

Chapter 142. Stormwater Management

Article IV. Stormwater Management

§ 142-401. General requirements.

- A. For any of the activities regulated by this chapter, unless preparation of a stormwater management (SWM) site plan is specifically exempted, the preliminary or final approval of subdivision and/or land development plans, the issuance of any building or occupancy permit, the commencement of any earth disturbance activity may not proceed until the property owner or applicant or his/her agent has received written approval from the Municipality of a SWM site plan that demonstrates compliance with the requirements of this chapter, and a written approval of an adequate erosion and sediment (E&S) control plan from the Municipality or County Conservation District when required.
- B. SWM site plan approved by the Municipality shall be on site throughout the duration of the regulated activity.
- C. The Municipality may, after consultation with the Department of Environmental Protection (DEP), approve measures for meeting the state water quality requirements other than those in this chapter, provided that they meet the minimum requirements of, and do not conflict with, state law including but not limited to the Clean Streams Law.^[1]
[1] Editor's Note: See 35 P.S. § 691.1 et seq.
- D. For all regulated earth disturbance activities, E&S control best management practices (BMPs) shall be designed, implemented, operated and maintained during the regulated earth disturbance activities (e.g., during construction) to meet the purposes and requirements of this chapter and to meet all requirements under Title 25 of the Pennsylvania Code and the Clean Streams Law. DEP regulations 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). In addition, under 25 Pa. Code Chapter **92**, a DEP NPDES construction activities permit is required for regulated earth disturbance activities. A copy of the erosion and sediment control plan and any required permit, as required by DEP regulations, shall be available on the project site at all times. Various BMPs and their design standards are listed in the Erosion and Sediment Pollution Control Program Manual (E&S Manual), No. 363-2134-008 (April 15, 2000), as amended and updated. However, the Municipality may require E&S controls for projects with lesser areas of earth disturbance.
- E. For all regulated activities, implementation of the water volume controls in § **142-406** (Area P and Area W) or water quality requirements in § **142-407** (Area T) is required.
- F. Impervious areas:
 - (1) The measurement of impervious areas shall include all of the impervious areas in the total proposed development even if development is to take place in stages.
 - (2) For development taking place in stages, the entire development plan must be used in determining conformance with this chapter.

- (3) For projects that add impervious area to a parcel, §§ **142-403** through **142-409** shall apply to the total impervious area within the limits of earth disturbance.
- G. Stormwater discharges onto adjacent property shall not be created, increased, decreased, relocated, or otherwise altered without written notification of the adjacent property owner(s). Such stormwater discharges shall be subject to the requirements of this chapter.
- H. No regulated activities shall commence until the Municipality issues written approval of an SWM site plan, which demonstrates compliance with the requirements of this chapter.
- I. All regulated activities shall include such measures as necessary to:
- (1) Protect health, safety and property;
 - (2) Meet the water quality goals of this chapter by implementing measures to:
 - (a) Minimize disturbance to floodplains, wetlands, and wooded areas.
 - (b) Maintain or extend riparian buffers.
 - (c) Avoid erosive flow conditions in natural flow pathways.
 - (d) Minimize thermal impacts to waters of this commonwealth.
 - (e) Disconnect impervious surfaces by directing runoff to pervious areas, wherever possible.
 - (3) To the maximum extent practicable, incorporate the techniques for low-impact development practices described in the Pennsylvania Stormwater Best Management Practices Manual (BMP Manual).
- J. The design of all facilities over karst shall include an evaluation of measures to minimize adverse effects.
- K. Infiltration BMPs should be dispersed on site, made as shallow as practicable, and located to maximize use of natural onsite infiltration features while still meeting the other requirements of this chapter.
- L. Storage facilities should completely drain both the volume control and rate control capacities over a period of time not less than 24 and not more than 72 hours from the end of the design storm.
- M. The design storm precipitation amounts to be used in the analysis of peak rates of discharge shall be those from the upper limits of the 90% confidence intervals for the twenty-four-hour precipitation events in the Precipitation-Frequency Atlas of the United States, Atlas 14, Volume 2, Version 3.0, U.S. Department of Commerce, National Oceanic and Atmospheric Administration (NOAA), National Weather Service (NWS), Hydrometeorological Design Studies Center (HDSC), Silver Spring, Maryland. NOAA's Atlas 14 can be accessed at <http://hdsc.nws.noaa.gov/hdsc/pfds/>.
- N. For all regulated activities, SWM BMPs shall be designed, implemented, operated, and maintained to meet the purposes and requirements of this chapter and to meet all requirements under Title 25 of the Pennsylvania Code, the Clean Streams Law, and the Storm Water Management Act.
- O. Various BMPs and their design standards are listed in the BMP Manual [Note: See Reference 1 in Article X, References.]

