Chapter 4: Unified Stormwater Sizing Criteria

Section 4.1 Introduction

This chapter presents a unified approach for sizing green infrastructure for runoff reduction and SMPs to meet pollutant removal goals, reduce channel erosion, prevent overbank flooding, and help control extreme floods. For a summary, please consult Table 4.1 below. The remaining sections describe the sizing criteria in detail and present guidance on how to properly compute and apply the required reduction and storage volumes.

Table 4.1 New York Stormwater Sizing Criteria[1]

Water Quality Volume (WQv)	**90% Rule:** WQ_v(acre-feet) = [(P)(Rv)(A)] /12 Rv = 0.05+0.009(I) I = Impervious Cover (Percent) Minimum Rv = 0.2 if WQv > RRv P(inch) = 90% Rainfall Event Number (See Figure 4.1)[2] A = site area in acres
Runoff Reduction Volume(RRv)	RRv (acre-feet)= Reduction of the total WQv by application of green infrastructure techniques and SMPs to replicate pre-development hydrology. The minimum required RRv is defined as the Specified Reduction Factor (S), provided objective technical justification is documented.
Channel Protection Volume(Cpv)	**Default Criterion:** Cp_v(acre-feet)= 24 hour extended detention of post-developed 1-year, 24-hour storm event; remaining after runoff reduction. Where site conditions allow, Runoff reduction of total CPv , is encouraged **Option for Sites Larger than 50 Acres:** Distributed Runoff Control - geomorphic assessment to determine the bankfull channel characteristics and thresholds for channel stability and bedload movement.
Overbank Flood (Q_p)	Q_p(cfs)=Control the peak discharge from the 10-year storm to 10-year predevelopment rates.
Extreme Storm (Q_f)	Q_f(cfs)=Control the peak discharge from the 100-year storm to 100-year predevelopment rates. Safely pass the 100-year storm event.
Alternative method (WQv):	Design, construct, and maintain systems sized to capture, reduce, reuse, treat, and manage rainfall on-site, and prevent the off-site discharge of the precipitation from all rainfall events less than or equal to the 95th percentile rainfall event, computed by an acceptable continuous simulation model.

[1] *Channel protection, overbank flood, and extreme storm requirements may be waived in some instances if the conditions specified in this chapter are met. For SMPs involving dams, follow Appendix A, Guidelines for Design of Dams for safe passage of the design flood.*
[2] *For required sizing criteria in redevelopment projects and phosphorus limited watersheds refer to Chapters 9 and 10, respectively.*

Section 4.2 Water Quality Volume (WQ_v)

The Water Quality Volume (denoted as the WQ_v) is designed to improve water quality sizing to capture and treat 90% of the average annual stormwater runoff volume. The WQ_v is directly related to the amount of impervious cover created at a site. Contour lines of the 90% rainfall event are presented in Figure 4.1.

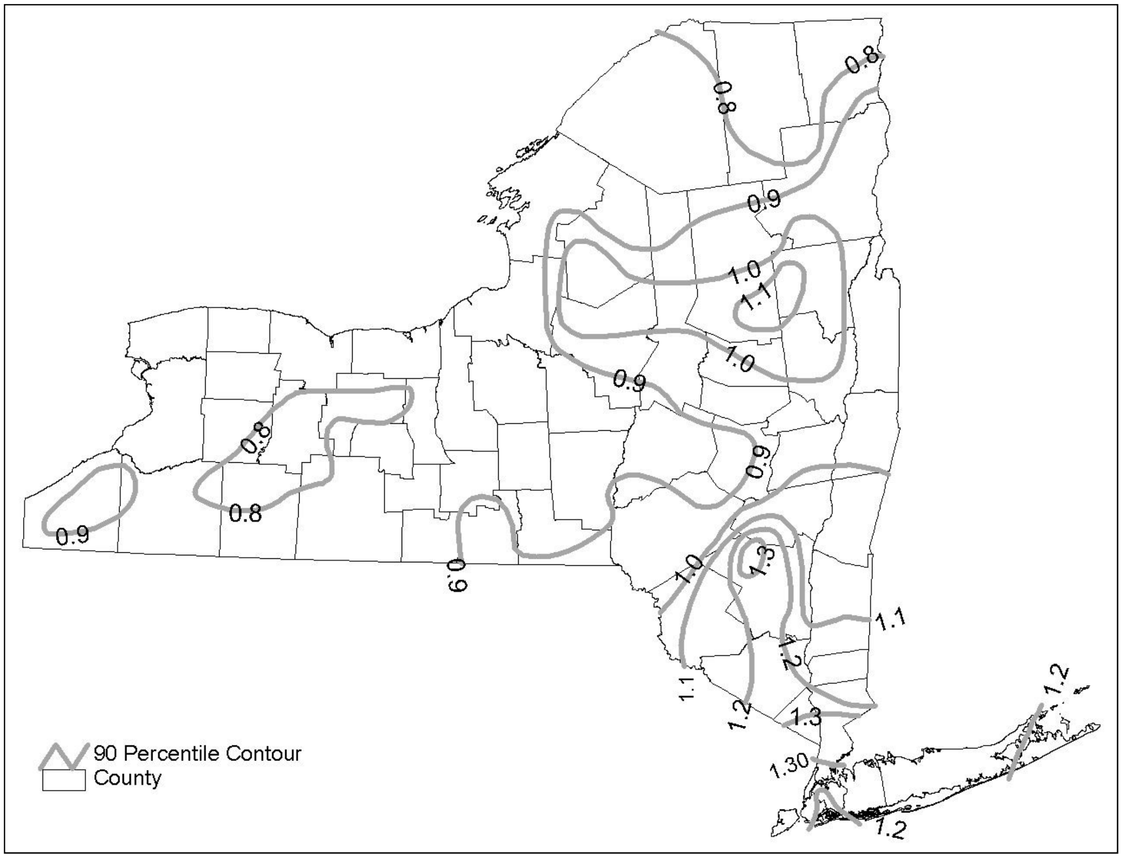
The following equation can be used to determine the water quality storage volume WQ_v (in acre-feet of storage):

$$WQ_v = \frac{(P)(R_v)(A)}{12}$$

where:
WQ_v = water quality volume (in acre-feet)
P = 90% Rainfall Event Number (see Figure 4.1)
R_v = 0.05 + 0.009(I), where I is percent impervious cover
A = site area in acres (Contributing area)

A minimum Rv of 0.2 will be applied to regulated sites.

