined under state regulations -- protection of *designated and existing uses* (See 25 Pa. Code Chapters 93 and 96)--including:

- A. Each stream segment in Pennsylvania has a “designated use,” such as “cold water fishery” or “potable water supply,” which are listed in Chapter 93. These uses must be protected and maintained, under state regulations.
- B. “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.
- C. Water quality involves the chemical, biological and physical characteristics of surface water bodies. After Regulated Earth Disturbance activities are complete, these characteristics can be impacted by addition of pollutants such as sediment, and changes in habitat through increased flow volumes and/or rates as a result of changes in land surface area from those activities. Therefore, permanent discharges to surface waters must be managed to protect the stream bank, streambed and structural integrity of the waterway, to prevent these impacts.

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

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

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

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

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

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

Stormwater Management Plan - The plan for managing those land use activities that will influence stormwater runoff quality and quantity and that would impact the Tulpehocken Creek and Schuylkill River Watersheds in the City of Reading adopted by Berks County as required by the Act of October 4, 1978, P.L. 864, (Act 167), and known as the "Tulpehocken Creek Watershed Act 167 Stormwater Management Plan" and the "Schuylkill River Watershed Act 167 Stormwater Management Plan".

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

Stream - A natural watercourse.

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

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

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

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

Surface Waters of the Commonwealth - Any and all rivers, streams, creeks, rivulets, ditches, watercourses, storm sewers, lakes, dammed water, wetlands, ponds, springs, and all other bodies

or channels of conveyance of surface, or parts thereof, whether natural or artificial, within or on the boundaries of this Commonwealth.

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

Timber Operations - See Forest Management.

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

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

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

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

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

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

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

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

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

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

ARTICLE III-STORMWATER MANAGEMENT

Section 301. General Requirements

- A. Applicants proposing regulated activities in the City of Reading which do not fall under the exemption criteria shown in Section 402 shall submit a drainage plan consistent with the applicable (Schuylkill River or Tulpehocken Creek) Stormwater Management Plan to

the municipality for review. These criteria shall apply to the total proposed development even if development is to take place in stages

- B. The Applicant is required to evaluate practicable alternatives to the surface discharge of stormwater, the creation of impervious surfaces and the degradation of waters of the Commonwealth, and must maintain as much as possible the natural hydrologic regime
- C. The Drainage Plan must be designed consistent with the sequencing provisions of Section 304 to ensure maintenance of the natural hydrologic regime and to promote groundwater recharge where appropriate and to protect groundwater and surface water quality and quantity. The Drainage Plan designer must proceed sequentially in accordance with Article III of this ordinance.
- D. Stormwater drainage systems shall be provided in order to permit unimpeded flow along natural watercourses, except as modified by stormwater management facilities or open channels consistent with this Ordinance.
- E. Existing points of concentrated drainage that discharge onto adjacent property shall not be altered in any manner which could cause property damage without permission of the affected property owner(s) and shall be subject to any applicable discharge criteria specified in this Ordinance.
- F. Areas of existing diffused drainage discharge shall be subject to any applicable discharge criteria in the general direction of existing discharge, whether proposed to be concentrated or maintained as diffused drainage areas, except as otherwise provided by this ordinance. If diffused drainage discharge is proposed to be concentrated and discharged onto adjacent property, the Applicant must document that adequate downstream conveyance facilities exist to safely transport the concentrated discharge, or otherwise prove that no erosion, sedimentation, flooding or other impacts will result from the concentrated discharge.
- G. Where a development site is traversed by existing watercourses, drainage easements shall be provided conforming to the line of such watercourses. The terms of the easement shall conform to the stream buffer requirements contained in Section 306.F of this Ordinance.
- H. Any stormwater management facilities regulated by this Ordinance that would be located in or adjacent to waters of the Commonwealth or wetlands shall be subject to approval by PaDEP through the Joint Permit Application process, or, where deemed appropriate by PaDEP, the General Permit process. When there is a question whether wetlands may be involved, it is the responsibility of the Applicant or his agent to show that the land in question cannot be classified as wetlands, otherwise approval to work in the area must be obtained from PaDEP.
- I. Any stormwater management facilities regulated by this Ordinance that would be located on State highway rights-of-way shall be subject to approval by the Pennsylvania Department of Transportation (PennDOT).
- J. Minimization of impervious surfaces and infiltration of runoff through seepage beds, infiltration trenches, etc. are encouraged, where soil conditions permit, to reduce the size or eliminate the need for detention facilities or other structural BMPs.

- K. Roof drains shall not be connected to streets, sanitary or storm sewers or roadside ditches in order to promote overland flow and infiltration/ percolation of stormwater where advantageous to do so. When it is more advantageous to connect directly to streets or storm sewers, then it shall be permitted on a case by case basis by the municipality.
- L. All stormwater runoff shall be pre-treated for water quality prior to discharge to surface or groundwater.
- M. All regulated earth disturbance activities within the Municipality shall be designed, implemented, operated and maintained to meet the purposes of this Ordinance, through these two elements:
1. Erosion and Sediment control during the earth disturbance activities (e.g., during construction), and
 2. Water quality protection measures after completion of earth disturbance activities (i.e. after construction), including operations and maintenance.
- N. No regulated earth disturbance activities within the Municipality shall commence until the requirements of this Ordinance are met.
- O. Post-construction water quality protection shall be addressed as required by Section 306.
- P. Operations and maintenance of permanent stormwater BMPs shall be addressed as required by Article VII.
- Q. All best management practices (BMPs) used to meet the requirements of this Ordinance shall conform to the State Water Quality Requirements, and any more stringent requirements as determined by the Municipality.
- R. Techniques described in Appendix E (Low Impact Development) of this Ordinance are encouraged, because they reduce the costs of complying with the requirements of this Ordinance and the State Water Quality Requirements.
- S. In selecting the appropriate BMPs or combinations thereof, the Applicant SHALL consider the following:
1. Total contributing area.
 2. Permeability and infiltration rate of the site soils.
 3. Slope and depth to bedrock.
 4. Seasonal high water table.
 5. Proximity to building foundations and well heads.
 6. Erodibility of soils.
 7. Land availability and configuration of the topography
 8. Peak discharge and required volume control.
 9. Stream bank erosion.
 10. Efficiency of the BMPs to mitigate potential water quality problems.

11. The volume of runoff that will be effectively treated.
 12. The nature of the pollutant(s) being removed.
 13. Maintenance requirements.
 14. Creation/protection of aquatic and wildlife habitat.
 15. Recreational value.
- T. Transference of runoff from one DEP designated Act 167 watershed to another shall be prohibited.

Section 302. Permit Requirements by Other Government Entities

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

- A. All regulated 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 105.
- C. Any stormwater management facility that would be located in or adjacent to surface waters of the Commonwealth, including wetlands, subject to permit by DEP under 25 Pa. Code Chapter 105.
- D. Any stormwater management facility that would be located on a State highway right-of-way, or require access from a state highway, shall be subject to approval by the 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.

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

- A. No Regulated Earth Disturbance activities within the Municipality shall commence until the Municipality receives or the Municipality receives notice of an approval from the Conservation District of an Erosion and Sediment Control Plan for construction activities.
- B. DEP has regulations that require an Erosion and Sediment Control Plan for any earth disturbance activity of 5,000 square feet or more, under 25 Pa. Code § 102.4(b).
- C. In addition, under 25 Pa. Code Chapter 92, a DEP "NPDES Construction Activities" permit is required for Regulated Earth Disturbance activities.

- 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 Municipality. The issuance of an NPDES Construction Permit (or permit coverage under the statewide General Permit (PAG-2) satisfies the requirements subsection 303.A. [*]
- E. A copy of the Erosion and Sediment Control plan and any required permit, as required by DEP regulations, shall be available at the project site at all times.
- F. Additional erosion and sediment control design standards and criteria are recommended to be applied where infiltration BMPs are proposed shall include the following:
 - 1. Areas proposed for infiltration BMPs shall be protected from sedimentation and compaction during the construction phase to maintain maximum infiltration capacity.
 - 2. Infiltration BMPs shall not be constructed nor receive runoff until the entire contributory drainage area to the infiltration BMP has achieved final stabilization

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

- A. The design of all Regulated Activities shall include the following steps in sequence to minimize stormwater impacts.
 - 1. The Applicant is required to evaluate practicable alternatives to the surface discharge of stormwater, the creation of impervious surfaces and the degradation of waters of the Commonwealth, and must maintain as much as possible the natural hydrologic regime of the site.
 - 2. An alternative is practicable if it is available and capable of being done after taking into consideration cost, existing technology and logistics in light of overall project purposes, and other municipal requirements.
 - 3. All practicable alternatives to the discharge of stormwater are presumed to have less adverse impact on quantity and quality of waters of the Commonwealth unless otherwise demonstrated.
- B. The Applicant shall demonstrate that they designed the Regulated Activities in the following sequence to minimize the increases in stormwater runoff and impacts to water quality:
 - 1. Prepare an Existing Resource and Site Analysis Map (ERSAM), showing environmentally sensitive areas including, but not limited to, steep slopes, ponds, lakes, streams, wetlands, hydric soils, vernal pools, flood plains, stream buffer zones, hydrologic soil groups A and B (areas conducive to infiltration), special geologic features, any existing recharge areas and any other requirements outlined in the municipal Subdivision and Land Development ordinance.

2. Establish appropriate buffers for each of the delineated environmentally sensitive areas per the municipal zoning ordinance (See Section 306.F. for stream buffers and Section 310.K. for special geologic feature buffers).
3. Prepare a draft project layout avoiding sensitive areas identified in Section 304.B.1.
4. Identify site specific existing conditions drainage areas, discharge points, recharge areas and hydrologic soil groups A and B.
5. Evaluate Nonstructural Stormwater Management Alternatives
 - a. Minimize earth disturbance
 - b. Minimize impervious surfaces
 - c. Break up large impervious surfaces.
6. Satisfy infiltration objective (Section 305) and provide for stormwater pretreatment prior to infiltration. Pretreatment may not be necessary for rooftop runoff which enters the infiltration facility directly from a roof leader.
7. Satisfy water quality (Section 306) and streambank erosion protection objective (Section 307).
8. Determine what Management District the site falls into (Appendix D) and conduct an existing conditions runoff analysis.
9. Prepare final project design to maintain existing conditions drainage areas and discharge points, to minimize earth disturbance and impervious surfaces, and to the maximum extent possible, to ensure the remaining site development has no surface or point discharge.
10. Conduct a proposed conditions runoff analysis based on the final design and to meet the release rate and in turn the overbank flow and extreme event requirements (Section 308).
11. Manage any remaining runoff through treatment prior to discharge, as part of detention, bioretention, direct discharge or other structural control.

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

The requirements for ground water recharge differ for the Schuylkill River watershed and the Tulpehocken Creek watershed. The applicant shall apply the appropriate regulations based on the location of a proposed site within the Schuylkill River or Tulpehocken Creek watersheds.

Ground Water Recharge for the Schuylkill River Watershed

Maximizing the ground water recharge capacity of the area being developed is required. Design of the infiltration stormwater management facilities shall give consideration to providing ground water recharge to compensate for the reduction in the percolation that occurs when the ground surface is disturbed or impervious surface is created. It is recommended that roof runoff be directed to infiltration BMPs which can be over-designed to compensate for the infiltration

losses due to parking areas. It is recommended that roof runoff be directed to infiltration BMPs which may be designed to compensate for the runoff from parking areas. These measures are required to be consistent with Section 103, and take advantage of utilizing any existing recharge areas.

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

A. Infiltration BMPs within the Schuylkill River Watershed shall meet the following minimum requirements:

1. Infiltration Requirements:

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

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

a. A minimum depth of 36 inches between the bottom of the BMP and the limiting zone.

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

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

d. Pretreatment shall be provided prior to infiltration.

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

a. NRCS Curve Number equation.