§ 142-402. Permit requirements by other governmental entities.

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

§ 142-403. Erosion and sediment control during regulated earth disturbance activities.

- A. 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.
- B. Additional erosion and sediment control design standards and criteria are recommended to be applied where infiltration BMPs are proposed. They 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 drainage area contributory to the infiltration BMP has achieved final stabilization.

§ 142-404. Nonstructural project design.

The design of all regulated activities should include the following to minimize stormwater impacts: (See Subappendix B-3 for a Nonstructural Project Design Checklist.)^[1]

- A. The applicant should find 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.
- B. An alternative is practicable if it is available and capable of implementation after taking into consideration existing technology and logistics in light of overall project purposes and other municipal requirements.
- C. 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.

[1] *Editor's Note: Appendixes A through J are on file in the Township offices.*

§ 142-405. Groundwater Recharge Requirements.

- A. Infiltration best management practices (BMPs) shall meet the following minimum requirements unless the site qualifies for an exemption from the infiltration requirements of this chapter as listed in § 142-106:
 - (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 soil depth of 24 inches between the bottoms of the infiltration BMPs and bedrock or other limiting zones such as clay layers.
 - (b) An infiltration rate sufficient to accept the additional stormwater load (stormwater load is the quantity above the pre-project condition quantity) and dewater completely as determined by field tests conducted by the applicant's qualified person.

- (c) All open-air infiltration facilities shall be designed to completely infiltrate the recharge (infiltration) volume (Re_v) within three days (72 hours) from the end of the design storm.
 - (d) All subsurface and contained facilities such as capture-and-reuse systems must have storage available equivalent to the water volume control amount within three days (72 hours) from the end of the design storm.
 - (e) Pretreatment (see § 142-202) shall be provided prior to infiltration.
- (2) The size of the infiltration facility shall be based upon the following volume criteria:
- (a) Where practicable and appropriate the recharge volume shall be infiltrated on site. The recharge volume shall be equal to 1.0 inch of runoff (I) over all proposed impervious surfaces.
 - (b) The Re_v required shall be computed as:

$$Re_v = (1/12) * (I)$$

Where:

Re_v = Recharge Volume (cubic feet)

I = Impervious Area within the limits of earth disturbance (square feet)

An asterisk (*) in equations denotes multiplication.

- B. Soils. A detailed soils evaluation of the project site shall be required to determine the suitability of infiltration facilities. The evaluation shall be performed by a qualified person, 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 may not 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 recharge volume (Re_v) 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 qualified person, it must be demonstrated to the Municipality that the soils are conducive to infiltrate on the lots identified.
 - (5) 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.

§ 142-406. Water volume control requirements.

The low-impact development practices provided in the BMP Manual shall be utilized for all regulated activities to the maximum extent practicable. Water volume controls shall be implemented using the Design Storm Method in Subsection A or the Simplified Method in Subsection B below. For regulated activity areas equal to or less than one acre that do not require hydrologic routing to design the stormwater facilities, this chapter establishes no preference for either methodology; therefore, the applicant may select either methodology on the basis of economic considerations, the intrinsic

limitations on applicability of the analytical procedures associated with each methodology, and other factors. All regulated activities greater than one acre must use the Design Storm Method.