Figure 4.1 90% Rainfall in New York State (NYSDEC, 2000)



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Basis of Design for Water Quality

As a basis for design, the following assumptions may be made:

Measuring Impervious Cover: the measured area of a site plan that does not have permanent vegetative or permeable cover shall be considered total impervious cover. Impervious cover is defined as all impermeable surfaces and includes: paved and gravel road surfaces, paved and gravel parking lots, paved driveways, building structures, paved sidewalks, and miscellaneous impermeable structures such as patios, pools, and sheds. Where site size makes direct measurement of impervious cover impractical, the land use/impervious cover relationships presented in Table 4.2 can be used to initially estimate impervious cover. In site specific planning impervious cover must be calculated based the specific proposed impervious cover.

Table 4.2 Land Use and Impervious Cover (Source: Cappiella and Brown, 2001)

Land Use Category	Mean Impervious Cover
Agriculture	**2**
Open Urban Land*	**9**
2 Acre Lot Residential	**11**
1 Acre Lot Residential	**14**
1/2 Acre Lot Residential	**21**
1/4Acre Lot Residential	**28**
1/8 Acre Lot Residential	**33**
Townhome Residential	**41**
Multifamily Residential	**44**
Institutional**	**28-41%**
Light Industrial	**48-59%**
Commercial	**68-76%**

* Open urban land includes developed park land, recreation areas, golf courses, and cemeteries.
** Institutional is defined as places of worship, schools, hospitals, government offices, and police and fire stations

- *Aquatic Resources*: More stringent local regulations may be in place or may be required to protect drinking water reservoirs, lakes, or other sensitive aquatic resources. Consult the local authority to determine the full requirements for these resources.

- *SMP Treatment*: The final WQ_v, remaining after application of runoff reduction sizing criterion, shall be treated by an acceptable practice from the list presented in this manual. Please consult Chapter 3 for a list of acceptable practices.

- *Determining Peak Discharge for WQ_v Storm*: When designing flow splitters for off-line practices, consult the small storm hydrology method provided in Appendix B.

- *Extended Detention for Water Quality Volume*: The water quality requirement for storage systems can be met by providing 24 hours of the WQ_v (provided a micropool is specified) extended detention. A local jurisdiction may reduce this requirement to as little as 12 hours in trout waters to prevent stream warming. If TR-55 method is used for the design of stormwater management practices for storms greater than 90%, detention time may be calculated using either a center of mass method or plug flow calculation method.

- *Off-site Areas:* Where off-site areas will drain to the SMP, calculate imperviousness of the off-site contributing drainage area based on its current condition. If water quality treatment is provided off-line, the practice must only treat on-site runoff.

Section 4.3 Runoff Reduction Volume (RRv)

Runoff Reduction Volume (RRv)	RRv (acre-feet)=Reduction of the total WQv by application of green infrastructure techniques and SMPs to replicate pre-development hydrology. The minimum required RRv is defined as the Specified Reduction Factor (S), provided objective technical justification is documented.

- Runoff reduction shall be achieved by infiltration, groundwater recharge, reuse, recycle, evaporation/evapotranspiration of 100 percent of the post-development water quality volumes to replicate pre-development hydrology by maintaining pre-construction infiltration, peak runoff flow, discharge volume, as well as minimizing concentrated flow by using runoff control techniques to provide treatment in a distributed manner before runoff reaches the collection system.. This requirement can be accomplished by application of on-site green infrastructure techniques, standard stormwater management practices with runoff reduction capacity, and good operation and maintenance.

- Runoff reduction volume (RRv) may be calculated based on three methods:
  1. Reduction of the practice contributing area in WQv computation (as defined in Chapter 5)
  2. Reduction of runoff volume by storage capacity of the practice (as defined in Chapter 5)
  3. Reduction using standards SMPs with runoff reduction capacity (as defined in Chapter 3)

- The SWPPP must demonstrate that all the green infrastructure planning and design options are evaluated to meet the runoff reduction requirement and provide documentation if any components of this approach are not technically feasible. Projects that cannot meet 100% of runoff reduction requirement must provide a justification that evaluates each of the green infrastructure planning and reduction techniques, presented in chapter 5, and identify the specific limitations of the site according to which application of this criterion is technically infeasible. Implementation of green infrastructure cannot not be considered infeasible unless physical constraints, hydraulic conditions, soil testing, existing and proposed slopes (detailed contour), or other existing technical limitations are objectively documented. A determination that application of none of the runoff reduction options is feasible may not be based on:
  - The cost of implementation measures; or
  - Lack of space for required footprint of the practice.