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

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

Where:

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

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

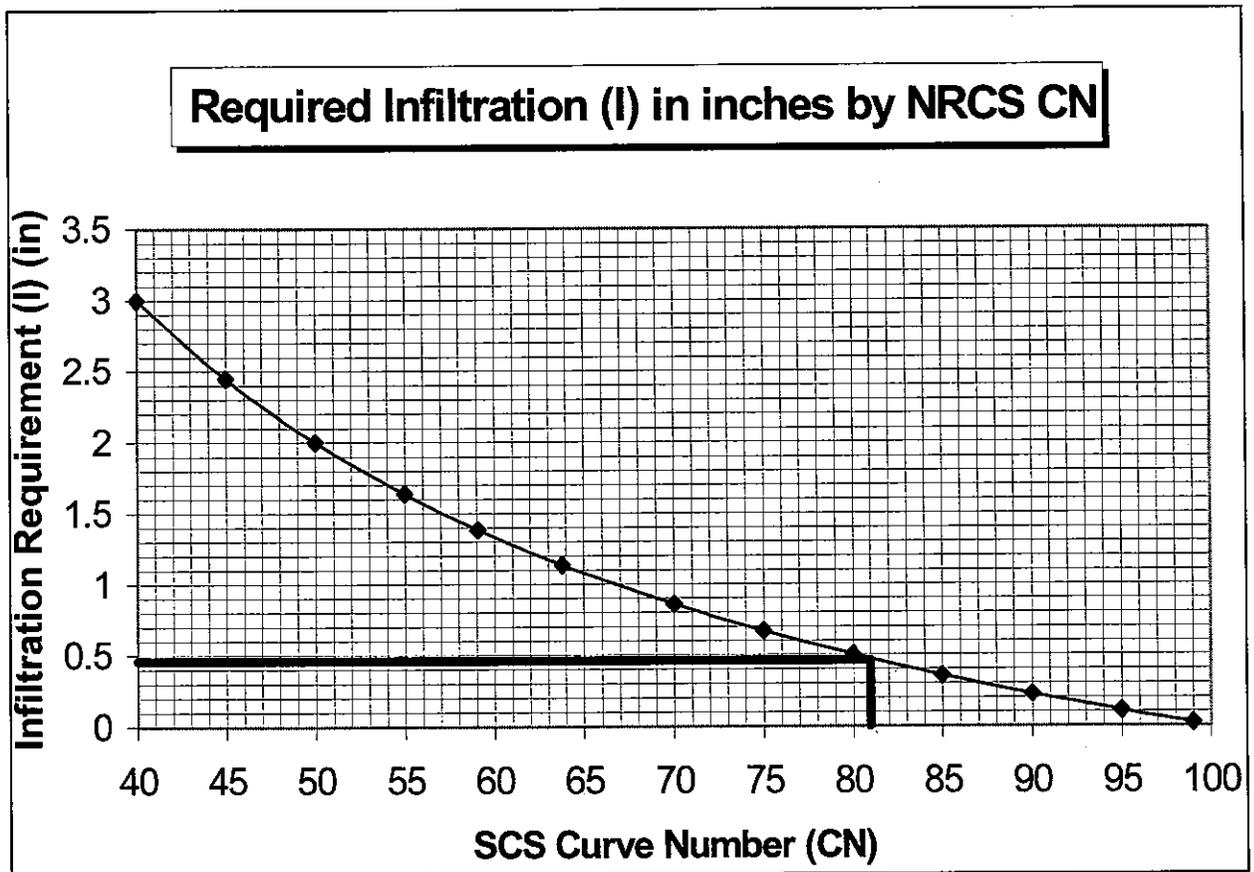


Figure 305.1. Infiltration requirement based upon NRCS Curve Number.

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

$$Re_v = I * \text{impervious area (square feet)} / (12 \text{ in/ft}) = \text{Cubic Feet} \quad \text{Eqn: 305.2}$$

Where:

I = infiltration requirements (in inches.)

b. Annual Recharge – Water Budget Approach.

It has been determined that infiltrating 0.46 inches of runoff from the impervious areas will aid in maintaining the hydrologic regime of the Schuylkill River watershed. If the goals of Section 305.A.3.a cannot be achieved, then 0.46 inches of rainfall shall be infiltrated from all impervious areas, up to an existing site conditions curve number of 81. Above a curve number of 81, Equation 305.1 or the curve in Figure 305.1 should be used to determine the infiltration requirement.

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

$$Re_v = (0.46 \text{ or } I, \text{ whichever is less}) * \text{impervious area (sq.ft.)} / (12\text{in/ft}) = \text{Cubic Feet. Eqn: 305.3}$$

Ground Water Recharge for the Tulpehocken Creek Watershed

The ability to retain and maximize the ground water recharge capacity of the area being developed is encouraged. Design of the infiltration/recharge stormwater management facilities shall give consideration to providing ground water recharge to compensate for the reduction in the percolation that occurs when the ground surface is paved and roofed over.

These measures are encouraged, particularly in hydrologic soil groups A and B and should be utilized wherever feasible. Soils used for the construction of basins shall have low-erodibility factors ("K" factors).

B. Infiltration BMPs shall meet the following minimum requirements:

1. Infiltration BMPs intended to receive runoff from developed areas shall be selected based on suitability of soils and site conditions and shall be constructed on soils that have the following characteristics:
 - a. A minimum depth of 48 inches between the bottom of the facility and the seasonal high water table and/or bedrock (limiting zones).
 - b. An infiltration and/or percolation rate sufficient to accept the additional stormwater load and drain completely as determined by field tests conducted by the Owner's professional designer.

2. Infiltration BMPs receiving only roof runoff may be placed in soils having a minimum depth of 24 inches between the bottom of the facility and the limiting zone.
3. The size of the recharge facility within the Tulpehocken Creek watershed shall be based upon the following equation:

$$R_{ev} = [(S) (R_v) (A)] / 12 \qquad \text{Eqn: 305.4}$$

Where:

R_{ev} = Recharge Volume (acre- feet)

S = Soil specific recharge factor (inches)

R_v = Volumetric runoff coefficient

A = Site area contributing to the recharge facility (acres)

And:

$$R_v = 0.05 + 0.009 (I)$$

Where:

I = percent impervious area

And:

S shall be obtained based upon hydrologic soil group based upon the table below:

Hydrologic Soil Group Soil Specific Recharge Factor (S)

- A 0.38 inches
- B 0.25 inches
- C 0.13 inches
- D 0.06 inches

If more than one hydrologic soil group (HSG) is present at a site, a composite recharge volume shall be computed based upon the proportion of total site area within each HSG.

4. The recharge volume provided at the site shall be directed to the most permeable HSG available.
5. The recharge facility shall be capable of completely infiltrating the impounded water within 48 hours.
6. The recharge facility shall be capable of completely infiltrating the impounded water within 48 hours.

Groundwater Recharge for the Schuylkill River and Tulpehocken Creek Watersheds

- B. Soils - A detailed soils evaluation of the project site shall be required where practicable to determine the suitability of infiltration facilities. The evaluation shall be performed by a

qualified design professional, and at a minimum, address soil permeability, depth to bedrock and subgrade stability. The general process for designing the infiltration BMP shall be:

1. Analyze hydrologic soil groups as well as natural and man-made features within the site to determine general areas of suitability for infiltration practices. In areas where development on fill material is under consideration, conduct geotechnical investigations of sub-grade stability; infiltration is not permitted to be ruled out without conducting these tests.
2. Provide field tests such as double ring infiltrometer or hydraulic conductivity tests (at the level of the proposed infiltration surface) to determine the appropriate hydraulic conductivity rate. Percolation tests are not recommended for design purposes.
3. Design the infiltration structure for the required retention (Re_v) volume based on field determined capacity at the level of the proposed infiltration surface.
4. If on-lot infiltration structures are proposed by the Applicant's design professional, it must be demonstrated to the municipality that the soils are conducive to infiltrate on the lots identified.

C. Carbonate Areas – The Applicant is required to investigate the ability of all areas on the site which are not underlain by carbonate rock to meet the infiltration requirements of Section 305.A or 305.B as applicable. If this investigation proves infeasible, infiltration can occur on areas underlain by carbonate rock by following the recommended procedure below in conjunction with Figure B-4 in Ordinance Appendix B. *However, the Applicant is not required to use infiltration in carbonate areas even if the site falls into the "Recommended" range on Figure B-4 in Ordinance Appendix B.* If infiltration is not proposed, the calculated infiltration volume (Section 305.A or 305.B) shall be treated by an acceptable BMP by a facility which prevents the required volume of runoff from being discharged off-site. Acceptable methods for treating this volume are storage and reuse, bio-retention, wet ponds, and soil composting. Other methods may be acceptable and all methods should generally follow the design guidelines outlined in the Pennsylvania Stormwater Best Management Practice Manual, latest edition.

Infiltration BMP loading rate percentages in Figure B-4 in Ordinance Appendix B shall be calculated as follows:

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

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

Area Description	Weighting
All disturbed area to be made impervious	100%

All disturbed areas to be made pervious	50%
All undisturbed impervious areas	100%
All undisturbed pervious areas	0%

Soil thickness is to be measured from the bottom of any proposed infiltration BMP. The effective soil thickness in Figure B-4 in Ordinance Appendix B is the measured soil thickness multiplied by the thickness factor based on soil permeability, as follows:

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

Whenever a basin will be located in an area underlain by limestone, a geological evaluation of the proposed location shall be conducted to determine susceptibility to sinkhole formations. The design of all facilities over limestone formations shall include measures to prevent ground water contamination and, where necessary, sinkhole formation.

It shall be the developer's responsibility to verify if the site is underlain by limestone. The following note shall be attached to all drainage plans and signed and sealed by the developer's engineer/surveyor/landscape/architect/geologist:

_____, certify that the proposed detention basin (circle one) is/is not underlain by limestone.

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

Examples of Hotspots:

- Vehicle salvage yards and recycling facilities
- Vehicle fueling stations
- Vehicle service and maintenance facilities
- Vehicle and equipment cleaning facilities
- Fleet storage areas (bus, truck, etc.)
- Industrial sites (based on Standard Industrial Codes)
- Marinas (service and maintenance)

- Outdoor liquid container storage
- Outdoor loading/unloading facilities
- Public works storage areas
- Facilities that generate or store hazardous materials
- Commercial container nursery
- Other land uses and activities as designated by an appropriate review authority

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

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

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

- E. Extreme caution shall be exercised where infiltration is proposed in Source Water Protection Areas as defined by the local Municipality or Water Authority.
- F. Infiltration facilities shall be used in conjunction with other innovative or traditional BMPs, stormwater control facilities, and nonstructural stormwater management alternatives.
- G. Extreme caution shall be exercised where salt or chloride (municipal salt storage) would be a pollutant since soils do little to filter this pollutant and it may contaminate the groundwater. The qualified design professional shall evaluate the possibility of groundwater contamination from the proposed infiltration facility and perform a hydrogeologic justification study if necessary.
- H. The infiltration requirement in High Quality or Exceptional Value waters shall be subject to the Department's Chapter 93 Antidegradation Regulations.
- I. An impermeable liner will be required in detention basins where the possibility of groundwater contamination exists. A detailed hydrogeologic investigation may be required by the municipality.
- J. The municipality shall require the Applicant to provide safeguards against groundwater contamination for land uses that may cause groundwater contamination should there be a mishap or spill.

K. Unless otherwise specified in the zoning ordinance, the following setbacks for infiltration facilities shall apply:

- 100 feet from water supply wells
- 10 feet downslope or 100 feet upslope from building foundations
- 50 feet from septic system drainfields
- 50 feet from a geologic contact with carbonate bedrock, unless a preliminary site investigation is done in the carbonate bedrock to show the absence of special geologic features within 50 feet of the proposed infiltration area;
- 100 feet from the property line unless documentation is provided to show all setbacks from wells, foundations and drainfields on the neighboring property will be met.

L. Where pervious pavement is permitted for parking lots, recreational facilities, non-dedicated streets, or other areas, pavement construction specifications shall be noted on the plan.

Section 306. Water Quality Requirements

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

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

A. The BMPs shall be designed, implemented and maintained to meet State Water Quality Requirements, and any other more stringent requirements as determined by the Municipality.

B. To control post-construction stormwater impacts from regulated earth disturbance activities, State Water Quality Requirements can be met by BMPs, including site design, which provide for replication of pre-construction stormwater infiltration and runoff conditions, so that post-construction stormwater discharges do not degrade the physical, chemical or biological characteristics of the receiving waters. As described in the DEP Comprehensive Stormwater Management Policy (#392-0300-002, September 28, 2002), this may be achieved by the following:

1. Infiltration: replication of pre-construction stormwater infiltration conditions,
2. Treatment: use of water quality treatment BMPs to ensure filtering out of the chemical and physical pollutants from the stormwater runoff, and
3. Streambank and Streambed Protection: management of volume and rate of post-construction stormwater discharges to prevent physical degradation of receiving waters (e.g., from scouring).

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

To achieve this goal, the following criterion is established:

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

$WQv = [(P)(Rv)(A)]/12$	Eqn: 306.1
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Where:

WQv = Water Quality Volume (acre-feet)

P = 1 inch

A = Total contributing drainage area to the water quality BMP (acres)

Rv = $0.05 + 0.009(I)$ where I is the percent of the area that is impervious surface ((impervious area/A)*100)

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

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

- D. For areas within defined Special Protection subwatersheds which include Exceptional Value (EV) and High Quality (HQ) waters, the temperature and quality of water and streams shall be maintained through the use of temperature sensitive BMPs and stormwater conveyance systems.
- E. To accomplish the above, the Applicant shall submit original and innovative designs to the Municipal Engineer for review and approval. Such designs may achieve the water quality objectives through a combination of BMPs (Best Management Practices).
- F. If a perennial or intermittent stream passes through the site, the applicant shall create a stream buffer extending a minimum of fifty (50) feet to either side of the top-of-bank of the channel. The buffer area shall be maintained with and encouraged to use appropriate native vegetation (Reference to Appendix H of Pennsylvania Handbook of Best Management Practices for Developing Area for plant lists). If the applicable rear or side yard setback is less than fifty (50) feet, the buffer width may be reduced to twenty-five (25) percent of the setback to a minimum of ten (10) feet. If an existing buffer is legally

prescribed (i.e. deed, covenant, easement, etc.) and it exceeds the requirements of this Ordinance, the existing buffer shall be maintained. [The Municipality may select a smaller or larger buffer width if desired, but the selected buffer may not be less than ten (10) feet]. This does not include lakes or wetlands.