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

(1) The post-development total runoff volume for all storms equal to or less than the two-year, twenty-four-hour storm event shall not be increased.

(2) For modeling purposes:

(a) Existing (predevelopment) nonforested pervious areas must be considered meadow.

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

B. The Simplified Method (CG-2 in the BMP Manual) provided below is independent of site conditions and should be used if the Design Storm Method is not followed. This method is not applicable to regulated activities greater than one acre, or for projects that require design of stormwater storage facilities. For new impervious surfaces:

(1) Stormwater facilities shall capture at least the first two inches of runoff from all new impervious surfaces. [Note: An asterisk (*) in equations denotes multiplication.]

Volume (cubic feet) = (2/12) * impervious surfaces (square feet)

(2) At least the first one inch of runoff from new impervious surfaces shall be permanently removed from the runoff flow, i.e., it shall not be released into the surface waters of the commonwealth. Removal options include reuse, evaporation, transpiration, and infiltration.

Volume (cubic feet) = (1/12) * impervious surfaces (square feet)

(3) Wherever possible, infiltration facilities should be designed to accommodate infiltration of the entire permanently removed runoff; however, in all cases at least the first 0.5 inch of the permanently removed runoff should be infiltrated.

(4) This method is exempt from the requirements of § 142-409, Stormwater peak rate controls and management districts.

§ 142-407. Water quality requirements.

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

(1) Developed areas shall provide adequate storage and treatment facilities necessary to capture and treat stormwater runoff. The recharge volume computed under § 142-403 may be a component of the water quality volume if the applicant chooses to manage both components in a single facility. If the recharge volume is less than the water quality volume, the remaining water quality volume may be captured and treated by methods other than infiltration best management practices (BMPs). The required water quality volume (WQ_v) is the storage capacity needed to capture and treat a portion of stormwater runoff from the developed areas of the site.

B. The following calculation formula is to be used to determine the water quality storage volume (WQ_v) in cubic feet:

$$WQ_v = [(P)*(Rv)*(A)]/12$$

Where:

- WQv = Water quality volume (acre-feet)
P = 1 inch
A = Area of the project contributing 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 surface/A)*100

An asterisk (*) in equations denotes multiplication.

- C. For a noninfiltrating BMP, 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.

§ 142-408. Stream bank erosion requirements (channel protection).

- A. If a perennial or intermittent stream passes through the site, the applicant shall create a riparian buffer extending a minimum of 50 feet to either side of the top-of-bank of the channel. The buffer area shall be established and maintained in an undisturbed state. This buffer area may be maintained as a meadow with minimal mowing of the grassed area, or as a forested buffer, being planted with appropriate native vegetation (refer to Appendix B of the BMP Manual for plant lists). If the applicable rear or side yard setback is less than 50 feet, the buffer width may be reduced to 25% of the setback to a minimum of 10 feet. If an existing buffer is legally prescribed (i.e., deed, covenant, easement, etc.) and it exceeds the requirements of this chapter, the existing buffer shall be maintained. This buffer requirement is for perennial or intermittent streams and does not include lakes or wetlands.
- B. Applicants shall adhere to the following stream bank erosion/channel protection requirements:
- (1) In addition to the control of water quality volume (in order to minimize the impact of stormwater runoff on downstream stream bank erosion), the primary requirement is to design a BMP to detain the proposed conditions two-year, twenty-four-hour storm event to the existing conditions one-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 or a sand filter) so that the proposed conditions one-year, twenty-four-hour storm event takes at least 24 hours to drain from the facility from a point when the maximum volume of water from the one-year, twenty-four-hour storm event 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 volume control or [or water quality] orifice is at the invert of the facility).
 - (2) The minimum orifice size in the outlet structure to the BMP shall be three inches in diameter where possible, and a trash rack shall be installed to prevent clogging. On sites with small drainage areas contributing to this BMP that do not provide enough runoff volume to allow a twenty-four-hour attenuation with the three-inch orifice, the calculations shall be submitted showing this condition. Orifice sizes less than three inches can be utilized, provided that the design will prevent clogging of the intake. It is recommended that the design, to accommodate maintenance, include a sand or porous media filter.