- Projects that do not achieve runoff reduction to pre-construction condition must, at a minimum, reduce a percentage of the runoff from impervious areas to be constructed on the site. The percent reduction is based on the Hydrologic Soil Group(s) (HSG) of the site and is defined as Specific Reduction Factor (*S*). The following lists the specific reduction factors for the HSGs:
  - HSG A = 0.55
  - HSG B = 0.40
  - HSG C = 0.30
  - HSG D = 0.20

The specific reduction factor (S) is based on the HSGs present at a site. The values are defined based on a hydrology analysis of low, medium, and high imperviousness. This reduction is achieved when runoff from a percentage of the impervious area on a site is captured, routed through green infrastructure or a SMP, infiltrated to the ground, reused, reduced by evapotranspiration, and eventually removed from the stormwater discharge from the site. The following equation can be used to determine the minimum runoff reduction volume:

RRv (in acre-feet of storage) = [(P)(Rv*)(*Ai*)] /12

Ai = (***S***)(***Aic)***

Ai = impervious cover targeted for runoff reduction

(Aic)= Total area of new impervious cover

Rv* = 0.05+0.009(I) where I is 100% impervious

S = Hydrologic Soil Group (HSG) Specific Reduction Factor (*S*)

- The basic premise of runoff reduction is to formally recognize the water quality benefits of certain site design practices to address flow as a pollutant of concern. Reduction of water quality treatment volume is a requirement and reduction of water "quantity" volumes associated with channel protection (Cp_v) is encouraged, where soil conditions allow. While runoff reduction methods can be highly effective in reducing WQv, small benefits are offered for peak discharge control of overbank flood control (Q_p) and extreme flood control (Q_f). If a developer incorporates one or more runoff reduction practices in the design of the site, the required SMP volume for capture and water quality treatment will be reduced.

- Site designers and developers are allowed to utilize as many runoff reduction methods as they can on a site. Greater reductions in stormwater storage volumes can be achieved when many techniques are combined (e.g., disconnecting rooftops and protecting natural conservation areas). However, reduction cannot be claimed twice for an identical area of the site (e.g., claiming the stream buffers and disconnecting rooftops over the same site area).

- An Underground Injection Control Permit may be required when certain conditions are met. Designer must Consult EPA's fact sheet for further information:
  - http://www.epa.gov/safewater/uic/class5/types_stormwater.html
  - http://www.epa.gov/ogwdw000/uic/class5/pdf/fs_uic-class5_classvstudy_fs_storm.pdf

- Designers must be selective with the design of infiltration on sites with karst geology, shallow bedrock and soils, and hotspot land uses. Projects located over karst geology must provide runoff reduction by techniques that do not involve large infiltration basins and deep, concentrated recharge to the ground. A geotechnical assessment is recommended for infiltration and recharge at small scales. For projects identified as "hotspot" runoff reduction cannot be provided by infiltration, unless an enhanced treatment that addresses the pollutants of concern is provided.

Section 4.4 Stream Channel Protection Volume Requirements (Cp_v)

- Stream Channel Protection Volume Requirements (Cp_v) are designed to protect stream channels from erosion. In New York State this goal is accomplished by providing 24-hour extended detention of the one-year, 24-hour storm event, remained from runoff reduction. Reduction of runoff for meeting stream channel protection objectives, where site conditions allow, is encouraged and the volume reduction achieved through green infrastructure can be deducted from CPv. Trout waters may be exempted from the 24-hour ED requirement, with only 12 hours of extended detention required to meet this criterion. Detention time may be calculated using either a center of mass method or plug flow calculation method.

For developments greater than 50 acres, with impervious cover greater than 25%, it is recommended that a detailed geomorphic assessment be performed to determine the appropriate level of control. Appendix J provides guidance on how to conduct this assessment.

The Cp_v requirement does not apply in certain conditions, including the following:

- Reduction of the entire Cp_v volume is achieved at a site through green infrastructure or infiltration systems.

- The site discharges directly tidal waters or fifth order (fifth downstream) or larger streams. Within New York State, streams are classified using the following:

New York State Codes Rules and Regulations (NYCRR)
Volumes B-F, Parts 800-941
West Publishing, Eagan, MN

However this classification system does not provide a numeric stream order. The methodology identified in this Manual is consistence with Strahler-Horton methodology. For an example of stream order identification see section 4.9.