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

Section 307. Streambank Erosion Requirements

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

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

In "no detention" areas (District C) only - (See Section 308), the objective is not to attenuate the storms greater than the 2-year recurrence interval. This can be accomplished by configuring the outlet structure not to control the larger storms, or by a bypass channel that diverts only the 2-year stormwater runoff into the basin or conversely, diverts flows in excess of the 2-year storm away from the basin.

Section 308. Stormwater Management Districts

- A. The City of Reading is comprised of two watersheds: Tulpehocken Creek and Schuylkill River. Additionally, each of these watersheds has been divided into stormwater management districts as shown on the Management District Map in Appendix D.

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

Standards for managing runoff from each subarea in the Schuylkill River Watershed for the 2-year through 100-year design storms are shown in Table 308.1 and 308.2.

Development sites located in each of the Districts must control proposed conditions runoff rates to existing conditions runoff rates for the design storms in accord with Table 308.1 and 308.2.

TABLE 308.1 – Water Quantity Requirements for Areas in the Schuylkill River Watershed

Management District	Proposed Condition Design Storm		Existing Condition Design Storm	Equivalent Release Rate
A	2-year	Reduce To	1-year	-
	5-year		5-year	100%
	10-year		10-year	100%
	25-year		25-year	100%
	50-year		50-year	100%
	100-year		100-year	100%
B	2-year	Reduce To	1-year	-
	5-year		2-year	30%
	10-year		5-year	75%
	25-year		10-year	75%
	50-year		25-year	75%
	100-year		50-year	75%
C	2-year	Reduce To	2-year	-
	5-year		5-year	100%
	10-year		10-year	100%
	25-year		25-year	100%
	50-year		50-year	100%
	100-year		100-year	100%

TABLE 308.2 -- Water Quantity Requirements for Areas in the Tulpehocken Creek Watershed

Management District	Design Storm Post-Development		Design Storm Pre-Development
A	2-year	Reduce to	1-year
	5-year		5-year
	10-year		10-year
	25-year		25-year
B1	2-year	Reduce to	1-year
	5-year		2-year
	10-year		5-year
	25-year		10-year
B2	2-year	Reduce to	1-year
	5-year		2-year
	10-year		5-year
	25-year		10-year
	100-year		100-year
C	2-year	Reduce to	1-year
	5-year		2-year

For any site which proposes Direct Discharge, the site may only utilize any available capacity in the downstream conveyance system which is equivalent to the ratio of the proposed development site acreage to the total watershed acreage to the downstream conveyance system. Therefore, if the proposed development site is 10% of the total watershed area, the increase in runoff may only use up 10% of the documented available downstream, capacity at peak flow.

All area which propose direct discharge to the main stem or to an existing stormwater drainage system must still meet the requirements of the groundwater recharge criteria (Section 305), water quality criteria (Section 306), and streambank erosion criteria (Section 307).

- B. General - Proposed condition rates of runoff from any regulated activity shall not exceed the peak release rates of runoff prior to development for the design storms specified on the Stormwater Management District Watershed Map (Ordinance Appendix D) and Section 308, of this Ordinance.
- C. District Boundaries - The boundaries of the Stormwater Management Districts are shown on an official map that is available for inspection at the municipal office. A copy of the official map at a reduced scale is included in the Ordinance Appendix D. 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 (or most accurate data required) provided as part of the Drainage Plan.

- D. Sites Located in More Than One District - For a proposed development site located within two or more stormwater management district category subareas, the peak discharge rate from any subarea shall meet the Management District Criteria for which the discharge is located, as indicated in Section 308. 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 discharge site. In this case, peak discharge in any direction shall follow Management District A criteria provided that the overall site discharge meets the Management District Criteria for which the discharge is located.
- E. Off-Site Areas - Off-site areas that drain through a proposed development site are not subject to release rate criteria when determining allowable peak runoff rates. However, on-site drainage facilities shall be designed to safely convey off-site flows through the development site.
- F. Site Areas - Where the site area to be impacted by a proposed development activity differs significantly from the total site area, only the proposed impact area utilizing stormwater management measures shall be subject to the Management District Criteria. In other words, unimpacted areas bypassing the stormwater management facilities would not be subject to the Management District Criteria.
- G. "No Harm" Option - For any proposed development site not located in a provisional direct discharge district, the Applicant has the option of using a less restrictive runoff control (including no detention) if the Applicant can prove that "no harm" would be caused by discharging at a higher runoff rate than that specified by the Stormwater Management Plan. The "no harm" option is used when an Applicant can prove that the proposed condition hydrographs can match existing conditions hydrographs, or if it can be proved that the proposed conditions will not cause increases in peaks at all points downstream. Proof of "no harm" must be shown based upon the following "Downstream Impact Evaluation" which shall include a "downstream hydraulic capacity analysis" consistent with Section 308.H to determine if adequate hydraulic capacity exists. The Applicant shall submit to the municipality this evaluation of the impacts due to increased downstream stormwater flows in the watershed.
 - 1. The Hydrologic Regime of the site must be maintained.
 - 2. The "Downstream Impact Evaluation" shall include hydrologic and hydraulic calculations necessary to determine the impact of hydrograph timing modifications due to the proposed development upon a dam, highway, structure, natural point of restricted streamflow or any stream channel section, established with the concurrence of the municipality.
 - 3. The evaluation shall continue downstream until the increase in flow diminishes due to additional flow from tributaries and/or stream attenuation.
 - 4. The peak flow values to be used for downstream areas for the design return period storms (2, 5, 10, 25, 50, and 100-year) shall be the values from the calibrated model for the applicable (Schuylkill River or Tulpehocken Creek) Watershed.

These flow values can be obtained from the original Act 167 watershed storm water management plans.

5. Applicant-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 Section 303.H.
 6. A financial distress shall not constitute grounds for the municipality to approve the use of the "no-harm" option.
 7. Capacity improvements may be provided as necessary to implement the "no harm" option which proposes specific capacity improvements to provide that a less stringent discharge control would not create any harm downstream.
 8. Any "no harm" justifications shall be submitted by the Applicant as part of the Drainage Plan submission per Article IV.
- H. "Downstream Hydraulic Capacity Analysis" - Any downstream capacity hydraulic analysis conducted in accordance with this Ordinance shall use the following criteria for determining adequacy for accepting increased peak flow rates:
1. Natural or man-made channels or swales must be able to convey the increased runoff associated with a 2-year return period event within their banks at velocities consistent with protection of the channels from erosion. Acceptable velocities shall be based upon criteria included in the DEP *Erosion and Sediment Pollution Control Program Manual*.
 2. Natural or man-made channels or swales must be able to convey increased 25-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 25-year return period runoff.
- I. 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 the prospective applicants. 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 on a case-by-case basis using the hydrologic model of the watershed consistent with protection of the downstream watershed areas. "Hydrologic model" refers to the calibrated model as developed for the Stormwater Management Plan.
- J. Hardship Option - The municipality may hear requests for waivers where it is alleged that the provisions of this (Act 167) Ordinance inflict unnecessary hardship upon the applicant. The waiver request shall be in writing and accompanied by the requisite fee based upon a fee schedule adopted by the municipality. A copy of the waiver request shall be provided

to each of the following: municipality, municipal engineer, municipal solicitor and Berks County Planning Commission. The request shall fully document the nature of the alleged hardship.

The municipality may grant a waiver provided that all of the following findings are made in a given case:

1. That there are unique physical circumstances or conditions, including irregularity of lot size or shape, or exceptional topographical or other physical conditions peculiar to the particular property, and that the unnecessary hardship is due to such conditions, and not the circumstances or conditions generally created by the provisions of this Ordinance in the Stormwater Management District in which the property is located;
2. That because of such physical circumstances or conditions, there is no possibility that the property can be developed in strict conformity with the provisions of this Ordinance, including the "no harm" provisions, and that the authorization of a waiver
3. That such unnecessary hardship has not been created by the applicant;
4. That the waiver, if authorized, will represent the minimum waiver that will afford relief and will represent the least modification possible of the regulation in issue; and
5. That financial hardship is not the criteria for granting of a hardship waiver.

In granting any waiver, the municipality may attach such conditions and safeguards as it may deem necessary to implement the purposes of Act 167 and this Ordinance. If a Hardship Waiver is granted, the applicant must still manage the quantity, velocity, direction and quality of resulting storm runoff as is necessary to prevent injury to health, safety or other property.

- a. For regulated activities in Section 105.A. and B., the Planning Commission shall hear requests for and decide on hardship waiver requests on behalf of the municipality.
- b. For regulated activities in Section 105.D., E., F., G. and H., the Municipal Engineer shall hear requests for and decide on hardship waiver requests on behalf of the municipality.
- c. The municipality shall not waive the water quality provisions of this Ordinance.

Section 309. Calculation Methodology

- A. Stormwater runoff from all development sites with a drainage area of greater than 200 acres shall be calculated using a generally accepted calculation technique that is based on the NRCS soil cover complex method. Table 309-1 summarizes acceptable computation

methods and the method selected by the design professional shall be based on the individual limitations and suitability of each method for a particular site. The Municipality may allow the use of the Rational Method to estimate peak discharges from drainage areas that contain less than 200 acres. The Soil Complex Method shall be used for drainage areas greater than 200 acres.

**TABLE 309-1
Acceptable Computation Methodologies For
Stormwater Management Plans**

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

- B. All calculations consistent with this Ordinance using the soil cover complex method shall use the appropriate design rainfall depths for the various return period storms according to the region in which they are located as presented in Table B-1 in Appendix B of this Ordinance. If a hydrologic computer model such as PSRM or HEC-1 / HEC-HMS is used for stormwater runoff calculations, then the duration of rainfall shall be 24 hours. The SCS 'S' curve shown in Figure B-1, Appendix B of this Ordinance shall be used for the rainfall distribution.
- C. For the purposes of existing conditions flow rate determination, undeveloped land shall be considered as "meadow" in good condition, unless the natural ground cover generates a lower curve number or Rational 'C' value (i.e., forest), as listed in Table B-2 or B-3 in Appendix B of this Ordinance.
- D. All calculations using the Rational Method shall use rainfall intensities consistent with appropriate times-of-concentration for overland flow and return periods from the Design Storm Curves from PA Department of Transportation Design Rainfall Curves (1986)

(Figures B-2 to B-4). Times-of-concentration for overland flow shall be calculated using the methodology presented in Chapter 3 of Urban Hydrology for Small Watersheds, NRCS, TR-55 (as amended or replaced from time to time by NRCS). Times-of-concentration for channel and pipe flow shall be computed using Manning's equation.

- E. Runoff Curve Numbers (CN) for both existing and proposed conditions to be used in the soil cover complex method shall be obtained from Table B-2 in Appendix B of this Ordinance.
- F. Runoff coefficients (c) for both existing and proposed conditions for use in the Rational method shall be obtained from Table B-3 in Appendix B of this Ordinance.
- G. Where uniform flow is anticipated, the Manning equation shall be used for hydraulic computations, and to determine the capacity of open channels, pipes, and storm sewers. Values for Manning's roughness coefficient (n) shall be consistent with Table B-4 in Appendix B of the Ordinance.
- H. Outlet structures for stormwater management facilities shall be designed to meet the performance standards of this Ordinance using any generally accepted hydraulic analysis technique or method.
- I. The design of any stormwater detention facilities intended to meet the performance standards of this Ordinance shall be verified by routing the design storm hydrograph through these facilities using the Storage-Indication Method. For drainage areas greater than 200 acres in size, the design storm hydrograph shall be computed using a calculation method that produces a full hydrograph (i.e. TR-20, TR-55, HEC-1, PSRM). The municipality may approve the use of any generally accepted full hydrograph approximation technique that shall use a total runoff volume that is consistent with the volume from a method that produces a full hydrograph.