§ 142-409. Stormwater peak rate control and management districts.

- A. Area P.

- (1) The Pennypack Creek Watershed has been divided into stormwater management districts as shown on the Management District Map (Figure 409.1P).^[1] Portions of Abington Township are in Districts A and B.
- (a) In addition to the requirements specified in Table 409.1 below, the erosion and sedimentation control (§ 142-403), the nonstructural project design (§ 142-404), the groundwater recharge (§ 142-405), the water volume control (§ 142-406), and the stream bank erosion (§ 142-408) requirements shall be implemented.
- (b) Standards for managing runoff from each subarea in the Pennypack Creek Watershed for the two-, five-, ten-, twenty-five-, fifty-, and one-hundred-year storm events are shown in Table 409.1P. Development sites located in each of the management districts must control proposed condition runoff rates to existing condition runoff rates for the design storms in accordance with Table 409.1P.

Table 409.1P
Peak Rate Control Standards by Stormwater Management District in the Pennypack Creek Watershed

District	Proposed Condition Design Storm		Existing Condition Design Storm
A	2-year	Reduce to	1-year
	5-year		5-year
	10-year		10-year
	25-year		25-year
	50-year		50-year
	100-year		100-year
B	2-year	Reduce to	1-year
	5-year		2-year
	10-year		5-year
	25-year		10-year
	50-year		25-year
	100-year		50-year

[1] *Editor's Note: Said figure is included as an attachment to this chapter.*

- (2) General. Proposed condition rates of runoff from any regulated activity shall not exceed the peak release rates of runoff from existing conditions for the design storms specified on the Stormwater Management District Watershed Map (Figure 409.1P).^[2]

[2] *Editor's Note: Said figure is included as an attachment to this chapter.*

- (3) District A is shown as the green area on **Figure 409.1P Area P Management District Watershed Map**.^[3]

[3] *Editor's Note: Said figure is included as an attachment to this chapter.*

- (4) District B is shown as the blue area on **Figure 409.1P Area P Management District Watershed Map**.^[4]

[4] *Editor's Note: Said figure is included as an attachment to this chapter.*

- (5) District C is shown as the pink area on **Figure 409.1P Area P Management District Watershed Map**.^[5]

[5] *Editor's Note: Said figure is included as an attachment to this chapter.*

- (6) District boundaries. The boundaries of the stormwater management districts are shown on an official map that is available for inspection at the municipal and County Planning offices. A copy of the official map at a reduced scale is included as Figure 409.1P.^[6] 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.
[6] Editor's Note: Said figure is included as an attachment to this chapter.
- (7) Sites located in more than one district. For a proposed development site located within two or more stormwater management districts, the peak discharge rate from any subarea shall meet the management district criteria in which the discharge is located.
- (8) 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.
- (9) 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.
- (10) Alternate criteria for redevelopment sites. For redevelopment sites, one of the following minimum design parameters shall be accomplished, whichever is most appropriate for the given site conditions as determined by Abington Township:
 - (a) Meet the full requirements specified by Table 409.1P and § 142-409A(1) through 5; or
 - (b) Reduce the total impervious surface on the site by at least 20% based upon a comparison of existing impervious surface to proposed impervious surface.

B. Area T.

- (1) The Tookany/Tacony-Frankford Watershed has been divided into stormwater management districts as shown on the Management District Map (Figure 409.1T).^[7] Portions of Abington Township are in Districts A and B.
 - (a) In addition to the requirements specified in Table 409.1T below, the erosion and sedimentation control (§ 142-403), the nonstructural project design (§ 142-404), the groundwater recharge (§ 142-405), the water quality (§ 142-407), and the stream bank erosion (§ 142-408) requirements shall be implemented.
 - (b) Standards for managing runoff from each subarea in the Tookany/Tacony-Frankford Watershed for the two-, five-, ten-, twenty-five-, fifty-, and one-hundred-year storm events are shown in Table 409.1T. Development sites located in each of the management districts must control proposed condition runoff rates to existing condition runoff rates for the design storms in accordance with Table 409.1T.