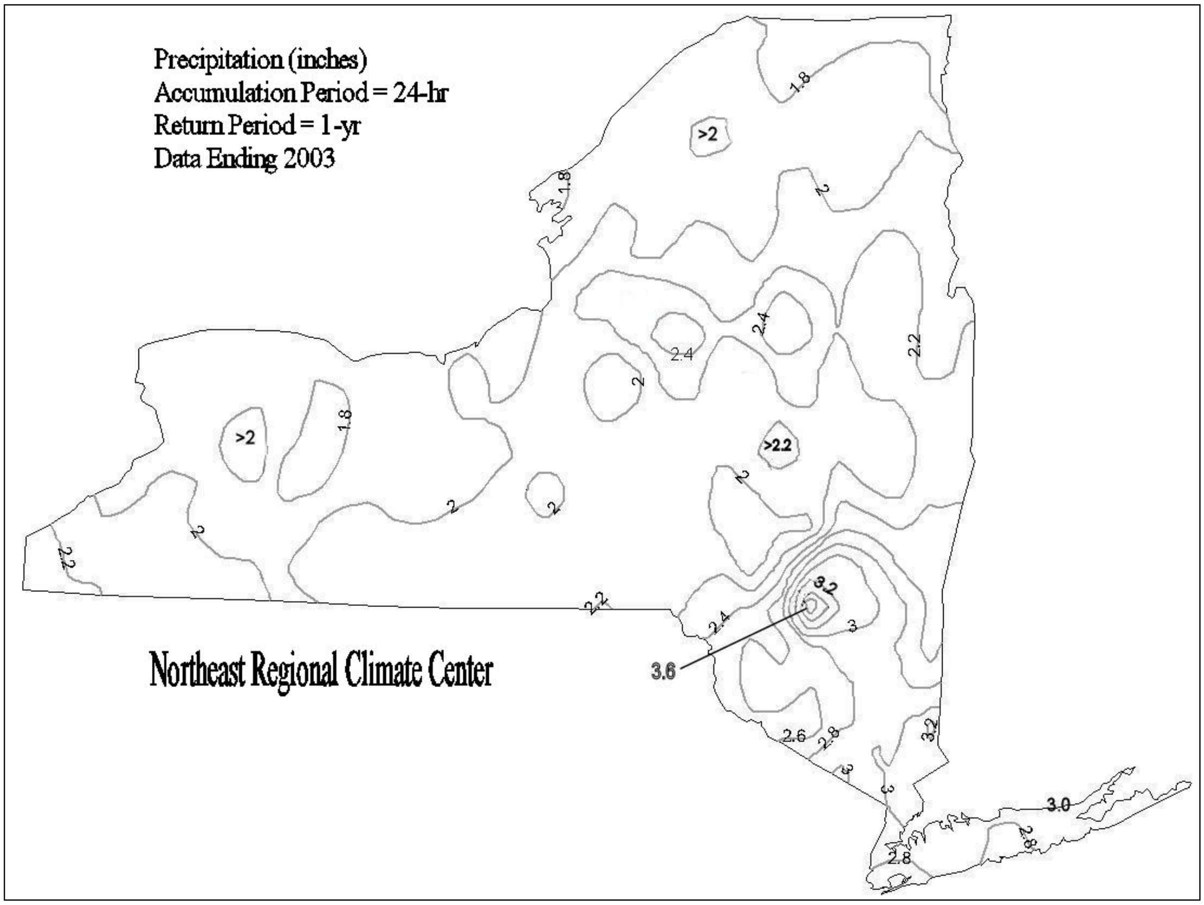
Detention ponds or underground detention systems and vaults are methods to meet the Cp_v requirement (and subsequent Q_{p10} and Q_f criteria). Note that, although these practices meet water quantity goals, they are unacceptable for water quality because of poor pollutant removal, and need to be coupled with a practice listed in Tables 3.2 and 3.3. The Cp_v requirement may also be provided above the water quality (WQ_v) storage in a wet pond or stormwater wetland.

Basis for Determining Channel Protection Storage Volume

The following represent the minimum basis for design:

- TR-55 and TR-20 (or approved equivalent) shall be used to determine peak discharge rates.
- Rainfall depths for the one-year, 24 hour storm event are provided in Figure 4.2.
- Off-site areas should be modeled as "present condition" for the one-year, 24 hour storm event.
- The length of overland flow used in time of concentration (t_c) calculations is limited to no more than 100 feet for post development conditions.
- The CPv control orifice should be designed to reduce the potential to clog with debris. An individual orifice may not be required for Cp_v at sites where the resulting diameter of the ED orifice is too small, to prevent clogging. Alternatively a minimum 3" orifice with a trash rack or 1" if the orifice is protected by a standpipe, having slots with an area less than the internal orifice are recommended. (See Figure 3 in Appendix K for design details).
- Extended detention storage provided for the channel protection (Cp_v-ED) does not meet the WQ_v requirement. Both water quality and channel protection storage may be provided in the same SMP, however.
- The CP_v detention time for the one-year storm is defined as the time difference between the center of mass of the inflow hydrograph (entering the SMP) and the center of mass of the outflow hydrograph (leaving the SMP). See Appendix B for a methodology for detaining this storm event.
- The isohyets maps for required design storms are presented in this Manual (based on TP-40 maps). However, as precipitation data are updated, designers may use the most recent rainfall frequency values developed by acceptable sources. A recommended source for isographs of design storm depths for the northeastern United States is the *Atlas of Precipitation Extremes for the Northeastern United States and Southeastern Canada (1993)*, produced by the Northeast Regional Climate Data Center.
- These map are available online at http://www.nrcc.cornell.edu/pptext/isomaps.html . These values may also be derived from other documented sources (Wilks, 1993).

Figure 4.2 One-Year Design Storm



Section 4.5 Overbank Flood Control Criteria (Q_p)

The primary purpose of the overbank flood control sizing criterion is to prevent an increase in the frequency and magnitude of out-of-bank flooding generated by urban development (i.e., flow events that exceed the bankfull capacity of the channel, and therefore must spill over into the floodplain).

Overbank control requires storage to attenuate the post development 10-year, 24-hour peak discharge rate (Q_p) to predevelopment rates.

The overbank flood control requirement (Q_p) does not apply in certain conditions, including:

- The site discharges directly tidal waters or fifth order (fifth downstream) or larger streams. Refer to Section 4.3 for instructions.
- A downstream analysis reveals that overbank control is not needed (see section 4.10).