Section 310. Other Requirements

- A. Any stormwater facility located on State highway rights-of-way shall be subject to approval by the Pennsylvania Department of Transportation (PennDOT).
- B. Pretreatment shall be provided prior to infiltration.
- C. All wet basin designs shall incorporate biologic controls consistent with the West Nile Guidance found in Appendix F.
- D. Any stormwater management facility (i.e., detention basin) designed to store runoff and requiring a berm or earthen embankment required or regulated by this Ordinance shall be designed to provide an emergency spillway to handle flow up to and including the 100-year proposed conditions. The height of embankment must provide a minimum 1.0 foot of freeboard above the maximum pool elevation computed when the facility functions for the 100-year proposed conditions inflow. Should any stormwater management facility require a dam safety permit under PaDEP Chapter 105, the facility shall be designed in accordance with Chapter 105 and meet the regulations of Chapter 105 concerning dam safety which may be required to pass storms larger than the 100-year event.
- E. Any facilities that constitute water obstructions (e.g., culverts, bridges, outfalls, or stream enclosures), and any work involving wetlands governed by PaDEP Chapter 105

regulations (as amended or replaced from time to time by PaDEP), shall be designed in accordance with Chapter 105 and will require a permit from PaDEP.

- F. Any other drainage conveyance facility that does not fall under Chapter 105 regulations must be able to convey, without damage to the drainage structure or roadway, runoff from the 25-year design storm with a minimum 1.0 foot of freeboard measured below the lowest point along the top of the roadway. Any facility that constitutes a dam as defined in PaDEP Chapter 105 regulations may require a permit under dam safety regulations. Any facility located within a PennDOT right-of-way must meet PennDOT minimum design standards and permit submission requirements.
- G. Any drainage conveyance facility and/or channel not governed by Chapter 105 Regulations, must be able to convey, without damage to the drainage structure or roadway, runoff from the 25-year design storm. Conveyance facilities to or exiting from stormwater management facilities (i.e., detention basins) shall be designed to convey the design flow to or from that structure. Roadway crossings located within designated floodplain areas must be able to convey runoff from a 100-year design storm. Any facility located within a PennDOT right-of-way must meet PennDOT minimum design standards and permit submission requirements.
- H. Storm sewers must be able to convey proposed conditions runoff from a 25-year design storm without surcharging inlets, where appropriate.
- I. Adequate erosion protection shall be provided along all open channels, and at all points of discharge.
- J. The design of all stormwater management facilities shall incorporate sound engineering principles and practices. The Municipality reserves the right to disapprove any design that would result in the construction in or continuation of a stormwater problem area.
- K. No stormwater detention facility shall be placed within fifty (50) feet of a special geologic feature. No stormwater conveyance facility shall be constructed within fifty (50) feet of a special geologic feature, unless it is constructed of concrete pipe utilizing watertight joints, or an approved equal.

Section 311. NPDES Requirements

Federal regulations approved October 1999 require operators of small municipal separate storm sewer systems (MS4s) to obtain NPDES Phase II permits from DEP by March 2003. (NPDES II is an acronym for the National Pollutant Discharge Elimination System Phase II Stormwater Permitting Regulations.) This program affects all municipalities in "urbanized areas" of the state. Therefore, these identified municipalities will be subject to the NPDES Phase II requirements mandated by the Federal Clean Water Act as administered by DEP. For more information on NPDES II requirements, contact the DEP Regional Office.

ARTICLE IV-DRAINAGE PLAN REQUIREMENTS

Section 401. General Requirements

For any of the activities regulated by this Ordinance, the preliminary or final approval of subdivision and/or land development plans, the issuance of any building or occupancy permit, or the commencement of any earth disturbance activity may not proceed until the Property Owner or Applicant or his/her agent has received written approval of a Drainage Plan from the Municipality and an adequate Erosion and Sediment Control Plan review by the Conservation District.

Section 402. Exemptions

A. General Exemptions

The following land use activities are exempt from the drainage plan submission requirements of this ordinance.

1. Use of land for gardening for home consumption.
2. Agriculture when operated in accordance with a Conservation Plan or Erosion and Sediment Control Plan (E & S) found adequate by the Conservation District.
3. Forest Management operations which are following the Department of Environmental Protection's management practices contained in its publication "Soil Erosion and Sedimentation Control Guidelines for Forestry" and are operating under an approved E&S Plan and must comply with stream buffer requirements in Section 306.F. A copy of the approved E&S Plan shall be submitted to the municipality to prove exemption from the requirements of the storm water ordinance.

B. Stormwater Quantity Control Exemption

Any Regulated Activity that meets the impervious area exemption criteria in Table 402-1 or Table 402-2 shall not be required to submit a drainage plan implementing the stormwater quantity controls, specified in Section 308 of this Ordinance. These criteria shall apply to the total development even if development is to take place in phases. The date of the municipal Ordinance adoption shall be the starting point from which to consider tracts as "parent tracts" in which future subdivisions and respective impervious area computations shall be cumulatively considered. Impervious areas existing on the "parent tract" prior to adoption of this Ordinance shall not be considered in cumulative impervious area calculations for exemption purposes.

**TABLE 402-1
Impervious Area Exemption Criteria for Schuylkill River Watershed**

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

**TABLE 402-2
Impervious Area Exemption Criteria for Tulpehocken Creek Watershed**

Total Parcel Size	Impervious Area Exemption
0 to 0.25 ac	2,500 sq. ft.
0.25 to 1 ac	5,000 sq. ft.
1 to 2 ac	10,000 sq. ft.
2 to 5 ac	15,000 sq. ft.
> 5 ac	20,000 sq. ft.

Applicants whose activities are exempted under Section 402.B. above shall still be required to meet the groundwater recharge (Section 305), water quality (Section 306), and streambank erosion (Section 307) controls of this Ordinance. Drainage plans in accordance with Sections 403 A.2, 403 B.7, 8, 11, 15, and 22 and 403.D.2. must still be submitted. Any exemption must first be approved by the Municipality.

C. Additional exemption criteria:

1. Exemption responsibilities – An exemption shall not relieve the Applicant from implementing such measures as are necessary to protect the public health, safety, and property. An exemption shall not relieve the Applicant from providing adequate stormwater management for Regulated Activities to meet the purpose of this Ordinance; however, drainage plans will not have to be submitted to the municipality.
2. HQ and EV streams - This exemption shall not relieve the Applicant from meeting the special requirements for watersheds draining to high quality (HQ) or

exceptional value (EV) waters, identified and Source Water Protection Areas (SWPA) and requirements for nonstructural project design sequencing (Section 304), groundwater recharge (Section 305), water quality (Section 306), and streambank erosion (Section 307).

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

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

Section 403. Drainage Plan Contents

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

The following items shall be included in the Drainage Plan:

A. General

1. General description of the project including those areas described in Section 304.
2. General description of permanent stormwater management techniques, including construction specifications of the materials to be used for stormwater management facilities.
3. Complete hydrologic, hydraulic, and structural computations for all stormwater management facilities.
4. An Erosion and Sediment Control Plan, including all reviews and approvals by the Conservation District.
5. A general description of nonpoint source pollution controls.

B. Maps

Map(s) of the project area shall be submitted on 24-inch x 36-inch sheets and/or shall be prepared in a form that meets the requirements for recording at the offices of the Recorder of Deeds of Berks County. If the Subdivision and Land Development

Ordinance (SALDO) has more stringent criteria than the more stringent criteria shall apply. The contents of the map(s) shall include, but not be limited to:

1. The location of the project relative to highways, municipalities or other identifiable landmarks.
2. Existing contours at intervals of two feet. In areas of steep slopes (greater than 15 percent), five-foot contour intervals may be used.
3. Existing streams, lakes, ponds or other Waters of the Commonwealth within the project area..
4. Other physical features including flood hazard boundaries, stream buffers, existing drainage courses, areas of natural vegetation to be preserved, and the total extent of the upstream area draining through the site.
5. The locations of all existing and proposed utilities, sanitary sewers, and water lines within fifty (50) feet of property lines.
6. An overlay showing soil names and boundaries.
7. Limits of earth disturbance, including the type and amount of impervious area that would be added.
8. Proposed structures, roads, paved areas, and buildings.
9. Final contours at intervals of two feet. In areas of steep slopes (greater than 15 percent), five-foot contour intervals may be used. The Municipal Engineer may require contours at less than the above based upon site-specific conditions.
10. The name of the development, the name and address of the owner of the property, and the name of the individual or firm preparing the plan.
11. The date of submission.
12. A graphic and written scale of one (1) inch equals no more than fifty (50) feet; for tracts of twenty (20) acres or more, the scale shall be one (1) inch equals no more than one hundred (100) feet.
13. A north arrow.
14. The total tract boundary and size with distances marked to the nearest foot and bearings to the nearest degree.
15. Existing and proposed land use(s).
16. A key map showing all existing man-made features beyond the property boundary that would be affected by the project.
17. Location of all open channels.
18. Overland drainage patterns and swales.

19. A minimum fifteen foot wide access easement surrounding all sides of all stormwater management facilities that would provide ingress to and egress from a public right-of-way.
20. The location of all erosion and sediment control facilities.
21. A note on the plan indicating the location and responsibility for maintenance of stormwater management facilities that would be located on/off-site. All on/off-site facilities shall meet the performance standards and design criteria specified in this Ordinance.
22. A statement, signed by the landowner, acknowledging that any revision to the approved Drainage Plan must be approved by the Municipality and the Conservation District.
23. The following signature block for the Design Engineer:

I, (Design Engineer), on this date (date of signature), hereby certify that the Drainage Plan meets all design standards and criteria of the applicable (Schuylkill River or Tulpehocken Creek) Watershed Act 167 Stormwater Management Ordinance."

C. Supplemental Information

1. A written description of the following information shall be submitted.
 - a. The overall stormwater management concept for the project designed in accordance with Section 304.
 - b. Stormwater runoff computations as specified in this Ordinance.
 - c. Stormwater management techniques to be applied both during and after development.
 - d. Expected project time schedule.
 - e. Development stages (project phases) if so proposed.
 - f. An operation and maintenance plan in accordance with Section 702 of this Ordinance.
2. An erosion and sediment control plan.
3. The effect of the project (in terms of runoff volumes and peak flows) on adjacent properties and on any existing municipal stormwater collection system that may receive runoff from the project site.
4. A Declaration of Adequacy and Highway Occupancy Permit from the PennDOT District Office when utilization of a PennDOT storm drainage system is proposed.

D. Stormwater Management Facilities

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

2. When infiltration facilities such as seepage pits, beds or trenches are used, the locations of existing and proposed septic tank infiltration areas and wells must be shown.
3. All calculations, assumptions, and criteria used in the design of the stormwater management facilities must be shown.

Section 404. Plan Submission

The Municipality shall require receipt of a complete plan, as specified in this Ordinance.

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

- A. For projects which require SALDO approval, the Drainage Plan shall be submitted by the Applicant as part of the Preliminary Plan submission where applicable for the Regulated Activity.
- B. For these regulated activities that do not require SALDO approval, See Section 401, General Requirements.
- C. Six (6) copies of the Drainage Plan shall be submitted and distributed as follows:
 1. Two (2) copies to the Municipality accompanied by the requisite Municipal Review Fee, as specified in this Ordinance.
 2. Two (2) copies to the Conservation District.
 3. One (1) copy to the Municipal Engineer.
 4. One (1) copy to the County Planning Commission/Department.

Section 405. Drainage Plan Review

- A. The Municipal Engineer shall review the Drainage Plan for consistency with the adopted applicable (Schuylkill River or Tulpehocken Creek) Watershed Act 167 Stormwater Management Plan. Any found incomplete shall not be accepted for review and shall be returned to the Applicant.
- B. The Municipal Engineer shall review the Drainage Plan for any subdivision or land development against the municipal subdivision and land development ordinance provisions not superseded by this Ordinance.

- C. The County Conservation District shall review and approve the E & S Plan for consistency with PaDEP's Chapter 102 regulations.
- D. For activities regulated by this Ordinance, the Municipal Engineer shall notify the Applicant and the Municipality in writing, within 45 calendar days, whether the Drainage Plan is consistent with the Stormwater Management Plan.
1. Should the Drainage Plan be determined to be consistent with the Stormwater Management Plan, the Municipal Engineer shall forward an approval letter to the Applicant.
 2. Should the Drainage Plan be determined to be inconsistent with the Stormwater Management Plan, the Municipal Engineer shall forward a disapproval letter to the Applicant. The disapproval letter shall cite the reason(s) and specific Ordinance sections for the disapproval. Disapproval may be due to inadequate information to make a reasonable judgment as to compliance with the stormwater management plan. Any disapproved Drainage Plans may be revised by the Applicant and resubmitted consistent with this Ordinance.
- E. For Regulated Activities specified in Section 105 of this Ordinance, which require a building permit, the Municipal Engineer shall notify the Chief Building Official in writing, within a time frame consistent with the International Building Code as adopted by the City of Reading and/or City of Reading Subdivision and Land Development Ordinance, whether the Drainage Plan is consistent with the Stormwater Management Plan and forward a copy of the approval/disapproval letter to the Applicant. Any disapproved drainage plan may be revised by the Applicant and resubmitted consistent with this Ordinance.
- F. For regulated activities under this ordinance that require an NPDES Permit Application, the Applicant shall forward a copy of the Municipal Engineer's letter stating that the Drainage Plan is consistent with the stormwater management plan to the Conservation District. PaDEP and the Conservation District may consider the Municipal Engineer's review comments in determining whether to issue a permit.
- G. The Municipality shall not grant approval or grant preliminary approval to any subdivision or land development for Regulated Activities specified in Section 105 of this Ordinance if the Drainage Plan has been found to be inconsistent with the Stormwater Management Plan, as determined by the Municipal Engineer. All required permits from PaDEP must be obtained prior to approval of any subdivision or land development.
- H. No building permits shall be issued for any Regulated Activity specified in Section 105 of this Ordinance if the Drainage Plan has been found to be inconsistent with the Stormwater Management Plan, as determined by the Municipal Engineer, or without considering the comments of the Municipal Engineer. All required permits from PaDEP must be obtained prior to issuance of a building permit.