**Table 409.1T
Peak Rate Control Standards by Stormwater Management District in the
Tookany/Tacony-Frankford Creek Watershed**

District	Proposed Condition Design Storm		Existing Condition Design Storm
A	2-year	Reduce to	1-year
	5-year		5-year

Table 409.1T

Peak Rate Control Standards by Stormwater Management District in the Tookany/Tacony-Frankford Creek Watershed

District	Proposed Condition Design Storm	Existing Condition Design Storm
	10-year	10-year
	25-year	25-year
	50-year	50-year
	100-year	100-year
B	2-year	Reduce to 1-year
	5-year	2-year
	10-year	5-year
	25-year	10-year
	50-year	25-year
	100-year	100-year

[7] *Editor's Note: Said figure is included as an attachment to this chapter.*

- (2) General. Proposed conditions rates of runoff from any regulated activity shall not exceed the peak release rates of runoff from existing conditions for the design storms specified on the Stormwater Management District Watershed Map (Figure 409.1T)^[8] and this section of this chapter.

[8] *Editor's Note: Said figure is included as an attachment to this chapter.*

- (3) District boundaries. The boundaries of the stormwater management districts are shown on an official map that is available for inspection at the municipal and County Planning offices. 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.
- (4) Sites located in more than one district. For a proposed development site located within two or more stormwater management districts, the peak discharge rate from any subarea shall meet the management district criteria in which the discharge is located.
- (5) 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.
- (6) 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.
- (7) Alternate criteria for redevelopment sites. For redevelopment sites, one of the following minimum design parameters shall be accomplished, whichever is most appropriate for the given site conditions as determined by the Township of Abington:
 - (a) Meet the full requirements specified by Table 409.1T and § **142-409B(1)** through **(6)**; or
 - (b) Reduce the total impervious surface on the site by at least 20% based upon a comparison of existing impervious surface to proposed impervious surface.

C. Area W.

- (1) The Wissahickon Creek Watershed has been divided into stormwater management districts as shown on the Management District Map (Figure 409.1W).^[9]
 - (a) The peak rate requirements specified in Table 409.1W below shall be implemented in addition to all other applicable requirements.
 - (b) Standards for managing peak rates of runoff from each subarea in the Wissahickon Creek Watershed for the two-, five-, ten-, twenty-five-, fifty-, and one-hundred-year storm events are shown in Table 409.1W. Development sites located in each of the management districts must control proposed condition runoff rates to existing condition runoff rates for the design storms in accordance with Table 409.1W.

Table 409.1W
Peak Rate Control Standards by Stormwater Management District in the
Wissahickon Creek Watershed

District	Proposed Condition Design Storm		Existing Condition Design Storm
A	2-year	Reduce to	1-year
	5-year		5-year
	10-year		10-year
	25-year		25-year
	50-year		50-year
	100-year		100-year
B	2-year	Reduce to	1-year
	5-year		2-year
	10-year		5-year
	25-year		10-year
	50-year		25-year
	100-year		50-year

[9] *Editor's Note: Said figure is included as an attachment to this chapter.*

- (2) General. Proposed condition rates of runoff from any regulated activity shall not exceed the peak release rates of runoff from existing conditions for the design storms specified on the Stormwater Management District Watershed Map (Figure 409.1W).^[10]

[10] *Editor's Note: Said figure is included as an attachment to this chapter.*

- (3) District boundaries. The boundaries of the stormwater management districts are shown on an official map that is available for inspection at the municipal and County Planning offices. A copy of the official map at a reduced scale is included as Figure 409.1W.^[11] 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.