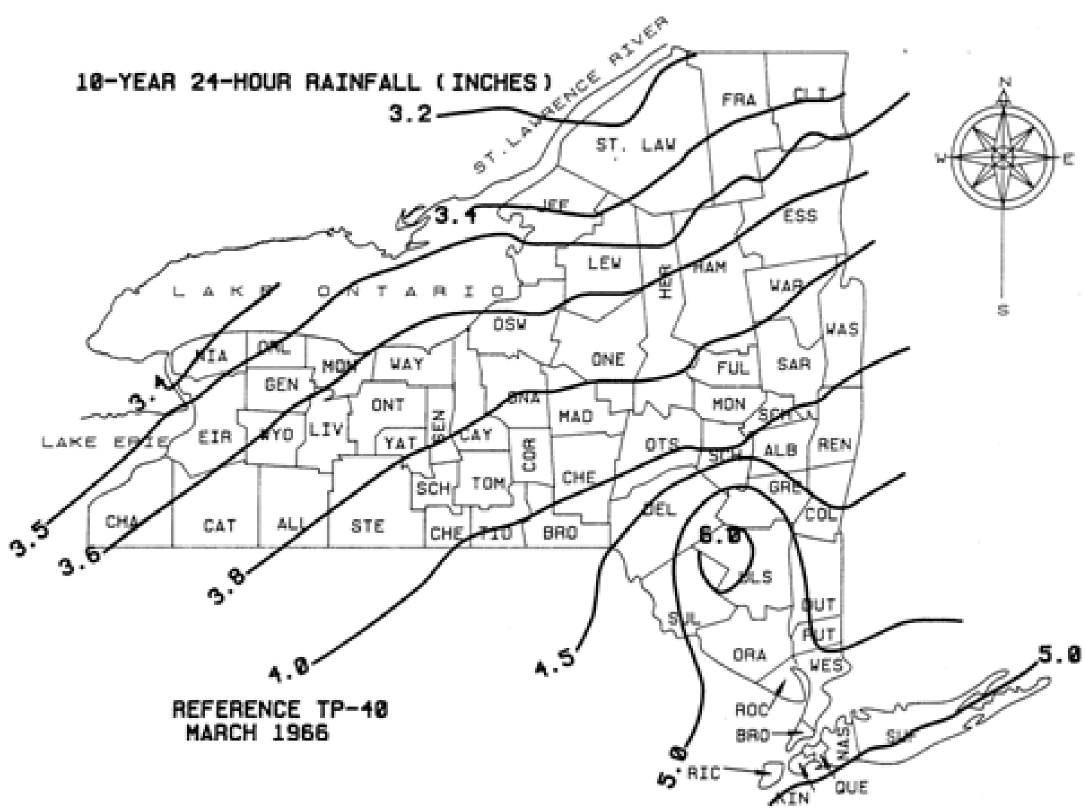
Basis for Design of Overbank Flood Control

When addressing the overbank flooding design criteria, the following represent the minimum basis for design:

- TR-55 and TR-20 (or approved equivalent) will be used to determine peak discharge rates.
- When the predevelopment land use is agriculture, the curve number for the pre-developed condition shall be “taken as meadow”.
- Off-site areas should be modeled as "present condition" for the 10-year storm event.
- Figure 4.3 indicates the depth of rainfall (24 hour) associated with the 10-year storm event throughout the State of New York.

  The length of overland flow used in t_c calculations is limited to no more than 150 feet for predevelopment conditions and 100 feet for post development conditions. On areas of extremely flat terrain (<1% average slope), this maximum distance is extended to 250 feet for predevelopment conditions and 150 feet for post development conditions.

Figure 4.3 10-Year Design Storm



Section 4.6 Extreme Flood Control Criteria (Q_f)

The intent of the extreme flood criteria is to (a) prevent the increased risk of flood damage from large storm events, (b) maintain the boundaries of the predevelopment 100-year floodplain, and (c) protect the physical integrity of stormwater management practices.

100 Year Control requires storage to attenuate the post development 100-year, 24-hour peak discharge rate (Q_f) to predevelopment rates.

The 100-year storm control requirement can be waived if:

- The site discharges directly tidal waters or fifth order (fifth downstream) or larger streams. Refer to Section 4.3 for instructions.
- Development is prohibited within the ultimate 100-year floodplain
- A downstream analysis reveals that 100-year control is not needed (see section 4.10)

Detention structures involving dams must provide safe overflow of the design flood, as discussed in Appendix A: “Guidelines for the Design of Dams.” The flow rates and floodplain extents referred to herein should not be confused with those developed by FEMA for use in the NFIP. Often FEMA has developed 10, 50, 100 and 500-yr flow rates for streams in developed, flood-prone areas, as shown in the Flood Insurance Study (FIS) for a given community. However, it should be noted that these flowrates are only provided at selected locations along studied streams, generally represent the watershed conditions existing at the time of the study, and are commonly developed using stream gauge records or USGS regression equations and therefore do not have any associated storm duration. The extents of the special flood hazard area (SFHA) as shown on the flood insurance rate maps (FIRMs) are defined using these flowrates. These flowrates and flood extents should not be used to compare the pre and post-project development conditions for the purposes of designing on storm water management facilities.