- I. The Applicant shall be responsible for completing record drawings of all stormwater management facilities included in the approved Drainage Plan. The record drawings and an explanation of any discrepancies with the design plans shall be submitted to the Municipal Engineer for final approval. In no case shall the Municipality approve the record drawings until the Municipality receives a copy of an approved Declaration of Adequacy and/or Highway Occupancy Permit from the PennDOT District Office, NPDES Permit, and any other applicable permits or approvals, from PaDEP or the Conservation District. The above permits and approvals must be based on the record drawings.
- J. The Municipality's approval of a Drainage Plan shall be valid for a period not to exceed five (5) years commencing on the date that the Municipality signs the approved Drainage Plan. If stormwater management facilities included in the approved Drainage plan have not been constructed, or if constructed, and record drawings of these facilities have not been approved within this five (5) year time period, then the Municipality may consider the Drainage plan disapproved and may revoke any and all permits. Drainage Plans that are considered disapproved by the Municipality shall be resubmitted in accordance with Section 407 of this Ordinance.

Section 406. Modification of Plans

- A. A modification to a Drainage Plan under review by the municipality for a development site that involves a change in stormwater management facilities or techniques, or that involves the relocation or re-design of stormwater management facilities, or that is necessary because soil or other conditions are not as stated on the Drainage Plan as determined by the Municipal Engineer, shall require a resubmission of the modified Drainage Plan consistent with Section 404 of this Ordinance and be subject to review as specified in Section 405 of this Ordinance.
- B. A modification to an already approved or disapproved Drainage Plan shall be submitted to the Municipality, accompanied by the applicable Municipal Review and Inspection Fee. A modification to a Drainage Plan for which a formal action has not been taken by the Municipality shall be submitted to the Municipality, accompanied by the applicable Municipal Review and Inspection Fee.

Section 407. Resubmission of Disapproved Drainage Plans

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

ARTICLE V-INSPECTIONS

Section 501. Schedule of Inspections

- A. The Municipal Engineer or his designee shall inspect all phases of the installation of the permanent stormwater management facilities as deemed appropriate by the Municipal Engineer.
- B. During any stage of the work, if the Municipal Engineer or his municipal designee determines that the permanent stormwater management facilities are not being installed in accordance with the approved Stormwater Management Plan, the Municipality shall revoke any existing building permits and issue a cease and desist order until a revised Drainage Plan is submitted and approved, as specified in this Ordinance.
- C. A final inspection of all stormwater management facilities shall be conducted by the Municipal Engineer or his municipal designee and to confirm compliance with the approved Drainage Plan prior to the issuance of any Occupancy Permit.

ARTICLE VI-FEES AND EXPENSES

Section 601. Municipality Drainage Plan Review and Inspection Fee

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

All fees in excess of the applicable filing fee, incurred for the review of plans and reports thereon by the Municipality's engineer or designee will be billed in accordance with the ordinary and customary charges of the Municipality's engineer and designee. The applicant shall, prior to the Municipality's approval of the Stormwater Management Report and plans, pay the Municipality the excess amount expended in the reviewing of the plans/reports. Any unused portion of the total fee charged to any applicant will be returned to the applicant. This refund will be made only after plan approval by the Municipality. No development or subdivision shall be approved unless all fees have been paid in full. Stormwater Management Reports and Drainage Plans included with submission under the City of Reading Subdivision and Land Development Ordinance. The Filing and Review Fee for Reports and Plans prepared to demonstrate compliance with this Ordinance is included in the Plan Review Fee established by resolution from time to time for submissions made under the City of Reading Subdivision and Land Development Ordinance.

Filing Fee \$100.00

Review of documentation in support of Exemption \$250.00
Review of Stormwater Management Report and Drainage Plan \$1,000.00

Construction Observations

The fee associated with Construction Observations will be made part of the Improvements Agreement established for the construction project.

Section 602. Expenses Covered by Fees

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

- A. Administrative costs.
- B. The review of the Drainage Plan by the Municipality and the Municipal Engineer.
- C. The site inspections.
- D. The inspection of stormwater management facilities and drainage improvements during construction.
- E. The final inspection upon completion of the stormwater management facilities and drainage improvements presented in the Drainage Plan.
- F. Any additional work required to enforce any permit provisions regulated by this Ordinance, correct violations, and assure proper completion of stipulated remedial actions.

ARTICLE VII-MAINTENANCE RESPONSIBILITIES

Section 701. Performance Guarantee

- A. For subdivisions and land developments the Applicant shall provide a financial guarantee to the Municipality for the timely installation and proper construction of all stormwater management controls as: 1) Required by the approved drainage plan equal to or greater than the full construction cost of the required controls or 2) in the amount and method of payment provided for in the subdivision and land development ordinance.
- B. For other regulated activities, the Municipality may require a financial guarantee from the Applicant.
- C. At the completion of the project, and as a prerequisite for the release of the performance guarantee, the Applicant or his representatives shall:

1. Provide a certification of completion from an engineer, architect, surveyor or other qualified person verifying that all permanent facilities have been constructed according to the plans and specifications and approved revisions thereto.
 2. Provide a set of record drawings in the form required by Section 202.
- D. After the municipality receives the certification, a final inspection shall be conducted by the municipal engineer or designee to certify compliance with this ordinance.

Section 702. Responsibilities for Operations and Maintenance of Stormwater Controls and BMPs

- A. No Regulated Earth Disturbance activities within the Municipality shall commence until approval by the Municipality of a Stormwater Control and BMP Operations and Maintenance plan which describes how the permanent (e.g., post-construction) stormwater controls and BMPs will be properly operated and maintained.
- B. The following items shall be included in the Stormwater Control and BMP Operations and Maintenance Plan:
1. Map(s) of the project area, in a form that meets the requirements for recording at the offices of the Recorder of Deeds of Berks County, and shall be submitted on 24-inch x 36-inch sheets. The contents of the maps(s) shall include, but not be limited to:
 - a. Clear identification of the location and nature of permanent stormwater controls and BMPs.
 - b. The location of the project site relative to highways, municipal boundaries or other identifiable landmarks.
 - c. Existing and final contours at intervals of two feet, or others as appropriate.
 - d. Existing streams, lakes, ponds, or other bodies of water within the project site area.
 - e. Other physical features including flood hazard boundaries, sinkholes, streams, existing drainage courses, and areas of natural vegetation to be preserved.
 - f. The locations of all existing and proposed utilities, sanitary sewers, and water lines within 50 feet of property lines of the project site.
 - g. Proposed final changes to the land surface and vegetative cover, including the type and amount of impervious area that would be added.
 - h. Proposed final structures, roads, paved areas, and buildings, and
 - i. A minimum fifteen-foot wide access easement surrounding all sides of all stormwater controls and BMPs that would provide ingress to and egress from a public right-of-way.
 2. A description of how each permanent stormwater control and BMP will be operated and maintained, and the identity of the person(s) responsible for operations and maintenance.

3. The name of the project site, the name and address of the owner of the property, and the name of the individual or firm preparing the plan, and
 4. A statement, signed by the landowner, acknowledging that the stormwater controls and BMPs are fixtures that can be altered or removed only after approval by the Municipality.
- C. The Stormwater Control and BMP Operations and Maintenance Plan for the project site shall establish responsibilities for the continuing operation and maintenance of all permanent stormwater controls and BMPs, 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 Municipality, stormwater controls and BMPs may also be dedicated to and maintained by the Municipality at the Municipality's sole discretion;
 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 controls and BMPs shall be the responsibility of the owner or private management entity.
- D. The Municipality shall make the final determination on the continuing operations and maintenance responsibilities. The Municipality reserves the right to accept or reject the operations and maintenance responsibility for any or all of the stormwater controls and BMPs.

Section 703. Municipality Review of Stormwater Control and BMP Operations and Maintenance Plan

- A. The Municipality shall review the Stormwater Control and BMP Operations and Maintenance Plan for consistency with the purposes and requirements of this ordinance, and any permits issued by DEP.
- B. The Municipality shall notify the Applicant in writing whether the Stormwater Control and BMP Operations and Maintenance Plan is approved.
- C. The Municipality requires submission of a "Record Drawing" of all stormwater controls and BMPs, and an explanation of any discrepancies with the Operations and Maintenance Plan. This must be completed in the same manner as defined in Section 202.

Section 704. Adherence to Approved Stormwater Control and BMP Operations and Maintenance Plan

It shall be unlawful to alter or remove any permanent stormwater control and BMP required by an approved Stormwater Control and BMP Operations and Maintenance Plan, or to allow the

property to remain in a condition which does not conform to an approved Stormwater Control and BMP Operations and Maintenance Plan.

Section 705. Operations and Maintenance Agreement for Privately Owned Stormwater Controls and BMPs

- A. The property owner shall sign an operations and maintenance agreement with the Municipality covering all stormwater controls and BMPs that are to be privately owned. The agreement shall be substantially the same as the agreement in Appendix A of this Ordinance.
- B. Other items may be included in the agreement where determined necessary to guarantee the satisfactory operation and maintenance of all permanent stormwater controls and BMPs. The agreement shall be subject to the review and approval of the Municipality.

Section 706. Stormwater Management Easements

- A. Stormwater management easements are required for all areas used for off-site stormwater control, unless a waiver is granted by the Municipal Engineer.
- B. Stormwater management easements shall be provided by the property owner if necessary for (1) access for inspections and maintenance, or (2) preservation of stormwater runoff conveyance, infiltration, and detention areas and other stormwater controls and BMPs, by persons other than the property owner. The purpose of the easement shall be specified in any agreement under Section 705.

Section 707. Maintenance Agreement for Privately Owned Stormwater Facilities

- A. Prior to final approval of the site's Drainage Plan, the Applicant shall sign and record the Maintenance Agreement contained in Appendix A which is attached and made part hereof, covering all stormwater control facilities that are to be privately owned.
- B. Other items may be included in the agreement where determined necessary to guarantee the satisfactory maintenance of all facilities. The Maintenance Agreement shall be subject to the review and approval of the Municipal Solicitor and Municipal Engineer, or their designees.

Section 708. Recording of Approved Stormwater Control and BMP Operations and Maintenance Plan and Related Agreements

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

2. Operations and Maintenance Agreements under Section 705, and
 3. Easements under Section 706.
- B. The Municipality may suspend or revoke any approvals granted or deny any and all permit subsequent issuance for the project site upon discovery of the failure of the owner to comply with this Section.

Section 709. Municipal Stormwater Control and BMP Operation and Maintenance Fund

- A. Persons installing stormwater controls or BMPs shall be required to pay a specified amount to the Municipal Stormwater Control and BMP Operation and Maintenance Fund to help defray costs of periodic inspections and maintenance expenses. The amount of the deposit shall be determined as follows:
1. If the stormwater control or BMP is to be privately owned and maintained, the deposit shall cover the cost of periodic inspections performed by the municipality for a period of ten (10) years, as estimated by the municipal engineer. After that period of time, inspections will be performed at the expense of the municipality.
 2. If the stormwater control or BMP is to be owned and maintained by the municipality, the deposit shall cover the estimated costs for maintenance and inspections for ten (10) years. The municipal engineer will establish the estimated costs utilizing information submitted by the Applicant.
 3. The amount of the deposit to the fund shall be converted to present worth of the annual series values. The municipal engineer shall determine the present worth equivalents, which shall be subject to the approval of the governing body.
- B. If a stormwater control or BMP is proposed that also serves as a recreation facility (e.g., ballfield, lake), the municipality may reduce or waive the amount of the maintenance fund deposit based upon the value of the land for public recreation purpose.
- C. If at some future time a stormwater control or BMP (whether publicly or privately owned) is eliminated due to the installation of storm sewers or other storage facility, the unused portion of the maintenance fund deposit will be applied to the cost of abandoning the facility and connecting to the storm sewer system or other facility. Any amount of the deposit remaining after the costs of abandonment are paid will be returned to the depositor.
- D. If stormwater controls or BMPs are accepted by the municipality for dedication, the Municipality may require persons installing stormwater controls or BMPs to pay a specified amount to the Municipal Stormwater Control and BMP Operation and Maintenance Fund, to help defray costs of operations and maintenance activities. The amount may be determined as follows:

1. If the stormwater control or BMP is to be owned and maintained by the Municipality, the amount shall cover the estimated costs for operations and maintenance for ten (10) years, as determined by the Municipality.
 2. The amount shall then be converted to present worth of the annual series values.
- E. If a stormwater control or BMP is proposed that also serves as a recreation facility (e.g. ball field, lake), the Municipality may adjust the amount due accordingly.
- F. Long-Term Maintenance – The municipality shall require applicants to pay a fee to the Municipal Stormwater Maintenance Fund to cover long term maintenance of stormwater control and best management practices.
- G. Stormwater Related Problems - The municipality may require applicants to pay a fee to the Municipal Stormwater Maintenance Fund to cover stormwater related problems which may arise from the land development and earth disturbance. The municipality and/or any adversely-impacted property owners may institute the appropriate legal, equitable or otherwise action to prevent, restrain, correct or abate problems and seek restitution and/or damages resulting from stormwater problems emanating from the land development or earth disturbance activities.