[11] *Editor's Note: Said figure is included as an attachment to this chapter.*

- (4) Sites located in more than one district. For a proposed development site located within two or more stormwater management districts, the peak discharge rate from any subarea shall meet the management district criteria in which the discharge is located.
- (5) 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.

- (6) 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.
- (7) Alternate criteria for redevelopment sites. For redevelopment sites, one of the following minimum design parameters shall be accomplished, whichever is most appropriate for the given site conditions as determined by Abington Township:
 - (a) Meet the full requirements specified by Table 409.1W and § 142-409C(1) through (6); or
 - (b) Reduce the total impervious surface on the site by at least 20% based upon a comparison of existing impervious surface to proposed impervious surface.
- (8) Stormwater control measures which increase storage or infiltration volume, and which are not associated with new land development or redevelopment activity that increases runoff volume above existing levels, are exempt from the peak rate requirements of this chapter, so long as peak outflow is not increased.

§ 142-410. 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. The qualified person must consult with the Municipality to gain approval of design methods prior to design.
 - (1) Table 410-1 summarizes acceptable computation methods and the method selected by the qualified person 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 Cover Complex Method shall be used for drainage areas greater than 200 acres.

Table 410-1

Acceptable Computation Methodologies for Stormwater Management Plans

Method	Method Developed by	Applicability
TR-20 or WINTR-20	USDA NRCS	Applicable where use of full hydrology computer model is desirable or necessary
TR-55 or WINTR-55	USDA NRCS	Applicable for land development plans within limitations described in TR-55
HEC-HMS	US Army Corps of Engineers	Applicable where use of full hydrologic computer model is desirable or necessary
Rational Method or commercial computer package based on Rational Method	Emil Kuichling (1889)	For sites less than 200 acres and with times of concentration less than 60 minutes ($t_c < 60$ min), or as approved by the Municipality and/or Municipal Engineer

Table 410-1

Acceptable Computation Methodologies for Stormwater Management Plans

Method	Method Developed by	Applicability
Other methods	Varies	Other computation methodologies approved by the Municipality and/or Municipal Engineer

* Note: Successors to the above methods are also acceptable.

- B. If a hydrologic computer model such as HydroCAD or HEC-HMS is used for stormwater runoff calculations, then the duration of rainfall shall be 24 hours. The rainfall distribution should reference NRCS Type II.
- C. For the purposes of existing conditions flow rate determination, undeveloped land shall be considered as "meadow," unless the natural ground cover generates a lower curve number or Rational 'C' value (i.e., forest), as listed in Table E-1 or E-2 in Appendix E of this chapter.^[1]
[1] Editor's Note: Appendixes A through J are on file in the Township offices.
- D. All calculations using the Rational Method shall use rainfall intensities from the NOAA 14 Precipitation-Frequency Atlas of the United States (2004, revised 2006). 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 flow velocities as determined by Manning's equation. NOAA's Atlas 14 can be accessed at <http://hdsc.nws.noaa.gov/hdsc/pfds/>.
- 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 E-1 in Appendix E of this chapter.^[2]
[2] Editor's Note: Appendixes A through J are on file in the Township offices.
- F. Runoff coefficients (c) for both existing and proposed conditions for use in the Rational method shall be obtained from Table E-2 in Appendix E of this chapter.^[3]
[3] Editor's Note: Appendixes A through J are on file in the Township offices.
- G. The Manning equation is preferred for 1-D, gradually-varied, open channel flow. In other cases, appropriate, applicable methods should be applied; however, early coordination with the Municipality is necessary.
- H. Outlet structures for stormwater management facilities shall be designed to meet the performance standards of this chapter using the generally accepted hydraulic analysis technique or method of the Municipality.
- I. The design of any stormwater detention facilities intended to meet the performance standards of this chapter 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. 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.

§ 142-411. Other requirements.

All wet basin designs shall incorporate biologic controls consistent with the West Nile Guidelines found in Appendix D.^[1]

[1] *Editor's Note: Appendixes A through J are on file in the Township offices.*