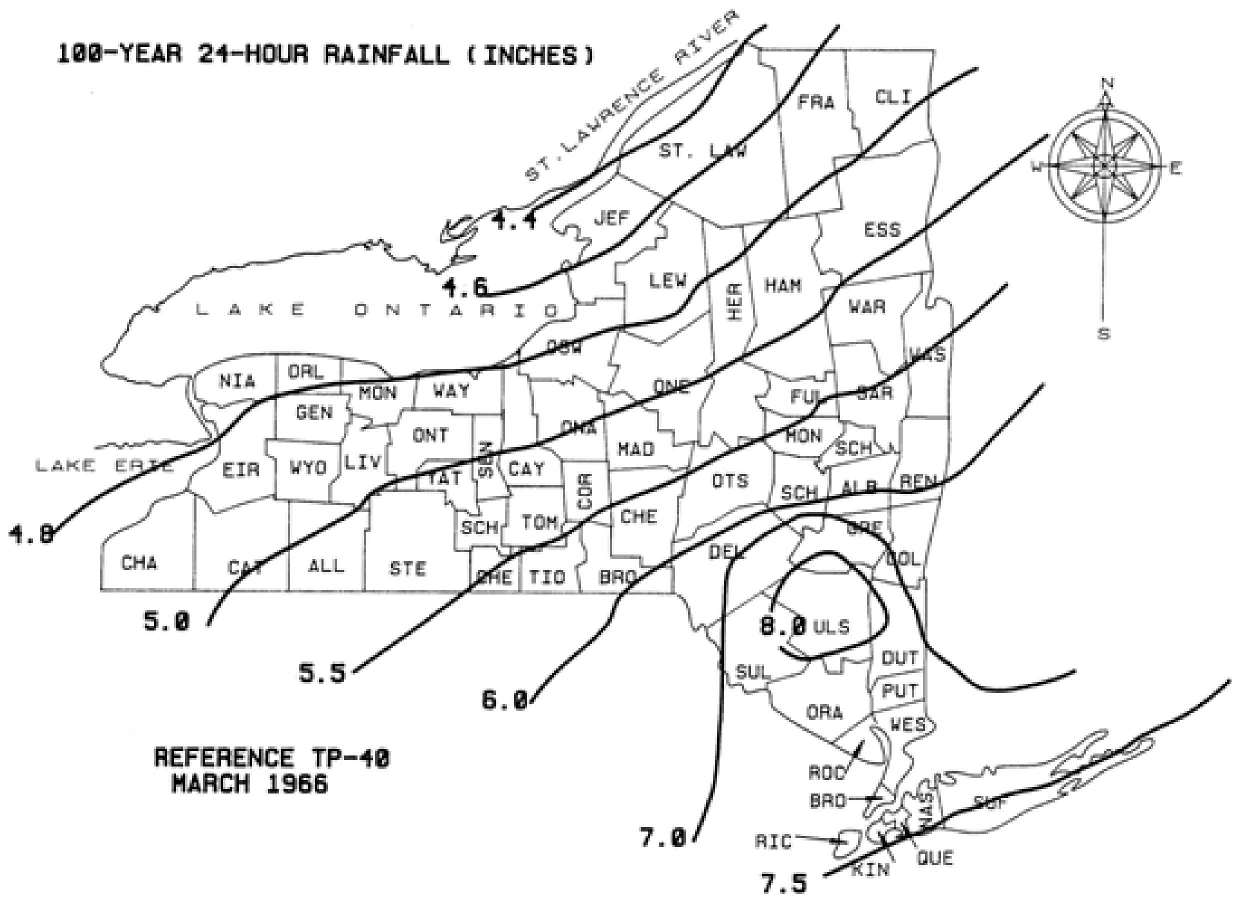
Basis for Design for Extreme Flood Criteria

- The same hydrologic and hydraulic methods used for overbank flood control shall be used to analyze Q_f.
- Figure 4.4 indicates the depth of rainfall (24 hour) associated with the 100-year storm event throughout New York State.
- When determining the storage required to reduce 100-year flood peaks, model off-site areas

under current conditions.

- When determining storage required to safely pass the 100-year flood, model off-site areas under ultimate conditions.

Figure 4.4 100-Year Design Storm



Section 4.7 Alternative Method

New development causes changes to runoff volume, flow rates, timing of runoff and, most importantly, habitat destruction and degradation of the physical and chemical quality of the receiving waterbody. Traditionally, event based design storms are used for evaluation of hydrology and sizing of stormwater management practices. With an increasing need for assessment of the long term effects of development and maintenance of pre-development hydrology, the necessity of continuous simulation modeling as an effective tool for analysis and evaluation of flow-duration, downstream quality, quantity, biological, and hydro-habitat sustainability has been acknowledged.

Continuous simulation models utilize historical precipitation records for estimating runoff volumes, duration, and pollutant loading. This method allows examination of watershed parameters' responses to long term of storm events, instead of the response to a site level single theoretical design storm provided by single event based models. Calculation of WQv using continuous simulation modeling accounts for infiltration, evapotranspiration, depression storage, and system storage, which allows a detailed and objective comparison of alternative treatments to determine if watershed characteristics are maintained by those treatments. Consequently, continuous simulation modeling allows for simulation of green infrastructure techniques and performance of flow duration analyses. An objective application of a continuous simulation model involves a calibrated model for a watershed on interest and incorporation of regional goals.

The following lists the guidelines for the design of stormwater management systems using a continuous simulation model:

- Design, construct, and maintain systems sized to capture, reduce, reuse, treat, and manage rainfall on-site, and prevent the off-site discharge of the precipitation from all rainfall events less than or equal to the 95th percentile rainfall event.
- The 95th percentile rainfall event is the event whose precipitation total is greater than or equal to 95 percent of all storm events over a given period of record.
- A minimum period of 20 years precipitation records is required to determine the 95th percentile storm and derive the corresponding design storm.
- Select a practice(s) that provides infiltration, evapotranspiration, reuse, or recycle of this volume.
- One hundred percent (100%) of the volume of water from storms less than or equal to the 95th percentile event shall not be discharged to surface water.
- Perform an analysis that shows post-construction flow-duration, shape of the hydrograph, and

downstream quality and quantity does not exceed pre-construction hydrology.

- Site evaluation and soils analysis must conform to the standards provided in this Manual.
- The stormwater management practices employed must conform to the standards provided in this Manual.

Some examples of continuous simulation modeling tools include:

Stormwater Management Model (SWMM) is an EPA supported urban runoff hydrology, hydraulics, and runoff quality model with detailed design tools capable of flow routing and storage for surface, sub-surface, stormwater and combined sewer overflow conveyance and groundwater systems, as well as determining the treatment capacity of stormwater management practices. Various applications of SWMM have utilized the detailed features of this model for simulating green infrastructure design features.