ARTICLE VIII- PROHIBITIONS

Section 801. Prohibited Discharges

- A. No person in the Municipality shall allow, or cause to allow, stormwater discharges into the Municipality's separate storm sewer system which are not composed entirely of stormwater, except (1) as provided in subsection B below, and (2) discharges allowed under a state or federal permit.
- B. Discharges which may be allowed based on a finding by the Municipality that the discharge(s) do not significantly contribute to pollution to surface waters of the Commonwealth, are:

Discharges from fire fighting activities
Potable water sources including dechlorinated water line and fire hydrant flushings
Irrigation drainage
Routine external building washdown (which does not use detergents or other compounds)
Air conditioning condensate
Water from individual residential

Uncontaminated water from foundation or from footing drains
Flows from riparian habitats and wetlands
Lawn watering
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
Dechlorinated swimming pool

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

ARTICLE IX-ENFORCEMENT AND PENALTIES

Section 901. Right-of-Entry

- A. Upon presentation of proper credentials, duly authorized representatives of the Municipality may enter at reasonable times upon any property within the Municipality to inspect the implementation, condition, or operation and maintenance of the stormwater controls or BMPs in regard to any aspect governed by this Ordinance.
- B. Stormwater control and BMP owners and operators shall allow persons working on behalf of the Municipality ready access to all parts of the premises for the purposes of determining compliance with this Ordinance.
- C. Persons working on behalf of the Municipality shall have the right to temporarily locate on any stormwater control or BMP in the Municipality such devices as are necessary to conduct monitoring and/or sampling of the discharges from such stormwater control or BMP.
- D. Unreasonable delays in allowing the Municipality access to a stormwater control or BMP is a violation of this Article.

Section 902. Public Nuisance

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

Section 903. Enforcement Generally

- A. Whenever the Municipality finds that a person has violated a prohibition or failed to meet a requirement of this Ordinance, the Municipality may order compliance by written notice to the responsible person. Such notice may require without limitation:
- The performance of monitoring, analyses, and reporting;
 - The elimination of prohibited connections or discharges;
 - Cessation of any violating discharges, practices, or operations;
 - The abatement or remediation of stormwater pollution or contamination hazards and the restoration of any affected property;
 - Payment of a fine to cover administrative and remediation costs;

6. The implementation of stormwater controls and BMPs; and
 7. Operation and maintenance of stormwater controls and BMPs.
- B. Such notification shall set forth the nature of the violation(s) and establish a time limit for correction of these violations(s). Said notice may further advise that, if applicable, should the violator fail to take the required action within the established deadline, the work will be done by the Municipality or designee and the expense thereof shall be charged to the violator.
- C. Failure to comply within the time specified shall also subject such person to the penalty provisions of this Ordinance. All such penalties shall be deemed cumulative and shall not prevent the Municipality from pursuing any and all other remedies available in law or equity.

Section 904. Suspension and Revocation of Permits and Approvals

- A. Any building, land development or other permit or approval issued by the Municipality may be suspended or revoked by the Municipality for:
1. Non-compliance with or failure to implement any provision of the permit;
 2. A violation of any provision of this Ordinance; or
 3. The creation of any condition or the commission of any act during construction or development which constitutes or creates a hazard or nuisance, pollution or which endangers the life or property of others.
- B. A suspended permit or approval shall be reinstated by the Municipality when:
1. The Municipal Engineer or designee has inspected and approved the corrections to the stormwater controls and BMPs, or the elimination of the hazard or nuisance, and/or;
 2. The Municipality is satisfied that the violation of the Ordinance, law, or rule and regulation has been corrected.
- C. A permit or approval which has been revoked by the Municipality at its discretion cannot be reinstated. The applicant may apply for a new permit under the procedures outlined in this Ordinance.

Section 905. Penalties

- A. Any person violating the provisions of this ordinance shall be subject to a fine of not less than \$ 100 nor more than \$ 1000 for each violation, recoverable with costs, or imprisonment for not more than ninety (90) days, or both. Each day that the violation continues shall constitute a separate offense and the applicable fines are cumulative.

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

Section 906. Notification

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

Section 907. Enforcement

The municipal governing body is hereby authorized and directed to enforce all of the provisions of this ordinance. All inspections regarding compliance with the drainage plan shall be the responsibility of the municipal engineer or his designee.

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

It shall be unlawful for any person, firm or corporation to undertake any regulated activity under Section 105 on any property except as provided for in the approved drainage plan and pursuant to the requirements of this ordinance. It shall be unlawful to alter or remove any control structure required by the drainage plan pursuant to this ordinance or to allow the property to remain in a condition which does not conform to the approved drainage plan.
- C. At the completion of the project, and as a prerequisite for the release of the performance guarantee, the owner or his representatives shall:
 - 1. Provide a certification of completion from an engineer, architect, surveyor or other qualified person verifying that all permanent facilities have been constructed according to the plans and specifications and approved revisions thereto.
 - 2. Provide a set of as-built (record) drawings.
- D. After receipt of the certification by the municipality, a final inspection shall be conducted by the municipal engineer or designated representative to certify compliance with this ordinance.

- E. Prior to revocation or suspension of a permit and at the request of the applicant, the governing body will schedule a hearing to discuss the non-compliance if there is no immediate danger to life, public health or property. The expense of a hearing shall be the owner's responsibility.

- F. **Occupancy Permit**

An occupancy permit shall not be issued unless the certification of completion pursuant to Section 907.C.1. has been secured and a final inspection performed pursuant to Section 907.D. The occupancy permit shall be required for each lot owner and/or Applicant for all subdivisions and land development in the municipality.

- G. The municipality and/or any adversely-impacted property owners may institute the appropriate legal, equitable or otherwise action to prevent, restrain, correct or abate problems and seek restitution and/or damages resulting from stormwater problems emanating from the land development or earth disturbance activities.

Section 908. Appeals

- A. Any person aggrieved by any action of the City of Reading or its designee may appeal to City Council within thirty (30) days of that action.

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

ENACTED and ORDAINED at a regular meeting of the _____
_____ on the _____ of _____, 19__ . This
Ordinance shall take effect immediately.

[Name]

[Title]

ATTEST:

Secretary

I hereby certify that the foregoing Ordinance was advertised in the
_____ on _____, 20__, a newspaper of general
circulation in the municipality and was duly enacted and approved as set forth at a regular
meeting of the municipality's governing body held on _____, 20__.

Secretary

ORDINANCE APPENDIX A

STORMWATER CONTROLS AND BEST MANAGEMENT PRACTICES OPERATIONS AND MAINTENANCE AGREEMENT

THIS AGREEMENT, made and entered into this _____ day of _____, 200__, by and between _____, (hereinafter the “Landowner”), and the City of Reading, Berks County, Pennsylvania, (hereinafter “Municipality”);

WITNESSETH

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

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

WHEREAS, the Stormwater Controls and BMP Operations and Maintenance Plan approved by 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 (BMPs); 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.
6. The intent and purpose of this Agreement is to ensure the proper maintenance of the onsite BMP(s) by the Landowner; provided, however, that this Agreement shall not be deemed to create or effect any additional liability of any party for damage alleged to result from or be caused by stormwater runoff.
7. The Landowner, its executors, administrators, assigns, and other successors in interests, shall release 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) at a minimum of once every three years to ensure their continued functioning.

This Agreement shall be recorded at the Office of the Recorder of Deeds of Berks 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 _____, 20__ do hereby certify that _____ whose name(s) is/are signed to the foregoing Agreement bearing date of the _____ day of _____, 20__, has acknowledged the same before me in my said County and State.

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

NOTARY PUBLIC

(SEAL)

ORDINANCE APPENDIX B
STORMWATER MANAGEMENT DESIGN CRITERIA

TABLE B-1
POINT PRECIPITATION FREQUENCY ESTIMATES FROM NOAA ATLAS 14

READING WB CITY, PENNSYLVANIA (36-7318) 40.3333 N 75.9667 W 298 feet

Source: "Precipitation-Frequency Atlas of the United States" NOAA Atlas 14, Volume 2, Version 3 G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M. Yekta, and D. Riley NOAA, National Weather Service, Silver Spring, Maryland, 2004 Extracted: Fri Jun 13 2008.

FIGURE B-1
NRCS TYPE II RAINFALL DISTRIBUTION – S CURVE

Source: NRCS, TR-55, June 1986

TABLE B-2
RUNOFF CURVE NUMBERS

Source: NRCS (SCS) TR-55

TABLE B-3
RATIONAL RUNOFF COEFFICIENTS

TABLE B-4
MANNING ROUGHNESS COEFFICIENTS

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

**TABLE B-1
POINT PRECIPITATION FREQUENCY ESTIMATES FROM NOAA ATLAS 14**

READING WB CITY, PENNSYLVANIA (36-7318) 40.3333 N 75.9667 W 298 feet

Source: "Precipitation-Frequency Atlas of the United States" NOAA Atlas 14, Volume 2, Version 3 G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M. Yekta, and D. Riley NOAA, National Weather Service, Silver Spring, Maryland, 2004 Extracted: Fri Jun 13 2008.

Precipitation Frequency Estimates (inches)																		
ARI* (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.34	0.53	0.66	0.90	1.12	1.36	1.49	1.87	2.29	2.65	3.08	3.43	4.03	4.62	6.24	7.77	9.80	11.76
2	0.40	0.63	0.79	1.09	1.36	1.65	1.81	2.25	2.77	3.19	3.72	4.13	4.83	5.51	7.40	9.15	11.50	13.77
5	0.47	0.74	0.94	1.32	1.69	2.05	2.26	2.81	3.46	4.00	4.68	5.14	5.96	6.71	8.81	10.65	13.21	15.70
10	0.52	0.82	1.03	1.49	1.93	2.37	2.60	3.25	4.04	4.68	5.46	5.97	6.89	7.67	9.93	11.82	14.50	17.13
25	0.57	0.90	1.14	1.68	2.22	2.79	3.08	3.89	4.89	5.67	6.57	7.16	8.23	9.03	11.44	13.36	16.14	18.95
50	0.61	0.96	1.22	1.81	2.45	3.14	3.46	4.41	5.61	6.50	7.49	8.14	9.34	10.12	12.63	14.54	17.36	20.28
100	0.65	1.02	1.29	1.95	2.68	3.49	3.85	4.97	6.39	7.41	8.49	9.18	10.51	11.26	13.83	15.70	18.52	21.52
200	0.68	1.07	1.35	2.08	2.90	3.86	4.26	5.57	7.25	8.40	9.55	10.29	11.78	12.45	15.05	16.86	19.64	22.70
500	0.72	1.13	1.42	2.23	3.18	4.37	4.83	6.42	8.52	9.84	11.07	11.88	13.58	14.11	16.71	18.37	21.03	24.15
1000	0.75	1.17	1.46	2.34	3.39	4.77	5.28	7.12	9.59	11.04	12.33	13.18	15.06	15.45	17.99	19.50	22.04	25.19

Precipitation Intensity Estimates (in/hr)																		
ARI* (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	4.02	3.19	2.65	1.81	1.12	0.68	0.50	0.31	0.19	0.11	0.06	0.04	0.02	0.02	0.01	0.01	0.01	0.01
2	4.78	3.80	3.17	2.18	1.36	0.82	0.60	0.38	0.23	0.13	0.08	0.04	0.03	0.02	0.02	0.01	0.01	0.01
5	5.59	4.45	3.74	2.64	1.69	1.02	0.75	0.47	0.29	0.17	0.10	0.05	0.04	0.03	0.02	0.01	0.01	0.01
10	6.20	4.91	4.13	2.97	1.93	1.18	0.87	0.54	0.34	0.20	0.11	0.06	0.04	0.03	0.02	0.02	0.01	0.01
25	6.86	5.42	4.56	3.35	2.22	1.40	1.03	0.65	0.41	0.24	0.14	0.07	0.05	0.04	0.02	0.02	0.01	0.01
50	7.32	5.77	4.86	3.63	2.45	1.57	1.15	0.74	0.47	0.27	0.16	0.08	0.06	0.04	0.03	0.02	0.02	0.01
100	7.78	6.12	5.15	3.90	2.68	1.75	1.28	0.83	0.53	0.31	0.18	0.10	0.06	0.05	0.03	0.02	0.02	0.01
200	8.21	6.43	5.39	4.15	2.90	1.93	1.42	0.93	0.60	0.35	0.20	0.11	0.07	0.05	0.03	0.02	0.02	0.02
500	8.66	6.77	5.67	4.46	3.18	2.18	1.61	1.07	0.71	0.41	0.23	0.12	0.08	0.06	0.03	0.03	0.02	0.02
1000	8.99	7.00	5.85	4.67	3.39	2.38	1.76	1.19	0.80	0.46	0.26	0.14	0.09	0.06	0.04	0.03	0.02	0.02

* These precipitation frequency estimates are based on a partial duration series. ARI is the Average Recurrence Interval.