Source Loading and Management Model for Windows (WinSLAMM) is a mid-range empirical model for evaluation of stormwater runoff loading in urban watersheds. This modeling tool uses small storm hydrology methods and calculates the runoff from historical precipitation data for a given period of time, pollutant loading from various land uses, and allows the user to simulate the stormwater load reduction effected by incorporating control devices. The stormwater management practices provided in WinSLAMM include several SMPs, green infrastructure design details and maintenance BMPs.

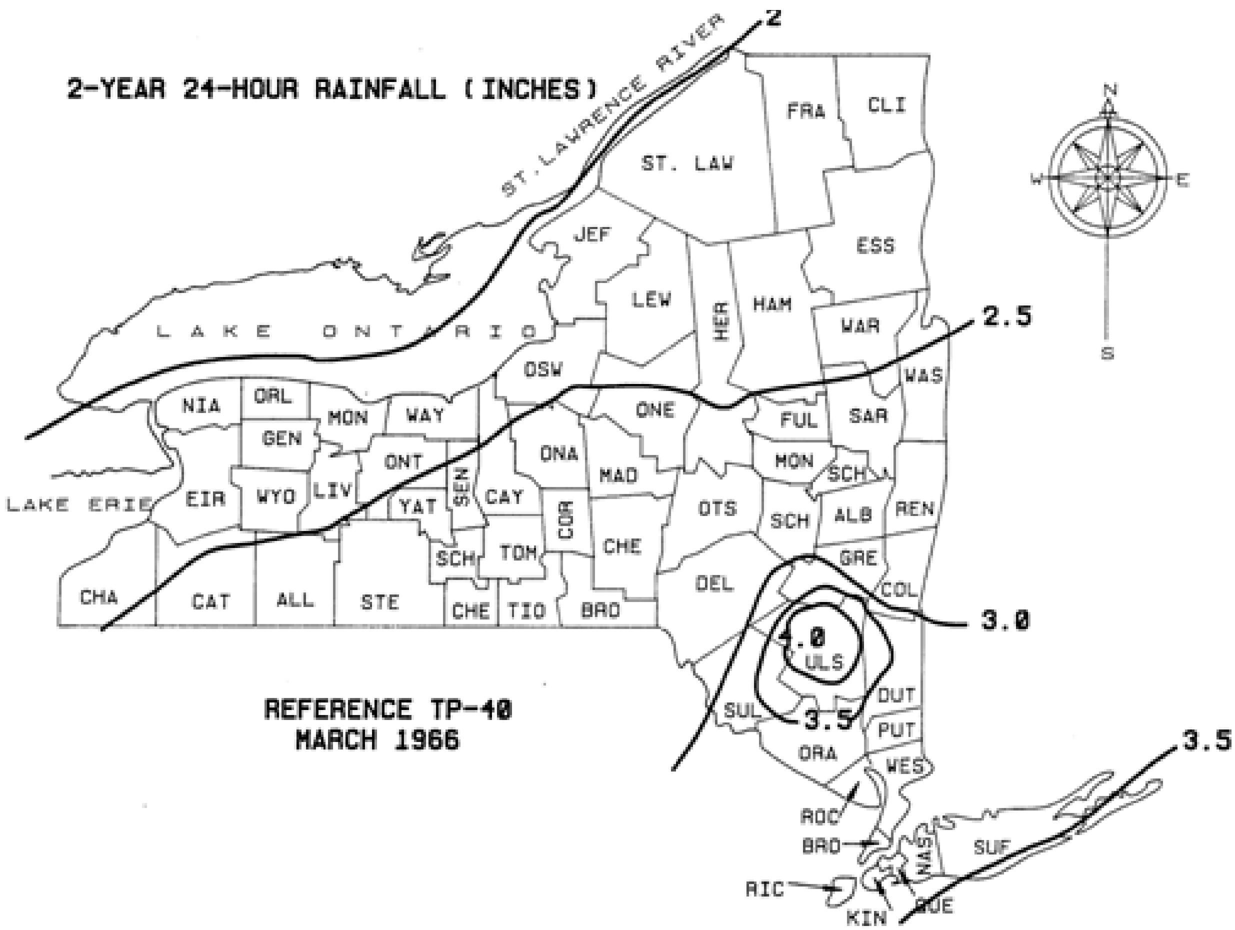
Hydrologic Simulation Program Fortran (HSPF) is an EPA supported program for simulation of watershed hydrology and water quality. The HSPF model uses information such as the time history of rainfall, temperature, soil, land surface such as land cover and land-use patterns; and land management practices to simulate the processes that occur in a watershed. The result of this simulation is a time history of the quantity and quality of runoff from an urban or agricultural watershed. The model also predicts flow rate, sediment load, and nutrient concentrations.

A successful example of the use of HSPF for stormwater applications is the Western Washington Hydrologic Model (WWHM). Similar adaptation of the models for applications in New York State will require several verifications such as validation of input variables, accurate precipitation data, and calibration of the model.

Section 4.8 Conveyance Criteria

In addition to the stormwater treatment volumes described above, this manual also provides guidance on safe and non-erosive conveyance to, from, and through SMPs. Typically, the targeted storm frequencies for conveyance are the two-year and ten-year events. The two-year event is used to ensure non-erosive flows through roadside swales, overflow channels, pond pilot channels, and over berms within practices. Figure 4.5 presents rainfall depths for the two-year, 24-hour storm event throughout New York State. The 10-year storm is typically used as a target sizing for outfalls, and as a safe conveyance criterion for open channel practices and overflow channels. The 10-year storm is recommended as a minimum sizing criterion for closed conveyance systems. Note that some agencies or municipalities may use a different design storm for this purpose.

Figure 4.5 2-Year Design Storm

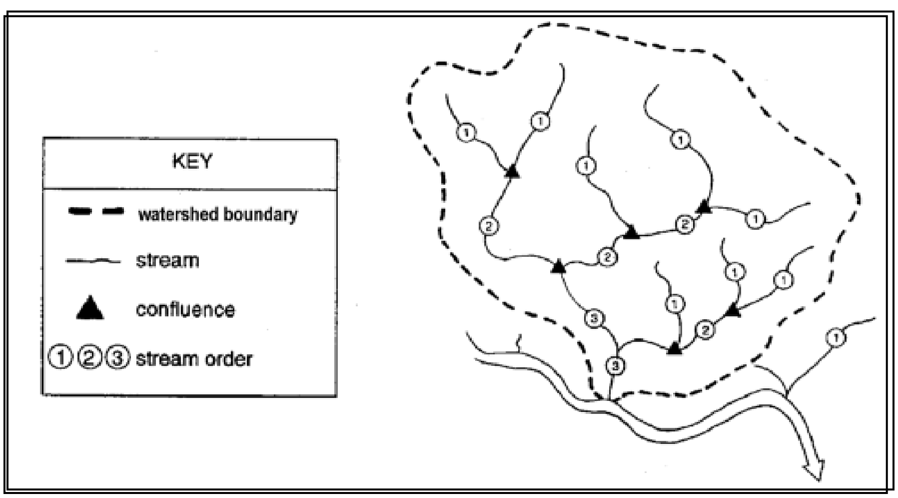


Section 4.9 Stream Order Identification

This section provides an example to help identify stream order based on Strahler-Horton Method. A network of streams drain each watershed. Streams can be classified according to their order in that network. A stream that has no tributaries or branches is defined as a first-order stream. When two first-order streams combine, a second-order stream is created, and so on. Figure 4.6 illustrates the stream order concept (Schueler, T. 1995).

Evaluation of stream order must be performed using the NHDplus dataset to determine if quantity controls do not apply. NHDPlus is an integrated suite of geospatial data sets that incorporate features of the National Hydrography Dataset (NHD) and the National Elevation Dataset (NED) at 1:100K scale. This application-ready data set is an outcome of a multi-agency effort aimed at developing many useful variables for water quality and quantity evaluation including stream order. Example maps are available on DEC website.

Figure 4.6 A Network of Headwater and Third-order Streams (Source: Schueler, 1995)



Section 4.10 Downstream Analysis

Overbank, and extreme flood requirements may be waived based on the results of a downstream analysis. In addition, such an analysis for overbank and extreme flood control is recommended for larger sites (i.e., greater than 50 acres) to size facilities in the context of a larger watershed. The analysis will help ensure that storage provided at a site is appropriate when combined with upstream and downstream flows. For example, detention at a site may in some instances exacerbate flooding problems within a watershed. This section provides brief guidance for conducting this analysis, including the specific points along the downstream channel to be evaluated and minimum elements to be included in the analysis.

Downstream analysis can be conducted using the 10% rule. That is, the analysis should extend from the point of discharge downstream to the point on the stream where the site represents 10% of the total drainage area. For example, the analysis points for a 10-acre area would include points on the stream from the points of discharge to the nearest downstream point with a drainage area of 100 acres. The required elements of the downstream analysis are described below.

- Compute pre-development and post-development peak flows and velocities for design storms (e.g., 10-year and 100-year), at all downstream confluences with first order or higher streams up to and including the point where the 10% rule is met. These analyses should include scenarios both with and without stormwater treatment practices in place, where applicable.

- Evaluate hydrologic and hydraulic effects of all culverts and/or obstructions within the downstream channel.
- Assess water surface elevations to determine if an increase in water surface elevations will impact existing buildings and other structures.

The design, or exemption, at a site level can be approved if both of the following criteria are met:

- Peak flow rates increase by less than 5% of the pre-developed condition for the design storm (e.g., 10-year or 100-year)
- No downstream structures or buildings are impacted.

Section 4. 11 Stormwater Hotspots

A stormwater hotspot is defined as a land use or activity that generates higher concentrations of hydrocarbons, trace metals or toxicants than are found in typical stormwater runoff, based on monitoring studies. If a site is designated as a hotspot, it has important implications for how stormwater is managed. First and foremost, stormwater runoff from hotspots cannot be allowed to infiltrate untreated into groundwater, where it may contaminate water supplies. Second, a greater level of stormwater treatment for hydrocarbons, trace metals or toxicants of concern is needed at hotspot sites to prevent pollutant washoff after construction. This treatment typically involves preparing and implementing *a stormwater* *pollution prevention plan* that includes a series of operational practices at the site that reduce the generation of pollutants from a site or prevent contact of rainfall with the pollutants. Table 4.3 provides a list of designated hotspots for the State of New York.

Under EPA's stormwater NPDES program, some industrial sites are required to prepare and implement a stormwater pollution prevention plan. A list of industrial categories that are subject to the pollution prevention requirement can be found in the State of New York SPDES General Permit for Stormwater Discharges Associated with Industrial Activity. In addition, New York's requirements for preparing and implementing a stormwater pollution prevention plan are described in the SPDES general discharge permit. The stormwater pollution prevention plan requirement applies to both existing and new industrial sites.

Table 4.3 Classification of Stormwater Hotspots

The following land uses and activities are deemed *stormwater 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 SIC codes outlined in the SPDES General Permit for Stormwater Discharges Associated with Industrial Activity)
- 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

 # indicates that the land use or activity is required to prepare a stormwater pollution prevention plan under the SPDES stormwater program.

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

- Residential streets and rural highways
- Residential development
- Institutional development
- Office developments

- Non-industrial rooftops
- Pervious areas, except golf courses and nurseries (which may need an Integrated Pest Management (IPM) Plan)

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