FIGURE B-1
NRCS (SCS) TYPE II RAINFALL DISTRIBUTION - S CURVE

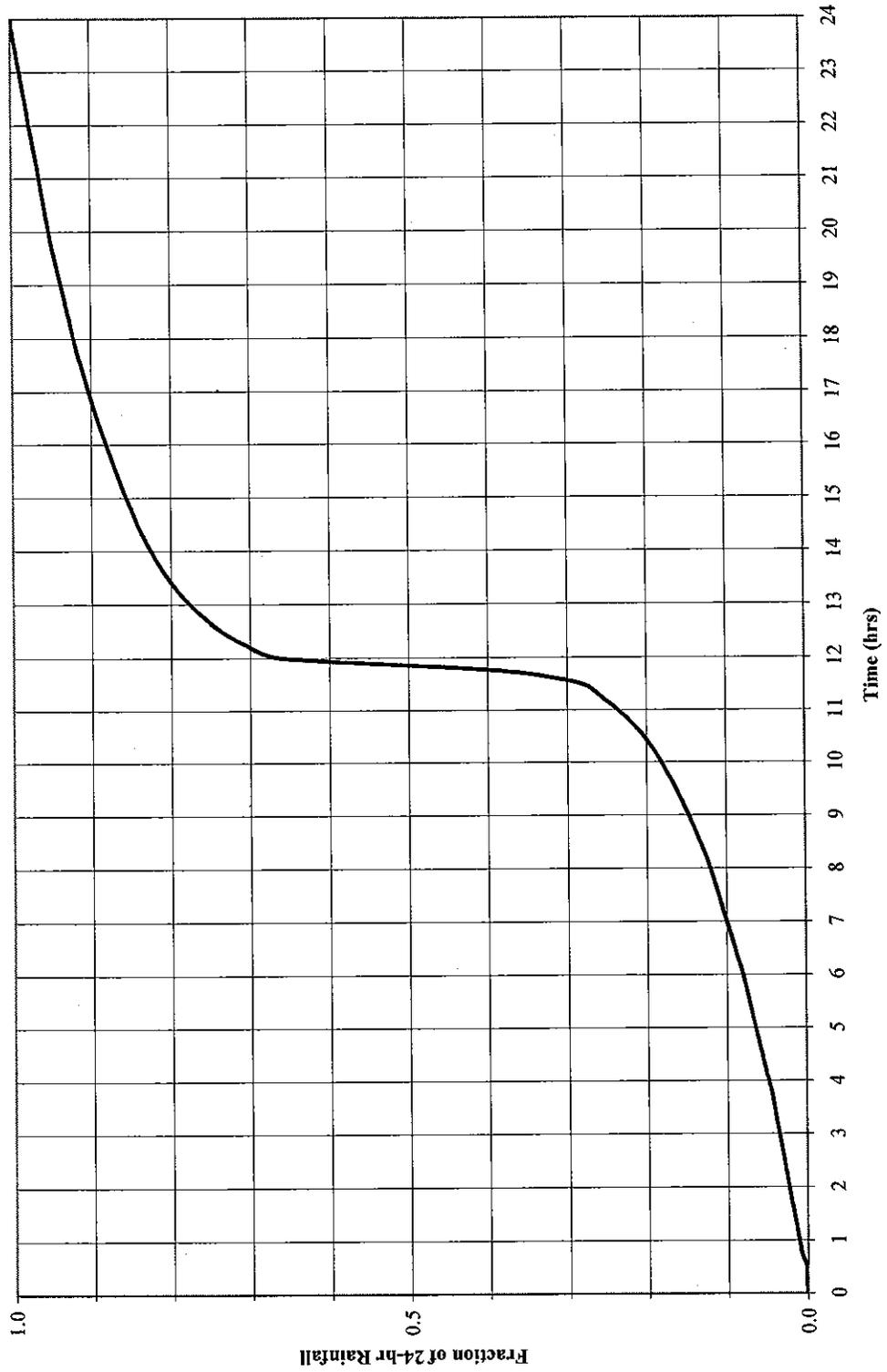


TABLE B-2
Runoff Curve Numbers
(From NRCS (SCS) TR-55)

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

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

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

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

Land Use	A				B				C				D			
	0-2%	2-6%	6%+	6%+	0-2%	2-6%	6%+	6%+	0-2%	2-6%	6%+	6%+	0-2%	2-6%	6%+	6%+
Cultivated Land	0.08 ^a	0.13	0.16	0.21	0.11	0.15	0.21	0.26	0.14	0.19	0.26	0.31	0.18	0.23	0.29	0.41
	0.14 ^b	0.18	0.22	0.28	0.16	0.21	0.28	0.34	0.20	0.25	0.34	0.41	0.24	0.29	0.37	0.45
Pasture	0.12	0.20	0.30	0.37	0.18	0.28	0.37	0.44	0.24	0.34	0.44	0.50	0.30	0.40	0.50	0.62
	0.15	0.25	0.37	0.45	0.23	0.34	0.45	0.52	0.30	0.42	0.52	0.62	0.37	0.50	0.62	0.75
Meadow	0.10	0.16	0.25	0.30	0.14	0.22	0.30	0.36	0.20	0.28	0.36	0.40	0.24	0.30	0.40	0.50
	0.14	0.22	0.30	0.37	0.20	0.28	0.37	0.44	0.26	0.35	0.44	0.50	0.30	0.40	0.50	0.62
Forest	0.05	0.08	0.11	0.14	0.08	0.11	0.14	0.16	0.10	0.13	0.16	0.20	0.12	0.16	0.20	0.25
	0.08	0.11	0.14	0.18	0.10	0.14	0.18	0.20	0.12	0.16	0.20	0.25	0.15	0.20	0.25	0.31
Residential Lot Size 1/8 Acre	0.25	0.28	0.31	0.35	0.27	0.30	0.35	0.38	0.30	0.33	0.38	0.42	0.33	0.36	0.42	0.54
	0.33	0.37	0.40	0.44	0.35	0.39	0.44	0.49	0.38	0.42	0.49	0.54	0.41	0.45	0.54	0.62
Lot Size 1/4 Acre	0.22	0.26	0.29	0.33	0.24	0.29	0.33	0.36	0.27	0.31	0.36	0.40	0.30	0.34	0.40	0.48
	0.30	0.34	0.37	0.42	0.33	0.37	0.42	0.47	0.36	0.40	0.47	0.52	0.38	0.42	0.52	0.62
Lot Size 1/3 Acre	0.19	0.23	0.26	0.30	0.22	0.26	0.30	0.34	0.25	0.29	0.34	0.39	0.28	0.32	0.39	0.46
	0.28	0.32	0.35	0.39	0.30	0.35	0.39	0.45	0.33	0.38	0.45	0.50	0.36	0.40	0.50	0.62
Lot Size 1/2 Acre	0.16	0.20	0.24	0.28	0.19	0.23	0.28	0.32	0.22	0.27	0.32	0.37	0.26	0.30	0.37	0.48
	0.25	0.29	0.32	0.36	0.28	0.32	0.36	0.42	0.31	0.35	0.42	0.48	0.34	0.38	0.48	0.62
Lot Size 1 Acre	0.14	0.19	0.22	0.26	0.17	0.21	0.26	0.31	0.20	0.25	0.31	0.35	0.24	0.29	0.35	0.46
	0.22	0.26	0.29	0.34	0.24	0.28	0.34	0.40	0.28	0.32	0.40	0.46	0.31	0.35	0.46	0.62
Industrial	0.67	0.68	0.68	0.68	0.68	0.68	0.69	0.69	0.68	0.69	0.69	0.70	0.69	0.69	0.70	0.88
	0.85	0.85	0.86	0.86	0.85	0.86	0.86	0.87	0.86	0.86	0.87	0.88	0.86	0.86	0.88	0.96
Commercial	0.71	0.71	0.72	0.72	0.71	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.90
	0.88	0.88	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.90	0.89	0.89	0.90	0.96
Streets	0.70	0.71	0.71	0.71	0.71	0.72	0.74	0.76	0.72	0.73	0.76	0.78	0.73	0.75	0.78	0.95
	0.76	0.77	0.79	0.79	0.80	0.82	0.84	0.89	0.84	0.85	0.89	0.95	0.89	0.91	0.95	1.00
Open Space	0.05	0.10	0.14	0.19	0.08	0.13	0.19	0.24	0.12	0.17	0.24	0.28	0.16	0.21	0.28	0.39
	0.11	0.16	0.20	0.26	0.14	0.19	0.26	0.32	0.18	0.23	0.32	0.39	0.22	0.27	0.39	0.50
Parking	0.85	0.86	0.87	0.87	0.85	0.86	0.87	0.87	0.85	0.86	0.87	0.87	0.85	0.86	0.87	0.97
	0.95	0.96	0.97	0.97	0.95	0.96	0.97	0.97	0.95	0.96	0.97	0.97	0.95	0.96	0.97	1.00

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

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

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

TABLE B-4

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

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

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

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

(1) Depending upon type, coating and diameter

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

FIGURE B-2

Recommendation Chart for Infiltration Stormwater Management BMP's in Carbonate Bedrock

SITE RISK FACTORS		CARBONATE BEDROCK											
		Less than 2 Feet			2 to 4 Feet			Over 4 Feet to 8 Feet			Over 8 Feet		
Geology Type	Effective Soil Thickness	Low/High Buffer	Medium Buffer	High Buffer	Low Buffer	Medium Buffer	High Buffer	Low Buffer	Medium Buffer	High Buffer	Low Buffer	Medium Buffer	High Buffer
Special Geologic Features*	(Unacceptable)	Preliminary											
DESIGN FACTORS	Infiltration Loading Rates (% increase)**	0-100% 100% 300%	0-100% 100% 300%	0-700% 100% 300%	0-100% 100% 300%								
	PROGRAM SUBBARY GUIDANCE ***	RECOMMENDED											
		100% 300%											
		0-100% 100% 300%	0-100% 100% 300%	0-700% 100% 300%	0-100% 100% 300%								
		Preliminary											
		100% 300%											
		0-100% 100% 300%	0-100% 100% 300%	0-700% 100% 300%	0-100% 100% 300%								
		Preliminary											
		100% 300%											
		0-100% 100% 300%	0-100% 100% 300%	0-700% 100% 300%	0-100% 100% 300%								
		Preliminary											
		100% 300%											
		0-100% 100% 300%	0-100% 100% 300%	0-700% 100% 300%	0-100% 100% 300%								
		Preliminary											

* 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 800% 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.

ORDINANCE APPENDIX C SAMPLE DRAINAGE PLAN APPLICATION

(To be attached to the "land subdivision plan or development plan review application or "minor land subdivision plan review application")

Application is hereby made for review of the Stormwater Management and Erosion and Sedimentation Control Plan and related data as submitted herewith in accordance with the City of Reading Stormwater Management and Earth Disturbance Ordinance.

_____ Final Plan _____ Preliminary Plan _____ Sketch Plan

Date of Submission _____ Submission No. _____

1. Name of subdivision or development _____

2. Name of Applicant _____ Telephone No. _____

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

_____ Officer 1
_____ Officer 2

Address _____

Zip _____

Applicants interest in subdivision or development
(if other than property owner give owners name and address)

3. Name of property owner _____ Telephone No. _____

Address _____

Zip _____

4. Name of engineer or surveyor _____ Telephone No. _____

Address _____

Zip _____

5. Type of subdivision or development proposed:

_____ Single-Family Lots	_____ Townhouses	_____ Commercial (Multi-Lot)
_____ Two Family Lots	_____ Garden Apartments	_____ Commercial (One-Lot)
_____ Multi-Family Lots	_____ Mobile-Home Park	_____ Industrial (Multi-Lot)
_____ Cluster Type Lots	_____ Campground	_____ Industrial (One-Lot)
_____ Planned Residential	_____ Other (_____)	

Development

6. Lineal feet of new road proposed _____ L.F.

7. Area of proposed and existing impervious area on entire tract.

a. Existing (to remain) _____ S.F. _____ % of Property
b. Proposed _____ S.F. _____ % of Property

8. Stormwater

a. Does the peak rate of runoff from proposed conditions exceed that flow which occurred for existing conditions for the designated design storm? _____

b. Design storm utilized (on-site conveyance systems) (24 hr.) _____
No. of Subarea _____
Watershed Name _____

Explain: _____

c. Does the submission and/or district meet the release rate criteria for the applicable subarea? _____

d. Number of subarea(s) from Ordinance Appendix D of the Watershed Stormwater Management Plan. _____

e. Type of proposed runoff control _____

f. Does the proposed stormwater control criteria meet the requirement/guidelines of the Stormwater Ordinances? _____

If not, what variances/waivers are requested? _____

Reasons _____

f. Does the plan meet the requirements of Article iii of the Stormwater Ordinances? _____

If not, what variances/waivers are requested? _____

Reasons Why _____

h. Was TR-55, June 1986 utilized in determining the time of concentration? _____

- i. What hydrologic method was used in the stormwater computations? _____

 - j. Is a hydraulic routing through the stormwater control structure submitted? _____

 - k. Is a construction schedule or staging attached? _____
 - l. Is a recommended maintenance program attached? _____
9. Erosion and Sediment Pollution Control (E&S):
- a. Has the stormwater management and E&S plan, supporting documentation and narrative been submitted to the Berks County Conservation District? _____
 - b. Total area of earth disturbance _____ S.F.
10. Wetlands
- a. Have the wetlands been delineated by someone trained in wetland delineation? _____
 - b. Have the wetland lines been verified by a state or federal permitting authority? _____
 - c. Have the wetland lines been surveyed? _____
 - d. Total acreage of wetland within the property _____
 - e. Total acreage of wetland disturbed _____
 - f. Supporting documentation _____
11. Filing
- a. Has the required fee been submitted? _____
Amount _____
 - b. Has the proposed schedule of construction inspection to be performed by the Applicant's engineer been submitted? _____
 - c. Name of individual who will be making the inspections _____
 - d. General comments about stormwater management at the development _____

CERTIFICATE OF OWNERSHIP AND ACKNOWLEDGMENT OF APPLICATION:

COMMONWEALTH OF PENNSYLVANIA
COUNTY OF [County Name] .

On this the _____ day of _____, 20____, before me, the undersigned officer, personally appeared _____ who being duly sworn, according to law, deposes and says that _____ owners of the property described in this application and that the application was made with _____ knowledge and/or direction and does hereby agree with the said application and to the submission of the same.

_____ Property Owner

My Commission Expires _____ 20 _____
Notary Public _____

I hereby certify that to the best of my knowledge and belief the information and statements given above are true and correct. I make this verification subject to the penalties of 18 Pa.C.S.A. §4904 relating to unsworn falsification to authorities.

SIGNATURE OF APPLICANT _____



(Information Below This Line To Be Completed By The Municipality)

_____ (Name of) Municipality official submission receipt:

Date complete application received _____ Plan Number _____

Fees _____ date fees paid _____ received by _____

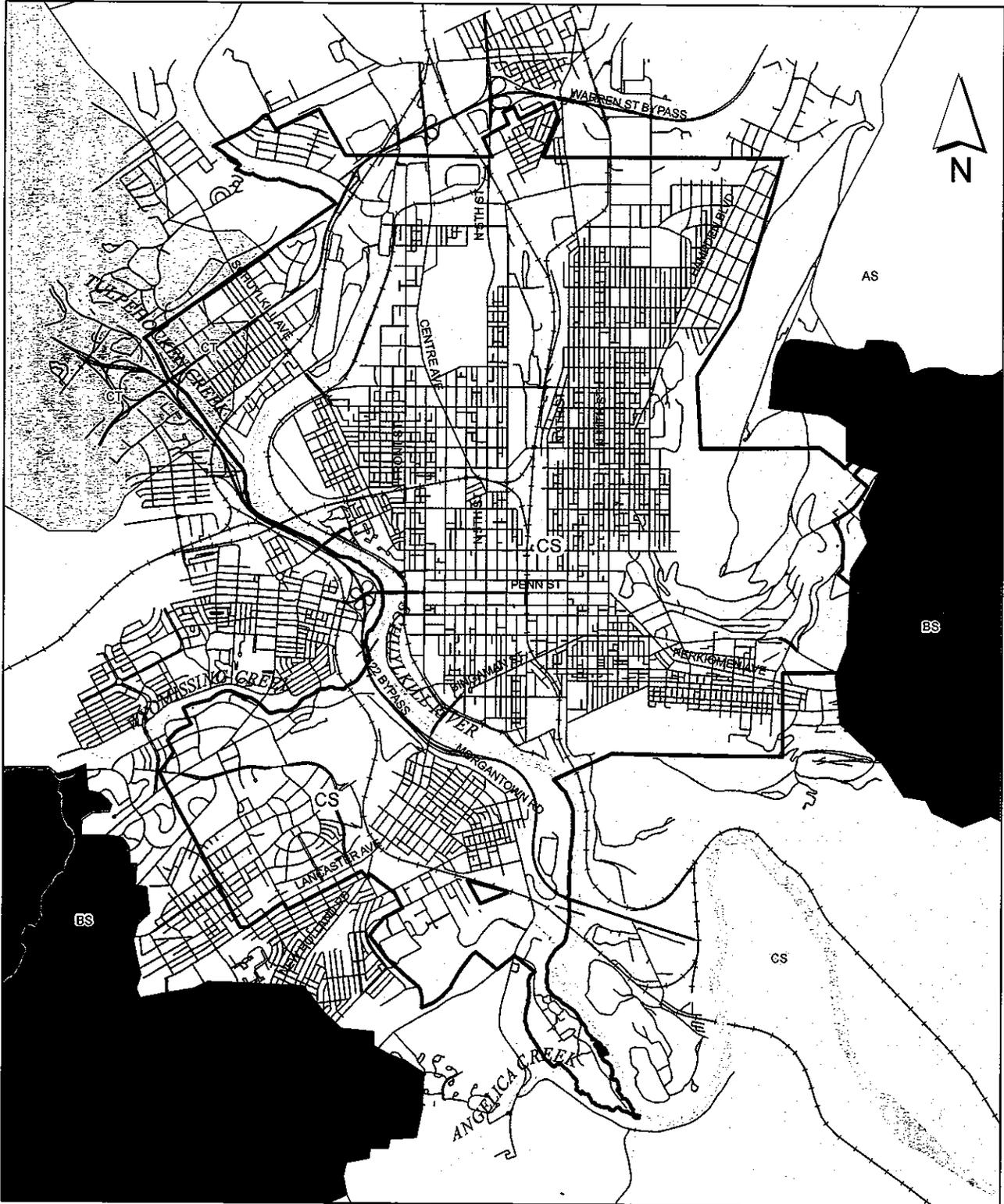
Official submission receipt date _____

Received by _____

Municipality

CITY OF READING

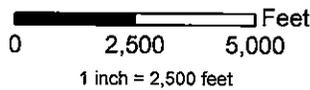
APPENDIX D - STORMWATER MANAGEMENT DISTRICTS



Legend

Management Districts
 S - Schuylkill T - Tulpehocken

	AS
	BS
	CS
	CT



CITY OF READING <small>CITY HALL, 414 WASHINGTON ST., READING, PA 19601</small>	
APPENDIX D - STORMWATER MANAGEMENT DISTRICTS	
CITY OF READING BERKS COUNTY PENNSA	
GVC	
GREAT VALLEY CONSULTANTS <small>15 COMBINE DRIVE WYOMISSING, PA 19381-1022</small>	
ENGINEERS • ARCHITECTS • PLANNERS • CONSULTANTS • SURVEYORS	
DRAFTED BY: KS	SCALE: 1" = 2,500'
CHECKED BY: CAP	DATE: 7/27/08
APPROVALS:	DRAWING NUMBER: 3098-017-8-001

ORDINANCE APPENDIX E LOW IMPACT DEVELOPMENT (LID) 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 leads ultimately to the degradation of water quality as well as expenditure of additional resources for detaining and managing concentrated runoff at some downstream location.

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

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

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

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

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

especially for low use surfaces such as driveways, overflow parking lots, and emergency access roads.

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

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

ORDINANCE APPENDIX F

West Nile Virus Guidance

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

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

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

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

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

Mosquitoes

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

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

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

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

Stormwater Facilities

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

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

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

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

Conclusion

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

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

ORDINANCE APPENDIX G REFERENCES

BMP Manuals

California

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

Georgia

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

Maryland

2000 Maryland Stormwater Design Manual –

[http://www.mde.state.md.us/Programs/Waterprograms/SedimentandStormwater/stormwater design/index.asp](http://www.mde.state.md.us/Programs/Waterprograms/SedimentandStormwater/stormwater%20design/index.asp)

Massachusetts

Stormwater Management, Volume Two: Stormwater Technical Handbook (Massachusetts, 1997) – separate file available at

<http://www.state.ma.us/dep/brp/stormwtr/stormpub.htm>

Minnesota

Minnesota Urban Small Sites BMP Manual: Stormwater Best Management Practices for Cold Climates (July 2001) –

<http://www.metrocouncil.org/environment/Watershed/BMP/manual.htm>

New Jersey

Revised Manual for New Jersey: Best Management Practices for Control of Non-point Source Pollution from Stormwater (Fifth Draft May 2000) –

<http://www.state.nj.us/dep/watershedmgt/bmpmanual.htm>

New York

New York State Stormwater Management Design Manual (2001) –

<http://www.dec.state.ny.us/website/dow/swmanual/swmanual.html>

Pennsylvania

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

Washington

Stormwater Management Manual for Western Washington (August 2001) –

<http://www.ecy.wa.gov/programs/wq/stormwater/manual.html>

Federal

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

USEPA Infiltration Trench Fact Sheet (September 1999) –

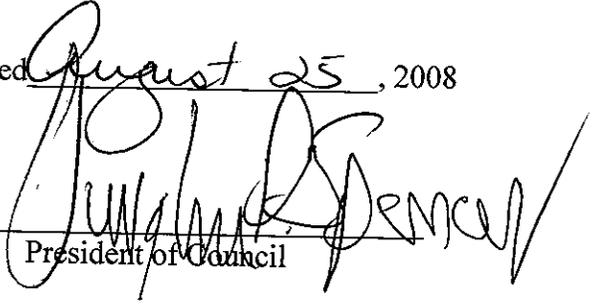
<http://cfpub.epa.gov/npdes/stormwater/menuofbmps/post.cfm>

Riparian Buffer References

- Alliance for the Chesapeake Bay, Pennsylvania Department of Environmental Protection, September 2000. *Forest Buffer Toolkit*, Stream ReLeaf Program.
- Penn State College of Agricultural Sciences, 1996. *Establishing Vegetative Buffer Strips Along Streams to Improve Water Quality*. Publication # AGRS-67.
- Fike, Jean, June 1999. *Terrestrial & Palustrine Plant Communities of Pennsylvania*, Pennsylvania Natural Diversity Inventory, The Nature Conservancy, Western Pennsylvania Conservancy, and Pennsylvania Department of Conservation and Natural Resources.
- Pennsylvania Association of Conservation Districts, Inc., Keystone Chapter, Soil and Water Conservation Society, Pennsylvania Department of Environmental Protection, Natural Resources Conservation Service, 1998. *Pennsylvania Handbook of Best Management Practices for Developing Areas*. Prepared by CH2MHill.
- Palone, R. S. and A. H. Todd (eds), 1997. *Chesapeake Bay Riparian Handbook: A Guide for Establishing and Maintaining Riparian Forest Buffers*. Chesapeake Bay Program and Northeastern Area State and Private Forestry. Natural Resources Conservation Service Cooperative State Research Education and Extension Services.
- The Federal Interagency Stream Restoration Working Group (FISRWG, 10/1998). *Stream Corridor Restoration Principles, Processes, and Practices*. GPO Item No. 0120-A; SuDocs No. A57.6/2:EN3/PT.653. ISBN-0-934213-59-3. Published October 1998. Revised August 2000.

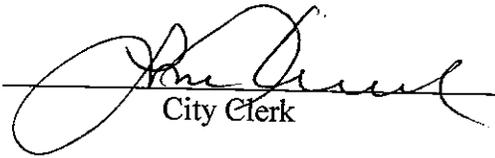
This Ordinance will become effective in ten (10) days, in accordance with Charter Section 219.

Enacted August 25, 2008



President of Council

Attest:



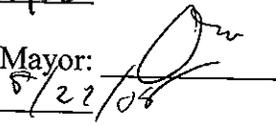
City Clerk

Submitted to Mayor: 

Date: 8/26/08

Received by the Mayor's Office: 

Date: 8/26/08

Approved by Mayor: 

Date: 8/22/08

Vetoed by Mayor: _____

Date: _____